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INDUSTRY 2000 – NEW PERSPECTIVES*

COLLECTED BACKGROUND PAPERS

Volume 3

INTERNATIONAL FLOWS OF TECHNOLOGY**

*Issued as document ID/CONF.4/3 for the Third General Conference of UNIDO, New Delhi, India, 21 January–8 February 1980.

**This background paper has been prepared by the UNIDO Secretariat assisted by a number of consultants.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

INDUSTRY 2000 - NEW PERSPECTIVES
COLLECTED BACKGROUND PAPERS
VOLUME 3

INTERNATIONAL FLOWS OF TECHNOLOGY

Vienna, Austria

December 1979

FOREWORD

This volume presents some of the background material for the study Industry 2000 - New Perspectives published by UNIDO as ID/CONF.4/3 (Vienna 1979) for the Third General Conference of UNIDO at New Delhi, India, 21 January - 8 February 1980.

The volume contains an overview of the subject area by the UNIDO secretariat, as well as some selected consultants' papers. For the latter papers the respective authors bear full responsibility for the opinions expressed as well as for the material presented. The publication of a consultant paper must not be taken as indicating support or agreement, tacit or otherwise, with its content or form by UNIDO or its secretariat. It is hoped, however, that the publication of this documentation will make a contribution towards the understanding of problems connected with the industrialisation of developing countries.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INDUSTRY 2000 - NEW PERSPECTIVES

A LIMITED BACKGROUND PAPERS

INTERNATIONAL FLOWS OF TECHNOLOGY

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ABBREVIATIONS

The following abbreviations have been adopted:

ACP	African Caribbean and Pacific States in association with the European Economic Community
CIEC	Conference on International Economic Co-operation
CMEA	Council for Mutual Economic Assistance
CPE	Centrally Planned Economies
DAC	Development Assistance Committee of OECD
DC	Developing Countries
DEG	Development Corporation of the Federal Republic of Germany
DFI	Direct Foreign Investment
DMEC	Developed Market Economy Countries
ECE	UN Economic Commission for Europe
EEC	European Economic Community
EFTA	European Free Trade Association
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration of the U.S.
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GNP	Gross National Product
GSP	Generalised System of Preferences
IBRD	International Bank for Reconstruction and Development (The World Bank)
IC	Industrialised Countries (including DMEC and CPE)
ICC	International Chamber of Commerce
ICOR	Incremental Capital Output Ratio
ICPO	Investment Co-operative Programme Office (of UNIDO)
IDA	International Development Association
IFC	International Finance Corporation (of the World Bank)
ILO	International Labour Organisation
IMF	International Monetary Fund
INPADOC	International Patent Documentation Centre
INTAL	Instituto para La Integración de América Latina
INTIB	Industrial and Technological Information Bank (of UNIDO)
LDC	Least Developed Countries (according to UN definitions)
MNC	Third World Multinational Corporation
MSA	Most Seriously Affected (Countries)
MVA	Manufacturing Value Added
NIEO	New International Economic Order
NTB	Non Tariff Barrier to Trade
OAPI	African Intellectual Property Organisation
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development

OPEC	Organisation of Petroleum Exporting Countries
R + D	Research and Development
SDR	Special Drawing Rights
SELA	Servicio Latinoamericano de Cooperación Empresarial
SITC	Standard International Trade Classification
TCDC	Technical Co-operation among Developing Countries
TIES	Technical Information Exchange System (of UNIDO)
TNC	Transnational Corporation
UNCITRAL	United Nations Commission on International Trade Law
UNCSTD	United Nations Conference on Science and Technology for Development
UNCTAD	United Nations Conference on Trade and Development
UNCTC	United Nations Centre on Transnational Corporations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
UNITAR	United Nations Institute for Training and Research
WIPO	World Intellectual Property Organisation

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CHAPTER 1: INTRODUCTION

The concensus of thought emerging during the post-war decades as a result of international discussions on development issues is articulated by the chapters of the New International Economic Order (NIEO) and the United Nations second development decade. These documents recognise the pivotal role that technology[1/] has played, plays and will play in any industrialised (IC) or developing country (DC)[2/]. As is generally beginning to be known and accepted, achieving technological autonomy in developing countries is perceived to be an explicit policy objective for international action. Whether developing countries follow new paths through a collective self-reliance policy or try simply to modify traditional channels through which "classical suppliers" have transferred the industrialised countries' technology, their eventual end will necessarily have to be directed at achieving results which may be integrated in the philosophy expressed in the Lima target. Its achievement will certainly depend on the speed, nature and sustenance of the technological changes that take place within the boundaries of the developing countries and/or among themselves, along with an industrial transformation within the South. Recent experience shows that the traditional flows of technology to developing countries have proved to be a failure in closing the technological gap that exists and differentiates industrialised from developing countries. This gap is incessantly widening; therefore, the need for abandoning or altering traditional instruments of technology transfer is being felt. There is substantial ground to believe that either the detection or creation of new channels for the developing countries' acquisition of technology is more than a mere alternative: it is a pre-requisite to development. It is evident that the present technological picture does not reflect the new international technological order that would be optimal for the developing countries. A different world technological framework is imperative. Notwithstanding, the establishment of this new order will occur progressively once the technological needs of the developing countries have been identified by their decision-makers. No matter how DCs try to reduce their technological lag through export promotion, import substituting industrialisation or self-reliance strategy, the final decision should always remain within the boundaries of the country facing this dilemma. Various complementary strains and positions expressed in international debates have been highlighted in the following pages in order to systematically analyse proposals to secure the crucial technological change required for the developing countries in the next two decades. The ideas dealt with in this study are not directed at supplanting previously approved concepts, on the contrary, they

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1/ By technology, we mean the variety of instruments, organisational forms, and know-how which enhance or have enhanced the productive capacities of economies.

2/ See, for instance, World Plan of Action for the Application of Science and Technology to Development, United Nations 1971; General Assembly resolutions 3362 (S-VII) and 3517 (XXX), the Lima Plan Declaration and Plan of Action on Industrial Development and Co-operation, 1975; The Buenos Aires Plan of Action, 1978; and resolutions, recommendations and decisions adopted at the fifth session, Manila, 7 May - 3 June 1979.

attempt to synthecize these concepts and provide a consistency in direction with analysis and policies recommended in UNCTAD V in Manila and UN Conference on Science and Technology (UNCSTD) in Vienna (both in 1979), and eventually in UNIDO III in New Delhi in 1980.[1/] The proposals made in the last section of this paper have been conceived in the light of current realities and future prospects so that a more harmonious and just world based on a community of international interest may be within the reach of future generations. Proposals are directed at restructuring the present international order through policies that will hopefully strengthen the internal capabilities of Southern countries.

1/ Specifically, see UNIDO ID/WG.301/4 and the associated documentation of the Expert Group Meeting on Technological Development and Self-Reliance in Developing Countries, Vienna, June 1979. Also, directly relevant to this context are the submission to UNCTAD V, TD/238, Towards the Technological Transformation of the Third World, and TD/238/Supp. 1, Technology Planning in Developing Countries, Manila, May 1979

CHAPTER 2: IDENTIFICATION, DISCUSSION AND EVALUATION OF ISSUES

2.1 The Need for Technology Strategies

With the development of the market system, and specifically market economies based on industrial production, the creation and diffusion of technology have become part of commercial transactions. Those who create technology and diffuse it enhance, on the one hand, the know-how which is potentially in perfectly elastic supply (it is infinitely replicable) for society as a whole; but, on the hand, the incentives to enhancing technology have primarily been private profit calculations. The conflict between social and private valuation has been resolved thus far in favour of technology creators and suppliers, by maintaining the technology market in a monopolistic structure. Restrictions allowing for the private appropriation of know-how are used to maintain quasi-rents for producers; this point is widely recognised as a central problem by analysts and policy-makers alike.

What is less frequently realised, though, is the social role played by the producers of technology in creating and circumscribing future production and consumption possibilities, often in the absence of current price data on end products. This aspect of the creation of technology endows suppliers with an autonomous role in relation to current economic transactions. This constitutes minimal case for social regulatory mechanisms for the creation of technology.[1/]

The evolution of the industrial market economies from relatively dispersed national spaces to an integrated global economy has accentuated problems of monopoly and economic autonomy in technology production. The birth and growth of Transnational Corporations (TNCs) as the major global diffusors(if not the creators of technology) have centralised power to apportion global technology stocks over geopolitical spaces and to direct the the flows of future global technological innovation. This has enhanced both the needs

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1/ See Freeman, C., The Economics of Industrial Innovation, 1974, pp. 302-303. The author recognises the complexity of the problem in his concluding comments: "In theory again the competitive market mechanism ought to be able to perform this function automatically. But it has been argued that the market place mechanism, which theoretically was supposed to ensure correspondence between consumer wishes and supply, no longer performs this function adequately, if it ever did so in some sectors. This means that increasingly the political mechanism must restore the lost consumer sovereignty which the autonomous market mechanism can no longer assure. It might have been expected that socialist societies would have been able to make social innovations, which would link the public R + D system more closely to consumer needs. But the evidence available does not justify this conclusion, possibly because they have been poor countries attempting to industrialise rapidly, and in the case of the Soviet Union and China, to compete militarily with other great powers". While we cannot go further into the problem at this stage, the citation substantiates the present emphasis on the intimate connection between technology and political processes.

for institutions which make social policy and created differentials in capacities for policy-enforcing power. It is difficult enough to conceptualise and devise adequate national regulatory mechanisms, but even more so at the level of international institutions. The problems just mentioned would be of little consequence, had it not been for the widely recognised analysis that Transnational Corporate Organisation is unsuitable for equalising economic differentials (at best) or it even accentuates inequalities between countries and peoples (at worst).1/

While technology is critical to industrialisation, the specific part which it has come to play is that of an instrument of power in the industrial system. Technology is in no sense a neutral entity which, whenever supplied, will automatically lead to economic improvements for everyone. On the contrary, it embodies the objectives of one or the other economic entity, and its use has the potential to exclude or curtail the interests of others. Policies towards technology cannot themselves be anodine or neutral; they must fully recognise that technology, if it is to ralise its unfulfilled promise, will only do so when those groups wanting to use it have a clear conception of what ends they hope to achieve. In such a context, technology may be able to contribute to a form of industrialisation capable of alleviating poverty and simultaneously providing the vital opportunities for greater participation of people in the decision-making processes which affect their own lives.2/

In the context of economic development, the relationships between technology and industrialisation have more dimensions than the quantitative increase in production and consumption possibilities. The composition of productive capacities and consumption goods has particular ramifications on the extent of welfare and waste generated by industrialising economies. In addition, the centralisation of technology-generating capacities and the global market system pose specific problems for the dynamics of DC technological development. They emanate from a host of factors, associated with the recomposition of output and changes in relevant technology frontiers, and which have resulted in a debilitation of their capacities to acquire and enhance their indigenous technological capacities. Thus the process of technological change has, for DCs, necessarily to be viewed in terms of their relationships with the world market system.

1/ The argument is best formulated by Hymer, S., The Multinational Corporation and the Law of Uneven Development. 1972, p. 52: "It is not technology which created inequality; rather it is organisation that imposes a ritual judicial asymmetry on the use of intrinsically symmetrical means of communications and arbitrarily creates unequal capacities to initiate and terminate exchange, to store and retrieve information, and to determine the extent of the exchange and terms of the discussion. Just as colonial powers in the past linked each point in the hinterland to the metropolis and inhibited lateral communications, preventing the growth of independent centres of decision-making and creativity, multinational corporations (backed by state powers) centralise control by imposing a hierarchical system."

2/ See page 68.

There are three feasible paths by which DCs can attempt industrialisation. Their implications for technological development need to be depicted, since each path imposes necessary constraints for the strategy to be sustained. Again, at the risk of repetition, it must be stressed that these are "pure cases" in an analytic sense and will not be found as neat trajectories in the real world. In fact, it is more probable to find two or more strategies co-existing within specific countries, as more or less coherent policy guides for individual sectors or groups of sectors. The implications of the three strategies for technological development then, could be:

Strategy 1 (Export Promotion): to sustain the export of manufactures it is necessary for the DC to attempt to attain the existing global technology frontier in the exporting sector. The acquisition of technology can be embodied (in terms of plant, know-how and capital equipment) and packaged in foreign investment, or unpackaged, i.e. introduced by domestic entrepreneurs. To achieve the position of leadership or near leadership in the export market, the eventual objective would be to acquire indigenous know-how and equipment to innovate in the production and marketing of the exportable manufactured item(s). This would result in, of course, achieving independent and dynamic comparative advantage in the field of activity.

Strategy 2 (Import Substituting Industrialisation): to be at or near the world technology frontier, but the imperatives towards attaining this level would be weaker than the first case, depending on the extent to which fiscal or other protective measures will be able to protect the sector(s) in question from competitive imports. However, to minimise waste of resources and reduce any relative inefficiencies, an attainment of world frontier technology within a relatively brief period ought to be a goal.

Strategy 2 (Production for Domestic Needs): The objective would be to serve mass markets in the economy. In view of the income distributional profile of DC economies and of consumption needs, this strategy almost inevitably implies the orientation of production towards basic needs. The technological and economic distances between IC and DC mass markets preclude IC technologies or existing world frontiers from being extremely relevant in this context. Here the technological choice would be to use ingredients of IC and domestic know-how to refashion productive facilities to produce basic goods at prices and in quantities appropriate to local income distribution and market size, respectively.

Each industrialisation strategy implies a particular type of acquisition or production of technology, of conscious action. Hence the argument for implementing national technology strategies. Like economic planning, technology planning is envisaged to be in the public domain, insofar as it will require the exercise and co-ordination of social decision-making.

At another level, the broader effects of international flows of technology on DC economies have been the subject of much concern and controversy. These effects may be grouped under three headings:

(i) The resource inputs of IC technologies are ill-adapted to the possibilities and potentialities of DCs.

(ii) Despite the growth of overall income, inequalities in income distribution have been accentuated because IC technologies have been introduced.

(iii) IC technologies have often been introduced in order to produce IC mass consumption goods, and to sell them via IC advertising and marketing systems. Consequently, deleterious effects in terms of the needs of the majority of the populations of DCs have been produced by the choices, prices and appropriateness of what is produced.

The controversy has yielded at least one conclusion: the necessity of selectivity of relations and conditions under which these relations are established between DCs and world markets, specifically DCs and TNCs.

In summary, then, it is recognised that national and international attempts should be made to readjust the distribution of technology stocks. This readjustment should consider both the quantitative and qualitative aspects of technologies. The rest of the paper indicates the possible scope and objectives of national technology strategies, reviews potentials and current constraints in the international economy, evaluates existing international mechanisms for technological co-operation and proposes new ones based on criteria discussed under preceeding points.

2.2 The Elements of Technology Strategies

2.2.1 Identification of National Technology Requirements

A strategy begins with the capability to identify the technological requirements of an economy. This, in turn, is necessarily related to two critical and essentially political variables: (i) the groups that undertake the identification and have the power to enforce finding; and (ii) these groups' objectives.

The above statement is both simple and complex. It is simple in that, were the political groups to remain ill-defined, it would not be possible to talk of any dominant strategy but rather of confusing conflicts and alliances among different strategies, whose resolution would be impossible to foretell. It is complex because in practice conflict and contradiction frequently prevail. More specifically, foreign controllers of technology will employ the technologies which best fit their global concepts of

maximising benefits. Larger domestic firms and often even state enterprises in developing countries will, because of the sectors in which they operate and because their managers are products of the technological culture of the industrialised countries, utilise foreign technology without full consideration of the impacts on the domestic economy.[1/] Smaller domestic producers, often with very little direct contact with the international system, may well continue to utilise technologies which have been developed in terms of local resources and potentialities. In this criss-cross of groups and interests, to speak of a "national technology strategy" may simply be a way of obfuscating rather than clarifying issues.

Yet for all this there seems little escaping the necessity of identifying what a country requires. Until now, experience in many developing countries seems to suggest that the interests of foreign technology holders, large domestic industrialists, the state bureaucracy, state enterprises, and various professional groups have received are furthered most by the kinds of technology introduced. These groups have supported additional imports of modern technologies discriminating against domestic technological capacities, potentials and consumption requirements.[2/]

These choices of specific technologies have been unsystematic and uncoordinated. The development of social technology strategies require different political imperatives. Whether such strategies contribute to "development", i.d. improving mass living standards is, however, another question. The argument here assumed that the groups holding power really seek to attack the fundamental problems of poverty. Admittedly this assumption has been justified in only a small number of countries and periods during the past few decades.

Any such search process must be fraught with difficulties. Four dimensions of the process would seem to be critical: First, a clear understanding and documentation of the resources, material and human, currently and potentially available in the economy; second, some detailed estimates of the items required from the industrial sector if a serious attempt is to be made to eliminate poverty by a specific date. This is important because the real needs of the majority of the population are rarely revealed through current market mechanisms; third, a listing of the available technology, both domestic and

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1/ See page 69.

2/ There are at least three reasons why the decision-making of any groups may diverge from social objectives. First, there are constraints on knowledge. World technologies which exist may be greater in number than decision-makers know. Second, as already indicated, private interests may diverge from social interests. Third, even if problems of information barriers and private decision-making are overcome, the existing global stock of technology may be inappropriate to the social objective in hand. Thus Francis Stewart, Technology and Underdevelopment, 1973, p. 3, points out: "If the technology in use is thought to be inappropriate, it may be inappropriate because world technology is inappropriate, or because an inappropriate subset is available to the country, or because an inappropriate selection is made or for some combination of the three reasons. Confusion is caused by failing to distinguish between the three".

foreign, relevant to the production and distribution of the required industrial items: fourth, a consideration of the alternative forms of social organisation which would allow domestic resources and technological capabilities to be used fully to meet the needs of the majority of the population. This last point carries technological issues beyond technical questions of engineering or economics and into the realm of legal and policy-making institutional structures capable of responding to national requirements.

These points can not be considered unless an activist State is at the heart of the strategy formulation and implementation process. An activist State, however, can take many forms and play its role in many different political systems. A cursory glance at the history of several countries normally considered technologically successful may serve as illustrations. Since the times of the Meiji restoration, Japan has had a state policy with respect to technology. It has supported domestic capital through foreign investment limitations, subsidies to encourage domestic innovation, the establishment of pilot plants and factories to demonstrate new technology to domestic industrialists and designed an educational system to train people to handle existing technologies and search for new ones. The Japanese economic system for over a century may be described as capitalistic, but it should be understood that the social setting of that capitalism has differed and continues to differ in important ways from the emphasis on individual or atomistic capitalism which supposedly was a key ingredient in the early technological development of, for example, Britain.[1/]

In a somewhat similar fashion, the notion of a planned capitalist development seems to have been central to the rapid changes which have taken place in the Republic of Korea during the past quarter of a century. That country too seems to manifest a strong correspondence of interest between the activities of large industrial groups and the technology policy of the Korean state. The state has established major institutions, of which a well-known example is the Korean Institute for Science and Technology (KIST), whose role has been to innovate by centralising certain scientific and technical resources

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1/ "Development of the technological capability was one of the key elements of (Japan's) pre-war development strategy. Although the relevant measures taken were not articulated by the policy-makers of the time as constituting a technology policy as such, they did in effect add up to a relatively well co-ordinated and consistent set of policy consideration, which may be called technology policy in the present day context of the term. Taking the pre-war period as a whole (1868-1937) and broadly speaking, there were five areas of policy-making in the field of technology:

(a) Introduction of advanced Western technology in the modern sector, including the infrastructure sector;

(b) Promotion of adaptation of the imported technology and creation of domestic technology;

(c) Encouragement of technological innovation and diffusion in the traditional sector;

(d) Development of skilled manpower; and

(e) Legal framework."

UNCTAD TD/B/C.6/26 Case Studies in the Transfer of Technology: Policies for Transfer and Development of Technology in Pre-war Japan.

to work on matters of immediate importance to the industrial sectory by instituting a system of contract work for which KIST has to engage in competitive bidding.[1/]

The state has taken a somewhat different role in some Western capitalist countries. Although an educational system has provided people with substantial technical skills as a ready-made labour force for domestic enterprises, much of the state's activities has been to subsidise directly the R + D efforts of individual firms while simultaneously providing a legal framework allowing those firms to reap monopolistic profits when innovations yielded marketable outputs. There seems little doubt that without such assistance it would have been far more difficult for those enterprises which currently control such large parts of the stocks and flows of modern technology to undertake necessary groundwork (see table 2 (1)).

Where socialist systems have operated, domestic generation of technology has been regarded as integral to the industrialisation effort. Technology requirements have been determined in relation to goals outlined by the state; the system of political organisation has given the state the power with which to pursue those goals. In such circumstances, the state is necessarily activist although this does not, of course, mean that its decision-making powers apply to all aspects of technology policy. It may be enough, depending on the country and the particular socialist path chosen, to identify requirements only in some key sectors and thus to concentrate the power to implement decisions in those sectors. Elsewhere, an activist socialist state might confine its policies to encouraging local initiatives, requiring only that the initiatives were to public rather than private advantage.

So in considering the role of the state in the formulation and implementation of technology strategies, it is not implied that only one political approach may be followed. Power can be wielded in various political settings; its results, particularly of a distributive type, may vary substantially from one context to another. By extension, particular mechanisms for international co-operation which a given developing country may wish to support or participate in can be of greatest value where a deliberate path of technological development has been conceived.

1/ KIST was established in 1966, as a technology-generating institution, with co-operation from the US Government. The institution concentrates mainly on the development of high precision technology for industrial upgrading. In the past decade the institute has carried out 1600 research contracts. The annual growth of the value of contracts was 36% in 1977 alone. The value of 1977 contracts was 5,185 million won. It has now become integrated into a structure of public sector marketing as well as financial institutions. See KIST Annual Review 1977 and other miscellaneous publications.

Table 2 (1): Technological Capacity - Selected Indicators[a/]

(Averages expressed as medians for 1970 or latest year available)

	Developed market economy countries	Developing countries and territories		
		Africa	Asia	Latin America
Science and Technology				
- Ratio of total stock of scientists and engineers per 10,000 pop.	112	5.8	22.0	69
- Ratio of technicians per 10,000 pop.	142.3	8.3	23.4	72.2
- Scientists and engineers engaged in R + D per 10,000 pop.	10.4	0.35	1.6	1.15
- Technicians engaged in R + D per 10,000 pop	8.2	0.4	0.6	1.4
- Expenditure on R + D as percentage of GNP	1.2	0.6	0.3	0.2

a/ The size of the sample of countries vary by indicator.

Source:: Transfer of Technology, Technological Dependence - its Nature, Consequences and Policy Implications, Report by the UNCTAD Secretariat, TD/90, December 1975.

2.2.2 Choice of Technology

To say that technology has a vital role in the industrialisation process is one thing; to imply that it is a panacea is quite another. Unfortunately much recent discussion has seemed to suggest that careful choice of technology can resolve, or help resolve, a whole range of issues from income distribution to alternative life styles. To present technological choice in such all embracing terms seems, at best, misleading. Many other broadly interpreted aspects of industrialisation policy should be brought into the decision-making. It would be quite wrong to suppose that technological choices alone could handle numerous issues at the same time and provide acceptable results for each. The ensuing comments and analysis intend to provide a realistic assessment of the number of problems which can be overcome by well-thought-out technological choices, and thereby indicate the content of technology plans.

Analytic discussion of choice of technology has focused on two criteria, which may sometimes be in conflict: surplus maximisation and the creation of employment opportunities. The former has been emphasised on the grounds that maximisation of the investible surplus will simultaneously maximise indirect as well as direct opportunities for increasing employment and output. The second criterion has concentrated on the twin facts that employment in developing countries tends to be well below full utilisation of the labour force, and that modern industrial techniques tend to use substantial amounts of capital per unit of labour. The achievement of full employment using these techniques would require the investment of very large quantities of fixed capital and perhaps substantial amounts

of working capital as well. The stress on employment criteria as central to technological choice has, in theory, come to be associated with the use of indigenous technologies whereas the emphasis on surplus maximisation has come to be linked with the proponents of industrialisation relying on imported plant and equipment from ICs.

A pragmatic approach to the two criteria, based as much on empirical considerations as on the theoretical analysis, suggests that economies can in fact usefully draw on both. Part of the strategy of "walking on two legs" is to try to create a sufficient surplus for investment and wider employment opportunities for the labour force. In this sense, there is no contradiction for an economy in choosing highly capital-intensive techniques in some sectors and very labour-intensive ones in others; indeed, the art of combining the two is probably at the core of the choice of technology. Phrased in this way, it is clear that choice of technology cannot be decided on micro-economic conditions alone. Instead, the location of a specific project or a sector in the macro-economic industrialisation strategy offers the general criteria on which technological decisions may be made.

A slightly more systematic view of the relationship between economic planning and technological choice may be illustrated by a sectoral model. Consider an industrial economy in the framework of these sectors, i.e. a "leading" sector geared towards the external market of import-substituting industrialisation, a "secondary" industrial sector, using modern or relatively up-to-date machinery, but geared towards some domestic production and consumption needs, and a "traditional" sector meeting rural or semi-rural market needs. Then the choice of technology may be related to the functions of the sectors in the following manner:

	Sector	Policy Objective	Technological Choice
A.	Leading	Capital formation through internal and external markets with output competing either on the international market or in the domestic one against imports. Linkage with economy to increase productive capacity in capital goods and/or provide a "growth pole" for surrounding activity.	1. Achievement of world technology frontier which implies importation at first, of foreign technology. 2. Efforts to assimilate the technology, in a "learning by doing" exercise, and perhaps eventually replicate the technology. Capital intensity may be a necessary consequence of imported technologies.
B.	Secondary	To serve the leading sector's needs, as well as miscellaneous domestic demands.	Reliance on foreign technology depending on foreign exchange saving and/or earning capacity. To an extent this sector makes best use of second-hand technologies, whether domestic or foreign. Here it would not at all be clear whether there is an objective constraint on capital intensity.

Page 1

	Sector	Policy Objective	Technological Choice
C	Traditional	To provide basic needs which are usually not met by the former sectors. The sector is by definition the one through which historically prevelent demands for non-agricultural output are met. It may be used to provide non-urban employment, especially since there will be a tendency towards labour-intensive industries. 1/	To adopt a non-discriminatory attitude towards the deepening of technological capacity (e.g. introducing new sources of power to traditional technologies) as well as widening the use of existing techniques in order to achieve a short-term solution to the basic needs problem. With an active policy meeting these criteria, this sector may offer the greatest grounds for employment stabilisation.

This example is not meant as any other than a brief analytic statement. "Real world" situations usually do not contain such well-defined sectors or clearly articulated and enforced policy objectives. Three points can be extrapolated:

First: The intimate connection between economic policy and technological choice.

Second: The realm of international action is not all embracing - the "traditional" sector, so defined, can draw very little from IC technologies, although there may be grounds for inter-developing country co-operation here.

Third: The choice of technology must be viewed to include both internal and external sources, depending on the function of each sector in the development effort.

2.2.3 The Development of Domestic Technology Capabilities in DCs.

At the risk of simplifying some complex historical issues, it would seem reasonable to argue that no country which has now reached an acceptable level of technological development has done so without some form of technological protection, which has come in diverse forms. At the beginning of the industrial revolution in Western Europe, England enjoyed the intrinsic protection of being the leader; the Soviet Union and some other socialist countries had the enforced protection which comes from being ostracised by dominant nations in the contemporary international system; in Japan the state has deliberately pursued technological selection and protection with the emphasis on permitting technology imports

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1/ A good illustration concerning this tendency is provided by the following example from India:

"The government has frozen the existing capacity for mill-made cloth, leaving future expansion of output to handlooms. Khadi (hand-spun yarn) is going to be given a boost by exempting polyester-khadi blended yarn from the stiff duty imposed on the mill-made variety.

"The Indian subsidiaries of Lever Brothers and Swedish Match have been asked gradually to phase out production of soap and matches, so these can be produced by village industries. Railway trains and stations are to help the village potter by storing drinking water in earthenware pots and serving passengers in throwaway clay cups instead of washable ceramic ones." The Economist, February 24, 1979, p. 73-4.

almost entirely in licensing and other disembodied forms. The story could be repeated for other countries, but the point is clear enough. Unless some form of technological protection exists naturally or is created through deliberate implementation of well-chosen fiscal and other policies, it is highly unlikely that significant development of domestic technological capabilities will occur. Unlike the arguments regarding trade or even the acquisition of technology, neither historical experience nor the current situation suggests that untrammelled free-market operations will encourage the possibility of DCs' developing domestic technological capabilities. Having said this, the relevant questions are (a) what should be protected and (b) to what end should this protection aim? The methods of protection available vary on a country-by-country as well as sectoral basis and cannot be easily handled in a general analytic discussion of this type. For this reason, they will be touched upon only peripherally.

To clarify, it must be stressed that this study does not advocate "technological primitivism", i.e. protecting absolutely inefficient indigenous technologies, nor does it recommend costly attempts at reinventing existing technologies. Rather, DCs (or groups of them) should be helped to "catch-up" in certain sectors, as they are already attempting to do. This issue has already been mentioned earlier in the chapter. The dynamics of catching-up with technological leaders seem to require striking the balance between initial inputs of technology from abroad and subsequent domestic development. The balance is affected by three major considerations, i.e. the nature of the foreign technology purchased - its complexity with reference to existing domestic skills; the non-financial conditions made when it is purchased, particularly those relating to the training of domestic staff and the permitted scope of or restrictions on domestic adaptation of the technology; and the opportunities to use and diffuse the technology. In short, the capacity to enhance domestic technological capabilities through acquisition of imported technologies is dependent on the extent of development of the technical culture of the economy and the linkages permitted by the engineering characteristics and terms of acquisition of the imported technology.

In connection with the protection of indigenous technological potential, there are five identifiable dimensions of the production of technology which may be considered. For existing technologies, countries may want to acquire capacities for (a) assimilation, (b) modification, and (c) replication of imported technologies. In addition, they may want to (d) create new technologies and (e) export them. The matrix drawn identifies necessary components of know-how and productive facilities required for these stages:

	REQUIREMENTS			
Stages	Shop-floor mechanical skills and the development of technical culture	Specialised design engineering and productive facilities in the machine-building sector	Applied and theoretical scientific knowledge	Domestic and international marketing facilities
Assimilation	x			
Modification	x	x		
Replication	x	x	x	
Creation	x	x	x	
Export	x	x	x	x

The nature and scope of protective mechanisms may be readily deduced from the cells of the matrix. Depending on the extent to which a developing country wishes to develop its technological capacity (i.e. how far it wishes to proceed down the columns of the matrix), it will have to acquire and nurture the elements identified horizontally. National mechanisms utilising fiscal and other institutional means are needed to protect each of the items.

It would be useful to elaborate on the relationship of these stages to international co-operative mechanisms:

- Productivity changes within a given technology (assimilation) covers improvements on the shop-floor due to repetitions of tasks and amendments of products. These are the activities, quite crucial in practice, which are generally considered under the heading of learning-by-doing. Some characteristics of these improvements can usefully be identified. First, while they may be sensitive to the size of the firm, they may not be critically influenced by its ownership, since all firms presumably have an interest in cost-reducing improvements deriving from internal efficiency. Second, and by the same token, these improvements probably cannot be transferred to other enterprises in the economy very easily, both because organisation varies from enterprise to enterprise and because the often segmented nature of the labour markets in developing countries means that workers may not be particularly mobile from one enterprise to another. The problem is further compounded in intra-economy flows. Third, it is unlikely that these improvements would have any direct implication for other entities, whether public or private, in the economy. Fourth, they may reach their limits quite quickly, i.e. there is a limit to which a machine operator, for example, can increase his speed or dexterity (while Adam Smith's Division of Labour may have been limited by the extent of the market, so localised "learning by doing" is also limited by the sophistication of the firm and its organisational and production technologies).

At national levels, government action can only play a supportive and perhaps indirect role by the establishment of technical institutes and polytechniques which promote the acquisition of skills through which shop-floor learning by doing may be promoted. However, for the reasons enumerated above, there seems little scope for international action here.

- The capacities to modify, replicate and create new technologies are directly dependent on the availability of specialised engineering skills and capital goods production capacity. Thus on an economy-wide basis the knowledge which must be assembled for amelioration of a technology may lead to the establishment of fresh organisations not only within the innovating enterprise (e.g. a new R + D department) but also to new organisations supplying technological inputs to a whole industry or set of industries. Where, over the long run, sustained improvements in technologies require continued application of new skills, the educational system of the country or its access to educational systems abroad, will have to be extended in scope. As opposed to learning by doing, design efforts will also generate a demand for technical capacities acquired through more formal processes. Technological development of the kinds referred to here may well make more intensive use of local raw materials as well as demanding greater employment of domestic creative capacities; in these senses, design efforts place much heavier demands on the mobilisation, utilisation and organisation of domestic resources.

Construction efforts include production plants, products and processes. Obviously, an economy possessing, or aspiring to possess, these capabilities will have to draw on a wider range of skills and institutions than an economy whose perspectives are limited to the first two areas mentioned above. Certainly, the growth of engineering consultancy services, marketing skills and financial support will all be necessary in ways previously not important. The creation of new products and processes may require investments in basic R + D, bringing together technology policy and science policy.

International action is relevant in this context insofar as it facilitates the spreading of risks in investment of resources and national utilisation of scarce know-how or resources, by promoting inter- or intra-regional specialisation and production-sharing co-operation.

- For potential DC technology exporters, the familiarity of the problems of barriers to entry is too great to repeat. International co-operative efforts for export promotion of DC technologies is an important area in the information sharing/distribution aspects and also in terms of export credits and financing. Not only will these efforts distribute the cost burdens of marketing over DC enterprises, but it will also enable the spreading of risks facing individual countries as producers.

In summary, then, this survey of the elements of technology strategy has identified two broad components, acquisition and production. Relevant criteria for acquisition have been touched upon, as have been the phases of production of technologies. International co-operation is, and will, play a role in most of these areas of activity. The preceding analysis may facilitate a clear evaluation of the thrust of international co-operative mechanisms, and the objectives of new proposals. Furthermore, in making new proposals, a certain flexibility will have to be maintained; it is not suggested that every developing country, or even the majority, will want to envisage technology strategies involving the whole range of matters just mentioned. For some countries it may be enough to develop a thorough strategy for technology selection and acquisition from abroad; other countries may wish to go further and elaborate strategies capable of assimilating, modifying and replicating existing technologies; still others seek mechanisms encouraging the creation of new technologies and their export, because they see themselves as technology exporters in several sectors in the future. Any country must make its own choices through its own "perception of possibilities". This statement is as true for many industrialised countries as it is for developing countries. Though what has been written so far frequently speaks of "the industrialised countries", only a few of them are major technology exporters - quite a few of the OECD members do not aspire to more than strategies for technology purchase and assimilation. For them also, therefore, the considerations sketched here are highly relevant; the probability is, in fact, that a number of today's developing countries have much better prospects of becoming substantial technology exporters than do quite a few OECD members.

2.2.4 The Choice of Sources and Terms of Purchase

Sectoral evidence[1/] suggests that the concentration of R + D expenditures and firm size are not strongly correlated in ICs. R + D and - to a greater extent - industrial innovation have often originated outside the largest IC coporations. However, as noted earlier, the larger corporations, more specifically TNCs, have been the main diffusors or commercialising vehicle in the international flow of technology. If non-TNC entities who create technology are taken into account, then even in potential North/South transactions, it can be contemplated that there are varying degrees of imperfections in technology markets[2/], which provide some scope for manoeuvre for DC purchasers of technology. Specific to this context has been the increasing emphasis placed on the need to focus on "small-scale" producers of technology in ICs. These producers may be more competitive in the sense that they may be able to accumulate or exert less market power and provide more appropriate terms of technology transfer to DCs.[3/]

In addition to the North, there are other sources of technology supply about which less systematised knowledge exists. These are:

(i) DC sources, including small-scale producers, large engineering and capital-goods-producing firms, and state enterprises engaging in technology production.

(ii) Socialist countries, who have not yet adequately exerted leverage on a multilateral basis in order to influence both the nature of technologies flowing to DCs and alternative contractual forms under which these may be supplied.

1/ See Freeman, op.cit., Ch. 6.

2/ Lall, S., in a paper prepared for this study, provides a useful threefold classification of technology markets: "(1) Fairly competitive markets, where a number of enterprises is capable of supplying a given technology, e.g. machinery suppliers, contractors or engineering consultants supplying a turnkey project)or particular types of know-how, as required). Monopoly rents would be low or non-existent, and hidden costs would also be low. (2) Fairly imperfect markets, where a few oligopolists can supply a technology of relatively recent origin, e.g. licensing. Monopoly rents would exist and would be realised by direct and indirect means. (3) Market "failures", where no satisfactory deal can be arranged between the parties, and the supplier would invest directly to exploit the technology. Monopoly rents may be quite large based on a combination of various elements apart from the technology".

3/ However, to believe that non-TNCs creators of technology from the North will introduce more appropriate technologies in DCs is rather naive. It has not yet been proved that this sort of technology will be adequate. Furthermore, it might simply be a sort of device for the developed countries to dispose of outdated technologies to the Third World. The doubts of whether these technologies stemming from small-scale entities in the North are a good thing for DCs are observed in The Economist, March 24, 1979, page 122.

While contemporary emphasis on DC-TNC transactions are perfectly justified as a major domain of international action, what has not been fully explored as yet is the creation of institutions which facilitate new entrants in technology markets, in order to counter-balance the high monopoly rent suppliers. To recount, these new entrants could and should be (i) non-TNCs from the North; (ii) DC suppliers; and (iii) increased Eastern-block suppliers, in addition to the "conventional" direct foreign investment (DFI) packages by TNCs. Efforts to match these suppliers to various demands will enable the realisation of more effective and genuine choice in terms and sources of technology.

There are at least five areas which involve one or more sets of the entities just mentioned. These are:

(i) Negotiation frameworks for improvement of financial terms of transfer in favour of recipient countries.

(ii) The limitation and elimination of restrictive clauses on the utilisation of acquired technology.

(iii) Information on alternate sources of supply of technology.

(iv) Information on optimal acquisition methods in order to maximise specific impacts on the domestic economy.

(v) Dissemination of information to DCs in order to realise the fullest potential from the centralised sources of knowledge.

Having observed this, it is directly relevant to review some of the outstanding problems in each of these areas:

- In negotiation frameworks the whole realm of restrictive business practices has become important and contentious issues. The general attempt has been both to encourage market transparency and to grapple with the burden of financial costs imposed by the present patent and trademark system.

- In the non-financial area, the set of issues at the legislative level includes inter alia export restrictions and other forms of international market sharing arrangements (particularly with reference to TNCs), limitations on sourcing for raw material inputs and purchases of intermediates, and grant-back provisions for advances in technology made within DCs. In addition, model contractual arrangements which draw experience of DC-TNC interaction cover performance guarantee schemes, the stability of contractual terms, particularly in relation to adequate supplies of support for acquired technology and the freedom of modification and replication in order to establish maximum linkages with DC economies.

- Information on alternate sources of supply is now being gathered by UNIDO and other international bodies, on sectoral bases. In addition to information on technology from OECD countries, much work has to be conducted on the supply potentials of Eastern-bloc countries and on DCs.

- Both UNIDO and UNCTAD have explored the relative advantages of different technology acquisition options, such as unpackaged purchases and turnkey projects. Here again, the emphasis has been largely (though not exclusively) on North/South flows. Relatively little knowledge has been centralised on East/South, East/East or South/South transactions and transactive instruments in order to evaluate them as alternative sources or model contractual alternatives in existing North/South flows.

- Information gathering endeavours have proliferated internationally and regionally. These activities are worthwhile attempts to improve the conditions under which transactions take place, because collecting information is an expense which can hardly be met adequately by the resources of one DC or a single sector in a DC. Moreover, as is well known, information collection and distribution yield substantial returns to scale. There is a danger of repetitive and dispersed information banks, or worse yet, or substantial gaps emerging between the efforts of the numerous bodies. An argument can be made for a co-operative effort among international and regional organisations[1/] to centralise and streamline information gathering and storage procedures.

- Information is a necessary condition for improving the present situation. It can only be used when the concerned countries unite their capacities and resources to absorb and use it. This seems an area of significant weakness at present, either due to the incapacity of governments and firms to formulate their technology policies or to their inconsistencies in approaching problems of technology acquisition. Here international action can play a dual role: helping to create bargaining possibilities and institutions on a lateral South/South basis; establishing bargaining institutions which could be shared by DCs to avoid replicating efforts and overly expensive endeavours.

2.3 Principal Problems of Current Technology Transactions

2.3.1 The Nature of Technology Markets

Note has already been taken of the "public-good" nature of technology. Once a technological innovation has taken place, it can be infinitely reproduced and should become a free good, if the dictates of economic theory hold and optimal prices are obtained. However, when motivated by the prospects of profitability, the technology market required monopolistic rents protected by state legislation. Born is the dilemma of finding social and/or market mechanisms capable of providing adequate rewards to innovators, adequate stimuli to would-be innovators (and, by extension, to the rate of investment in technology creation), and yet providing the maximum opportunity for all would-be users of technology to obtain it

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1/ This thinking seems to be in line with the project initiated by SELA which has created an information office - RITLA (Red de Información Tecnológica Latino-Americana) in order to identify, evaluate, select, adopt and systematise technologies in accordance with the requirements of the Latin American countries. See Comercio Exterior, Vol. 28, no. 9 septiembre de 1978, pp. 1117-1118. See also for the INTAL case, Business Latin America, 20 December 1978, p. 407, Notas sobre la economía y el desarrollo de América Latina (CEPAL), Evaluacion de la Ciudad de La Paz, p. 16.

with the least possible financial or non-financial hindrance. As a matter of necessity, the private enterprise system must depart from its ideology of non-intervention by non-market entities and adapt its legal and institutional framework to seek an uneasy balance among the conflicting desiderata mentioned above. Normally, the solution has been to grant legal property rights over the use of new productive knowledge and of a series of elements, such as product distribution, sale and production with protected processes, in return for which the entities generating new technology are supposed to disclose fully their discoveries.

In practice (probably increasingly so), legal property rights are reinforced by industrial secrecy (both because patents do not always fully disclose the knowledge necessary for productive use and because many innovations are not patented), by know-how embodied in the experience of the innovating enterprise, by commercial practices both to create goodwill and to restrict the ways in which technological knowledge is employed. Consequently, the size and time duration of the economic rents which the innovator is able to appropriate may be much greater than would be indicated simply by considering legal protection.

As noted in section 2.2, the purchaser can shop around and bargain to improve purchase terms, but from a social point of view, these are palliative measures attempting to cope with non-optimal situations. Technology may be sold outright; it may be licensed with some sort of joint venture between the seller and the user arranged; or direct investment built around control of technology may take place. It is evident that the range of the possibilities is substantial and that no a priori statement can be made with regard to specific outcomes of any search-cum-bargaining process. The degree of imperfections is certainly uneven across markets although it is possible that the growing concentration of industrial enterprises in the developed countries may reduce that range of choice.

Despite these complexities, a consideration of the broad characteristics of technology markets may illuminate feasible avenues for international co-operation in the field:

- First, the innovator of a technology is not necessarily the only source of supply. As a rough guide, one may say that the older a technology, the greater the possibility of competition on the sellers' side, since producers of existing technologies may proliferate with time. This applies particularly to embodied technologies, but is not necessarily restricted to them. For example, machinery producers are interested in supplying new processes which will be embodied in equipment or in turnkey plant operations; their main interests may focus on completing individual projects and in establishing a long-term reputation for quality, reliability and performance. It is less likely that they would have strong interests in weaving a network of conditions around technology contracts which would impose additional obligations on the purchaser. Engineering consultants, whose stock in trade is disembodied knowledge (their assets are, in essence, themselves) likewise have a major interest in creating and maintaining a reputation in the market. Since their activities consist, mainly, of packaging "custom-made" technology for users, they too have relatively little interest in building up tie-in conditions. But many of the important engineering consultancy firms operating in the industrialised countries today are associated,

via equity control or otherwise, with the owners of important technological processes (this is especially true in the chemical industry). To this extent, consultancy firms may not be independent from the strategies and behaviour of process holders. A third category of technology supplier is the firm who licenses processes and frequently the trademarks attached to them. Such firms employ various contractual agreements which may govern the conditions under which the technological knowledge can be employed. A final category is the direct investor whose technology is an instrument of control within a much larger setting. Generally speaking, the last category will offer relatively less scope for competition in the technology transactions, since finding alternatives implies much more than simply a search in technology markets.

- Second, technology comes bundled with other elements of knowledge (marketing, organisational or technical kinds) and resources. Certainly, the broader the package, the less immediate activity required from the recipient; but, by the same token, the economic rent collected by the technology owner is liable to be greater. The more a buyer is prepared to do, the better the terms he may get; searching for information, evaluating and manipulating it in negotiation processes, willingness to learn in the shortest possible time the technical and management details of the operation of a technology all require considerable effort. However, that effort will collect its returns not only be increasing the benefit/cost ratio accruing to the purchaser from the project in hand, but also because the knowledge and experience gained will greatly facilitate future transactions.

Third, technology by nature is dynamic. Consequently, purchasing and selling decisions cannot be determined only by today's alternatives but also must be considered in relation to the probabilities that different, and perhaps more advantageous, technologies will become available. The speed of change, or more precisely, the expected spped, will thus influence the decisions made. Roughly speaking, one may say that stable technologies might be transferred satisfactorily through turnkey operations or other arms-length acquisitions, where the user's initiative and effort should reduce dependence on the source of supply over time. Less stable technologies might be transacted through licensing arrangements whose relatively limited duration allows buyers and sellers to adjust arrangements in response to external circumstances. Complex and rapidly evolving technologies may be shifted through DFI since the requirements of the technology holder as well as the possibilities for the country in which the technology is to be used may militate in favour of particular kinds of packaging.

Technology is moved through different combinations of costs, risks, and potential benefits among the parties concerned. Although certain basic ideas argue the maximum unpackaging of technology transactions, by and large it can be rarely guaranteed that any one situation will always be superior to others. The best arrangements will always be the product of the macro and micro organisation efforts to employ technology to best advantage.

This discussion emphasises that purchasers do not lack influence over imperfections in technology markets. To a considerable extent, a capable enterprise may be able to influence competitive conditions selecting different components of a technology from several sources, including its own research and development. An inexperienced enterprise, on the other hand, may not be able to assimilate even the simplest technology and consequently, may experience "market failure" in negotiating with the supplier. Market imperfections may be influenced by the degree of access to, and use of, information in addition to other structural conditions. The important recognition for buyer enterprises is that at least to some extent, the nature of the technology market facing them is dependent on their capabilities. Capabilities can be improved by self-help, which is where national technology policy can play a role, and by outside help, which is where international organisations in particular can improve the terrain on which technology transactions are undertaken.

To summarise then, there are three sources of imperfection in technology markets:

(i) Imperfections created through (a) legal protection of technological innovations through patent legislation, (b) legal protection of products and enterprises through differentiation of products via trademarks and their associated advertising, (c) commercial secrecy, and (d) the possession of advanced skills and know-how which give a clear edge to the seller. In essence, these market imperfections are associated with the supply side of technology, and they are buttressed by legal structures, investments in R + D and the speed of change of technology.

(ii) Imperfections deriving from the relative technological, managerial and perhaps institutional weakness of the buyer. The arguments in sections 2.1 and 2.2 of this chapter sustain the view that national policies in developing countries can do a great deal to reduce these demand-associated imperfections, by providing direct support to existing institutions and by creating new ones capable of altering the overall balance of power in the technology transactions. The argument is that a totality of measures is required which will address both indirect and direct reasons for technological and managerial weakness.

(iii) Imperfections based upon the lack of information concerning sources and terms of technology supply. These are the genuine "information gaps" about which so much has been said in discussions of technology problems. International co-operation can contribute a great deal to their removal and it is no accident that almost all sets of proposals for international co-operative mechanisms in this field begin with information gaps.

The configuration of these various sources of imperfection in technology markets determines the result. Differences in that configuration as perceived in different places and times make it difficult to generalise and analyse policies regarding the degree of imperfection in specific markets. Certainly, a technology supplied in one situation, providing what is considered a "fair" distribution of benefits to all parties (including groups not directly involved in the transaction), may be transacted under very different conditions

elsewhere. These differences pertain not only to the overall terms of purchase but also include how the technology is transacted, e.g. the buyer dealing with various machinery producers and engineering consultants may have a clearer vision of the total process that any one of the sellers, while in another situation everything may be sold via a single institutional form, with buyer and seller possessing equal amounts of information, or the seller possessing more information than the buyer.

In broad terms, DC technology buyers (including governments and state enterprises) can do much to improve demand-related conditions of imperfections and to fill information gaps. To some extent also, through exploration of alternative legal and institutional arrangements at the national level and pressures for changes in international arrangements, developing countries can alter some of the supply-related conditions. Effective international co-operation in this field would mean that developing countries could rely on the assistance of industrialised countries. In practice, however, significant parts of the wealth of industrialised countries depend precisely on their retention of specific advantages. For this reason, the reality of much of what is labelled international co-operation is, in fact, a series of conflicts where industrialised countries seek to preserve if not re-enforce the structural context in which technology transactions are undertaken. This is why developing countries should not rely totally on trade, the traditional area for international co-operation. In a well-functioning system, where all groups have genuine access to technological assets and in which confidence could be placed in the competitive operation of markets, the long-term benefits of international trade could be realised to the maximum extent both in amount and distribution, but given the systematic biases in access to technology, the issues surrounding corrective measures on trade are, from the developing countries' point of view, attempts to deal with consequences rather than causes of the problems of global inequality.

2.3.2 Methods of Technology Acquisition

Typologies of technology transactions have been established in various ways. Consistent with the remarks made earlier, three dimensions are described and discussed here: (i) the nature of technology transactions; (ii) the industry where transactions occur; and (iii) the instruments through which the transactions are effected.

The nature of technology transactions. Technology as knowledge is not transmitted through strictly commercial means, e.g. it may flow through scientific exchanges and publications. The latter forms may well have significant impacts even if they are indirect, on not only the decisions made regarding commercial transactions, but also on various groups' cultural perceptions of the meaning and significance of technology in a development process. Conversely, there are transactions of enormous value in cash-terms, e.g. international sales of machinery, which perhaps embody considerable amounts of technological know-how yet are not really transfers of knowledge about production. While recognising the importance of the first sort of flows, the focus here will be on commercial transactions in technology of more direct types; i.e. on turnkey contracts, consulting services of various kinds, licensing arrangements, and DFI involving the transfer of technology.

A helpful threefold categorisation of transactions, developed in a recent study identifies:[1]

(i) "Simple direct" sales of technology which consist of outright sales of technological assets and services to unrelated buyer firms. These sales are generally made by capital-goods producers and engineering consultants in "arms length" markets.

(ii) "Process-packaged" sales of technology where complete industrial processes are supplied along with the corresponding preinvestment studies, design, commissioning and construction of plant, start-up of the plant, training of domestic personnel. Generally speaking, the sellers of these kinds of technology will tend to be consultants with specific engineering specialities, machinery manufacturers and final product manufacturers.

(iii) "Project-packaged" sales of technology where the technology is accompanied not only by the associated technical services just described in (ii) but also by a whole host of additional factors essential for effective commercial (and not just technical) operation, e.g. management, finance, product marketings of outputs. By the same token project-packaged sales are accompanied by more direct forms of control over the continuing use of the technology by the seller. This control implies DFI of some sort.

This categorisation, clearly presented in terms not only of different compositions of items which are the subject of transactions, but also in terms of different kinds of sellers, has the merit of underlining that technology policy, even when confined to issues of international acquisition, cannot be seen only in terms of whether or not TNCs can be made to give up some of their control over DFI or related instruments of commercial power (the factors included in category (iii)). Instead what is important to consider is the alternative modalities of acquisition. The categorisation also fits rather well with the three different sources of imperfections outlined in the preceding subsections, since specific elements of monopoly power tend to be associated with (i), (ii) or (iii). Generally speaking, one would suppose that developing countries with greater experience and capabilities in technology generation would be able to operate more in areas (i) and (ii) than would countries with relatively little experience. Similarly, when developing countries themselves export technology (a matter to be taken up later in this part of the chapter) they would be active more in areas (i) and (ii) than in area (iii). Finally, the categorisation is sensitive to inter-industrial differences because sectors where advanced technology predominates will tend to be marked by project-packaged transactions. Indeed, such transactions prevail in the dealing among industrialised countries themselves. Certainly, project-packaged transactions can vary since wholly-owned foreign investments do not offer the same flexibility as licensing arrangements of joint ventures. Despite differences within project-packaged transactions, the category is qualitatively separable from the others because of the ingredients and elements of control embodied in these transactions.

1/ This point is drawn from Cooper and Hoffman, 1978, pp. 19-22.

The position of developing countries as a whole may now be evaluated. The bulk of empirical information currently available refers to project-packaged transactions, or to simple direct sales of technology or technologically intensive outputs. Even here, the indicators of relative positions of developing countries are extremely crude, since the technological content of transactions is only one component of the value of DFI or sales of machinery and transport equipment. Tables 2 (2) to 2 (7) attempt to capture some of the dimensions of inequalities in technological endowments and in flows of output by presenting data on the global distribution of researchers (table 2 (2)), the distribution of world R + D expenditures (table 2 (3)), a breakdown of exports of machinery and transport equipment in world exports (tables 2 (4) and 2 (5)), along with aggregate values (table 2 (6)) and, finally, the direct costs to DCs of transfers in technology in comparison to other foreign exchange flows (table 2 (7)). To summarise, it can be seen that DCs possess only 12.6 per cent of global stocks of R + D scientists and engineers, of which 9.4 per cent are concentrated in a few countries of Asia. Further, IC economies absorb 97 per cent of global expenditures on technological innovation. In terms of current flows, the crude indicators in table 2 (4) show that DCs account for only 2.8 to 3.2 per cent of global exports of technology-intensive goods - there are no readily available data for services, although there is little reason to suppose the picture would be much different. The problem of technological dependence, a direct result of these inequalities, is suggested by the fact (table 2 (5)) that about 90 per cent of DC imports of machinery and transport equipment emanate from the ICs, and only 4.6 to 5.5 per cent come from other DCs.

Table 2 (2): Distribution of researchers (R + D scientists and engineers) among major regions and per million economic active population, in 1973

	Researchers (R + D scientists and engineers)		
	Total ('000)	% of world total	per mn EAP
WORLD Total	2,279	100.0	1,570
DEVELOPING COUNTRIES	288	12.6	307
Africa (excl. South Africa	28	1.2	271
South and Middle America	46	2.0	461
Asia (excl. Japan)	214	9.4	292
DEVELOPED COUNTRIES	1,990	87.4	3,871
Eastern Europe (incl. USSR)	730	32.0	3,958
Western Europe (incl. Israel, Turkey)	387	17.0	2,441
North America	548	24.1	5,386
Other (incl. Japan, Australia)	325	14.3	4,687

Source: Preliminary data from the World R + D Survey, 1978. Figures are rounded, but percentages and other data are calculated with the most detailed figures available.

Table 2 (3): Distribution of World R + D expenditures among major regions and by average share of gross national product and per economic active person, in 1973

	R + D Expenditures			
	in mn US dollars	% of world total	per EAP in US dollars	% of GNP at market prices
WORLD Total	96,418	100.0	66.4	1.97
DEVELOPING COUNTRIES	2,770	2.9	3.0	0.35
Africa (excl. South Africa)	298	0.31	2.8	0.34
South and Middle America	902	0.94	9.0	0.37
Asia (excl. Japan)	1,571	1,63	2.1	0.34
DEVELOPED COUNTRIES	93,648	97.1	182.1	2.29
Eastern Europe (incl. USSR)	29,509	30.6	160.0	3.82
Western Europe (incl. Israel, Turkey)	21,418	22.2	135.1	1.55
North America	33,716	35.0	331.1	2.35
Other (incl. Japan, Australia)	9,005	9.3	129.8	1.76

Source: Preliminary data from the World R + D Survey, 1978. Figures are rounded, but percentages and other data are calculated on the most detailed figures available.

Table 2 (4): Percentage share of exports of machinery and transport equipment in world exports, 1973-1976[1/]

Category	1973	1974	1975	1976
Developed market economy countries	86.6	87.2	87.1	86.9
USSR	2.9	2.6	2.6	2.6
Other socialist countries of Eastern Europe	7.6	6.9	7.4	6.9
Latin America	0.7	0.7	0.7	0.68
Africa	0.05	0.07	0.02	0.04
West Asia	0.2	0.2	0.2	0.2
South and South-East Asia	1.9	2.2	1.8	2.4
DC Total	2.8	3.2	2.9	3.4
Socialist countries of Asia	0.06	0.06	0.05	0.07

Table 2 (5): Breakdown of DC imports of machinery and transport equipment, 1973 - 1976

Source of DC imports	1973	1974	1975	1976
Developed market economy countries	89.2	89.6	90.8	90.3
USSR	3.5	2.4	2.1	2.1
Other socialist countries of Eastern Europe	2.4	2.4	2.4	2.1
Intra-DC	4.8	5.5	4.6	5.1
Socialist countries of Asia	0.02	0.02	0.02	0.03

Source: UN Handbook of International Trade and Development Statistics, 1979, Appendix table A10.

1/ All figures are per cent of regional exports to world exports.

Table 2 (6): Network of exports of machinery and transport equipment (SITC 7)

Values are expressed in millions of US dollars, f.o.b.

Destination / Origin	Year	World	Latin America Value	Latin America % of World	Africa Value	Africa % of World	West Asia Value	West Asia % of World	South + South-East Asia Value	South + South-East Asia % of World	DC Total Value	% of World
World	1973	164,280	10,800	6.57	8,800	5.35	5,630	3.42	9,670	5.88	35,150	21.39
	1974	205,600	15,470	7.5	11,790	5.73	9,450	4.59	13,790	6.7	50,810	24.71
	1975	244,150	19,420	7.95	17,060	6.98	18,470	7.56	15,110	6.18	70,410	28.83
Developed market economy countries	1973	142,310	9,800	6.88	8,070	5.67	4,700	3.30	8,540	6.0	31,360	22.03
	1974	179,360	13,990	7.79	10,880	6.06	8,160	4.54	12,100	6.79	45,530	25.38
	1975	212,630	17,590	8.26	15,920	7.48	16,670	7.83	13,410	6.30	63,920	30.06
Developing countries and territories	1973	4,590	540	11.76	150	3.26	180	3.92	790	17.21	1,660	36.16
	1974	6,490	920	14.17	305	4.69	400	6.16	1,150	17.71	2,700	42.08
	1975	6,860	1,020	14.86	450	6.55	510	7.43	1,240	18.07	3,240	47.23
OPEC	1973	125	10	8.0	9	7.2	55	44.0	19	15.2	93	74.4
	1974	200	11	5.5	28	14.0	115	57.5	9	4.5	160	80.0
	1975	-	-	-	-	-	-	-	-	-	-	-
Other DCs	1973	4,160	530	11.88	140	3.13	125	2.8	770	17.26	1,570	35.2
	1974	6,290	910	14.46	275	4.37	285	4.53	1,150	18.28	2,630	41.81
	1975	6,860	1,020	14.86	450	6.55	510	7.43	1,240	18.07	3,240	47.23
USSR	1973	4,710	290	6.15	330	7.0	450	9.55	160	3.39	1,240	26.32
	1974	5,330	365	6.47	250	4.69	460	8.63	165	3.09	1,220	22.88
	1975	6,380	475	7.44	240	3.76	610	1.72	195	3.05	1,520	23.82
Socialist countries of Eastern Europe	1973	17,280	445	2.57	560	3.24	730	4.22	300	1.73	2,050	11.86
	1974	19,640	550	2.8	590	3.0	880	4.48	400	2.3	2,420	12.32
	1975	24,530	800	3.26	670	2.73	1,290	5.25	415	1.69	3,170	12.92
Socialist countries of Asia	1973	100	12	12.0	19	19.0	9	9.0	40	40.0	6	6.0
	1974	120	11	9.16	14	11.66	5	4.16	43	35.83	10	8.33
	1975	130	11	8.46	15	11.53	7	5.38	48	36.92	11	8.46

Source: Based on UN Handbook of International Trade and Development Statistics, 1977.

Table 2 (7): Direct costs of transfer of technology in comparison with other relevant foreign exchange flows of developing countries, 1968[a]

Flows	Value (millions of dollars)	Percentage
Outflows		
1. Direct payments for transfer of technology (patents, licenses, know-how, trademarks and management and other technical equipment)	1,500	5.8
2. Technology-related payments:		
(a) Imports (c.i.f.) of machinery and equipment (excluding passenger vehicles) and of chemicals	18,420	71.8
(b) Profit on direct foreign investment (excluding oil-producing countries)	1,721	6.7
3. Service payments on external public debt	4,022	15.7
Total payments in above categories	25,663	100.0

a/ Excluding South European countries

Source: Based on UNCTAD, 1975, p. 28.

The nature of the industrial sector. Work by UNCTAD[1/] has provided some data on the industrial distribution of technology sales to developing countries. The data, based on the results of a questionnarie survey, refer to the situation as of end 1970. Table 2 (8) summarises the information grouped according to "modern", "traditional" and "other" manufacturing. It would have been more useful to have a much finer classification differentiating between high and low technology processes within each industry since there is no firm correlation between the degree of modernity of an industry and its capacity for innovation. In the absence of more detailed information, however, the present data will have to suffice.

The sample shows that the 14 countries listed had 57 per cent of the technology contracts in the modern sector, 26 per cent in the traditional sector and 17 per cent in other manufacturing. Note that the more industrialised countries had a greater share of contracts in the modern sector. This may reflect the earlier contention that some movement exists towards transactions which are not project-packaged in developing countries with greater industrial capacities. Moreover, some of these countries may have no need to import technology in some sectors, since indigenous sources may fulfil demands. Finally, technology frontiers are continually shifting and it is by no means impossible or even unlikely that some of the so-called traditional sectors will experience substantial technological changes in future years, thereby changing the picture radically.

1/ See UNCTAD, Major Issues Arising from the Transfer of Technology to Developing Countries, UN/TD/B/AC.11/Rev. 2, 1975.

Table 2 (5): Contractual agreements on the transfer of technology by major sectors of manufacturing industry in selected countries, end of 197[a]

Country[b]	Number of Contractual Agreements: Total manufacturing	Modern sector[c]	Traditional sector	Other manufacturing[d]	Percentage of Total: Modern sector	Traditional sector	Other manufacturing
Cyprus	36	7	24	5	19	67	14
Dahomey	25	5	20	-	20	80	-
Pakistan	695	209	311	175	30	45	25
Greece	326	146	89	91	45	27	28
Sri Lanka	79	37	24	18	47	30	23
Colombia	353	173	135	45	49	38	13
Chile	735	375	264	96	51	36	13
Brazil	1,579	879	242	458	56	15	29
Argentina	342	219	73	50	64	21	15
Yugoslavia	692	458	203	31	66	29	5
Spain[e]	2,014	1,344	464	206	67	23	10
Iran	90	68	13	9	76	14	10
Rep. of Korea	221	179	40	2	81	18	1
India	(1,491)	(1,491)	...	...	..	..	..
Total (excl. India)	7,187	4,099	1,902	1,186	57	26	17

a/ UNCTAD, Major Issues Arising from the Transfer of Technology to Developing Countries, New York, UN/TD/B/AC.11/Rev. 2, 1975.

b/ Listed in ascending order of the percentage of agreements in the modern sector.

c/ Includes the following manufacturing industries: food, tobacco, textiles, clothing, leather products, wood products, paper and printing, stones, clay and glass, fabricated metal parts.

d/ Includes the following manufacturing industries: cosmetics, rubber goods, ferrous metals, non-ferrous metals, other manufacturing.

e/ Refers to the annual average number of contracts concluded in the period 1964 to 1969.

Source: UNCTAD, 1975, p. 9.

The nature of instruments. It may be recalled that technology, where transmitted through commercial channels, moves in various forms. These include:

(a) Capital goods, which embody technology in machines.

(b) Mixtures of sales of capital goods and technical services found when complete processes or plants are purchased. While capital goods sales embody technology in the engineering sense, transaction processes or plants transfer technology in the economic sense, by incorporating transactions in human skills as well as machines.

(c) At the other end of the spectrum, are sales through technically disembodied instruments, by the provision of consultancies and other technical services.

(d) Licensing is a mixture of technically embodied and disembodied methods of technology acquisition. Licensing covers products and processes protected by patents; know-how which is often, though not always, related to these patents; and trademarks and similar commercial instruments, which frequently are to be found in patent-licensing agreements. Without the latter, it may not be possible for sellers to utilise the other forms of license arrangements to derive commercial benefits. Precise contractual agreements may tend to be sensitive to the location of market power for particular industrial technologies. Consequently, although any set of industries may reveal a similar quantitative incidence of licensing arrangements, it is quite possible that the mixture of the three sorts of licenses will vary substantially.

(e) DFI, where there may be no contractual arrangement for technology as such since supply and purchase will occur automatically (though in controlled fashion) between affiliates and present operations of transnational corporate networks. In this case, any of the preceding instruments may be used, although detecting their importance may be quite difficult.

Contractual information does not encompass the whole spectrum of issues that has been discussed. Table 2 (9) provides data[1/] for a nine country sample on the relationship of some kinds of contractual transfers to the ownership characteristics of the contracting enterprises in technology-purchasing countries. The data indicates that even foreign-majority owned firms import technology through "arms length" type contractual arrangements.

2.3.3 Terms and Conditions of Technology Acquisition

There are several data problems in assessing the financial costs of technology transactions. These arise from several factors, some of which are:

- The national data is neither consistent nor comprehensive.

- Even where some figures are provided, it is not possible to separate payments for technology from other capital account flows.

- Besides explicit costs of technology transfer, there are numerous costs which do not appear in the balance of payments due, for example, to transfer price manipulations in inter-TNC transactions. Data on transfer price adjustment is frequently partial and inadequate to enable compensating calculations to be made. The hidden costs, especially those which are due to internal transactions of TNCs will probably persist over time, since TNCs will change their accounting practices in response to the economic environment in which they undertake transfers of technology, e.g. the problems thrown forth by the destabilisation of exchange rates, and tax and tariff rates which may effect technology transactions. Despite these problems some empirical observations may be made.

1/ See UNCTAD TD/B/AC.11/Rev. 2, p. 11.

Table 2 (9): Contracts involving transfer of technology and ownership characteristics of the contracting enterprises in the technology-receiving country

Country[a]	Number of Contracts: Enterprises with an equity that is: Majority foreign[b]	Minority foreign	Wholly nationally owned enterprises	Total	Percentages: Enterprises with an equity that is: Majority foreign[b]	Minority foreign	Wholly nationally owned enterprises
Cyprus	12	11	2	25	48	44	8
Colombia	132	35[c]	127[c]	294	45	12[c]	43[c]
Brazil	572		1,007[c]	1,579	36		64[c]
Sri Lanka	23	33	23	79	29	42	29
Peru	25	17[c]	49	89	28	19[c]	55
Rep. of Korea	28		193[c]	221	13		87[c]
Pakistan	85	58	549	692	12	8	79[d]
India	49	169	1,249	1,467	3	12	85
Yugoslavia	..	37	655	692	..	5	95

a/ In descending order of the proportion of contracts signed by majority foreign-owned enterprises.

b/ 50 per cent or more foreign ownership (including wholly foreign-owned).

c/ Minority foreign control has been treated as "wholly national" in the reply to the questionnaire.

d/ Specified as "100 per cent government controlled" in the reply to the questionnaire.

Note: Figures are for the end of 1970, except for Brazil (1969) and Peru (1968). All data refer to the manufacturing sector only, excluding those contracts not specifying the ownership characteristics of the enterprise concerned. The sample for Peru is very small, covering only 25 enterprises in eight industrial branches.

The most obvious forms of payments for the acquisition of technology are royalty fees and payments for imports of capital equipment. Estimates of these are available from standard accounting sources of the industrial countries and to a lesser extent, from sources in DCs. In the UN system, estimates have been made by UNCTAD, based on questionnaire responses and on balance of payments data; UNIDO had also conducted a compilation for some DCs in connection with its Technological Information Exchange System (TIES); finally, the UNCTC in its publication "Transnational Corporations in World Development: A Re-Examination" provides estimates for payments for the mid-1970s. Tables 2 (10) and 2 (11) reproduce the UN Centre for Transnational Corporations and UNCTAD computations, as they are the most recent available.

Table 2 (10): Payments of royalties and fees by selected developing countries, latest available year

Country	Year	Payments of royalties and fees: Millions of dollars	Percentage of exports
Argentina	1974	101	2.56
Brazil	1976	272	2.68
Chile	1972	17	1.98
Colombia	1975	17	1.16
Mexico	1971	167	11.11
Trinidad and Tobago	1975	18	1.02
India[a]	1973	24	0.81

a/ Fiscal year ending 31 March.

Source: UN Centre on Transnational Corporations, 1978, p. 280.

For DCs, a comparative statement can be obtained from the sample presented in table 2 (10). For these countries, if they constitute a representative sample of DCs, then it could be concluded that direct payments for transfer of technology typically vary from between 0.9 to 2.7 per cent of the value of exports. The outstanding example is Mexico where technology tranfer payments were equivalent to 11.1 per cent of the value of total exports.

The data for ICs, which is also derived from the CTC sources is a bit more comprehensive. Two observations need to be made. First as can be seen in table (11), in any given year, only a minority of ICs seem to be net exporters of technology, which indicate that substantial flows of technology take place on an intra-IC basis. Secondly, the average annual growth rates of receipts were highest for France (83% for 1971 to 1974), Japan (67% over 1971 to 1976) and the US (34% over 1971 to 1976). These differentials in growth rates should not be overly emphasised due to the wide dispersions in the initial positions of these countries, however, they do suggest a relative widening of the sources of technology supply, even in the OECD countries.

The institutional patterns of IC transactions are reflected to some extent by the payments and receipts of royalties and fees. The CTC provides data[1/] for the flows under these heads for the US, Britain and Germany, and classifies them in accordance with flows on intra-affiliate basis and transactions among non-affiliated firms. The present discussion draws on only the US and German examples - the British data being noncomparable - in order to provide representative examples. Thus, for the US receipts of royalties and fees from affiliates of US corporations were 75% of global reciepts in 1971, and by 1976, this proportion went up to over 80%. For Germany, the equivalent figures went from 4.6% in 1971 to 5.1% in 1975. On the payments side, for the U.S. the ratio of payments to affiliated firms was 49% in 1971, and it increased to 59% in 1976, and for Germany these ratios were 49.2% and 67.4% in 1971 and 1975 respectively.

The preceeding data are for trade between the ICs in question and the rest of the world. There is no compilation for intra-IC transactions and those between ICs and DCs. Data from the US for 1975 shows that the share of DCs in receipts from the sale of license technology in the manufacturing sector was 10% in 1975, and 9% in 1976: the corresponding shares for royalties and fees were 8% and 7%, and for other payments, i.e. management fees, service charges, etc. 17% and 14%. On a geographical basis Latin America accounted for nearly 10% of these receipts with Mexico alone accounting for 42%. The chemical sector is particularly important in the Latin American case, compared to a relatively low share, in contrast to other regions of the Third World, of payments for machinery and transport equipment. The shares for Africa and the Middle East are below 10% and for Asia, excluding the Middle East, about 23%.

1/ UN CTC, op.cit., pp. 278-280.

Table 2 (11): Receipts and payments of royalties and fees, selected developed countries,[a/]

1971 - 1976 (millions of dollars)

Country	1971 Receipts	1971 Payments	1971 Balance	1972 Receipts	1972 Payments	1972 Balance	1973 Receipts	1973 Payments	1973 Balance
United States	2,545	241	+ 2,304	2,770	294	+ 2,476	3,225	385	+ 2,840
France	397	466	- 69	583	587	- 4	845	743	+ 102
United Kingdom	358	300	+ 58	416	345	+ 71	494	392	+ 102
FRG	156	425	- 269	211	494	- 283	223	619	- 396
Belgium - Luxembourg	129	169	- 40	150	212	- 62	206	248	- 42
Netherlands	105	117	- 12	104	153	- 49	142	191	- 49
Sweden	75[c/]	218[c/]	- 143	84	226	- 142	112	283	- 176
Japan	60	488	- 428	74	572	- 498	88	715	- 627
Italy	115	329	- 214	89	259	- 170	97	304	- 207
Canada[b/]	60	327	- 267	...	...	...	94	500	- 406
Spain	...	...	...	...	...	...	29	261	- 232
New Zealand	15	9	+ 4	13	13	...	16	17	- 1
Austria	8	33	- 25	8	41	- 33	8	48	- 40
Australia	7	73	- 66	5	67	- 62	6	107	- 101

Country	1974 Receipts	1974 Payments	1974 Balance	1975 Receipts	1975 Payments	1975 Balance	1976 Receipts	1976 Payments	1976 Balance
United States	3,821	346	+ 3,475	4,302	480	+ 3,822	4,366	468	+ 3,895
France	991	821	+ 170	...	...	...	...	...	...
United Kingdom	574	465	+ 109	610	530	+ 80	...	...	...
FRG	275	670	- 395	324	834	- 510	304	806	- 502
Belgium - Luxembourg	224	343	- 119	...	...	...	...	...	...
Netherlands	161	237	- 76	...	...	...	...	...	...
Sweden	115	395	- 280	204	517	- 313	175	620	- 445
Japan	113	718	- 605	161	712	- 551	...	...	...
Italy	107	280	- 173	...	...	...	...	...	...
Canada[b/]	...	...	...	...	...	...	...	...	...
Spain	36	314	- 278	50	301	- 251	61	467	- 406
New Zealand	24	14	+ 10	25	20	+ 5	20	23	- 3
Austria	12	65	- 53	...	...	...	...	...	...
Australia	7	95	- 88	12	98	- 86	...	...	...

a/ Ranked in descending order of magnitude of receipts in 1974.

b/ Figures for 1971 refer to 1969, taken from a special survey done in the same year.

c/ For technical assistance including other items, separate figure not available

Source: Transnational Corporations in World Development: A Re-Examination, UN Publication, 1978, No. E.78.II.A.5, p. 275.

Thus, there are four summary points which can be made from this brief consideration of the direct costs of technology transfer. First, major shares of technology transactions take place on an intra-corporate basis. Second, there is a considerable concentration in the sources of supply in the OECD group, with the US, the European Economic Community countries (especially France and Germany) and Japan being the major suppliers, and the latter three growing faster than the former. Third, most technology flows take place within the ICs, with DCs as a whole accounting for not more than 10 per cent, as the crude indicators suggest. Finally, even within DCs there is a high concentration of recipients both on cross-regional basis, and on intra-regional basis. About six DCs would probably account for more than half the value of total IC - DC flows. Having made these observations and analytic conclusions on the direct costs of technology transfers, it is immediately relevant to consider indirect costs involved within the process of transacting technology purchases.

Indirect costs of technology transfer include costs viewed from the social perspective, e.g. the differences in prices which are generated within the constraints of specific institutional and legal frameworks as compared to competitive valuations. Here, in addition to recorded data problems, there are several conceptual difficulties in measurement, since competitive market reference prices are often not available for purposes of comparison. These difficulties do not, however, negate the importance or the value of taking such costs into consideration. At the same time, the discussion has, necessarily, to be sketchy, since the impact on DCs of a plethora of issues, such as restrictive business practices, the extent of increase in degrees of monopoly as a result of the entry of TNCs, and the loss of control by domestic economic actors, has yet to be evaluated fully. The ensuing discussion draws analytic points from empirical work by UNCTAD on the issue of restrictive business practices and the policies which have been developed to contain them.

Tables 2 (12) and 2 (13) indicate tha range of restrictive business practices faced by DCs in their technology acquisition via TNCs and some policy responses. This statement merely indicates the range and frequency of particular problems, based on a sample of respondent DCs. This type of cataloguing does not, by itself, demonstrate the impacts of the contractual restrictions involved. Taken as a whole, such restrictive conditions impinge on the possibilities of export of manufactures from DCs, the degree of competition in domestic markets and certain possible dynamic effects of technology transfers. This observed, it is also important to note that prohibition of such contractual arrangements is only a necessary, and by no means sufficient, condition for the elimination of the effects of restrictive business practices. To take an elementary example, the elimination of export restriction clauses will not result in automatic increases of DC exports; the barriers to entry problems are too familiar to repete here. Perhaps of more significance, and less immediately apparent, is the possibility that some of these restrictive clauses may have been used in the negotiation process as trade-offs against higher royalties and fees. To treat the problems of restrictive business practices as merely legal issues would ignore the various compensatory responses by technology suppliers, who can use different strategies in maintaining their economic rents.

Table 2 (12): Pattern of limitations on access to technology by developing countries

Type of limitation	Replies as to whether the country faced the specified limitation: Yes	No
Tied purchases of imported inputs, equipment and spare parts	Argentina, Chile, Cyprus, Ecuador, Greece, Iran, Malta, Mexico, Nigeria, Pakistan, Peru, Sri Lanka, Turkey	Republic of Korea
Restrictions of exports (total prohibition, partial limitations, geographical constraints)	Argentina, Chile, Cyprus, Ecuador, Greece, Iran, Malta, Mexico, Nigeria, Pakistan, Peru, Sri Lanka, Turkey	Singapore
Requirements of guarantees against changes in taxes, tariffs and exchange rates affecting profits, royalties and remittances	Cyprus, Nigeria, Turkey	Greece, Iran, Malta, Mexico, Singapore
Limitations of competing supplies by:		
(a) restriction on competing imports	Cyprus, Greece, Mexico, Nigeria, Peru	Iran, Malta, Pakistan, Rep. of Korea, Singapore, Turkey
(b) preventing competition for local resources	Greece, Malta, Mexico	Iran, Nigeria, Pakistan, Rep. of Korea, Singapore
(c) obtaining local patents to eliminate competitors	Ecuador, Malta, Nigeria	...
Constraints limiting the dynamic effects of the transfer		
(a) excessive use of expatriate personnel	Argentina, Malta, Mexico, Nigeria, Peru, Turkey	Singapore
(b) discouragement of the development of local technical and research and the development capabilities	Argentina, Ecuador, Greece, Malta, Mexico, Nigeria, Turkey	...

Source: UNCTAD, 1975, p. 15.

Table 2 (13): Principal issues in regulatory practices of selected countries concerning imports and use of technology

Principal Issues	Countries
I. Limitations on field of activity and ownership by external enterprises	
1. Exclusion of some areas of the economy from direct foreign investments	Algeria, Argentina, India, Indonesia, Mexico, Sri Lanka, Andean Pact countries, Portugal
2. Nationalisation in some areas of this economy	Algeria, Chile, Guinea, Guyana, Iraq, Libyan Arab Republic, Syria, United Republic of Tanzania, Venezuela
3. Promotion of joint venture arrangements	Argentina, India, Indonesia, Mexico, Afghanistan, Yugoslavia, Andean Pact countries, Hungary, Romania
4. Acquisition of control of national enterprises by foreigners	Argentina, India, Mexico, Andean Pact countries, Canada
5. Guarantees given by investor's country in cases of nationalisation, expropriation or other measures adopted in receiving country	Australia, Canada, Denmark, FRG, Japan, Netherlands, Norway, Portugal, Sweden, Switzerland, United States of America

Table 2 (13) continued

Principal Issues		Countries
II.	Policies on controlling costs	
6.	Ceiling on remittance arising from foreign direct investments	Algeria, Argentina, Brazil, India, Paraguay, Andean Pact countries
7.	Ceiling on remittance of royalties	Argentina, Brazil, India
8.	Limitations regarding payment of royalties between subsidiary and parent company	Brazil, India, Andean Pact countries
9.	Technological contributions entitled only to royalties and cannot be registered as capital contributions	Andean Pact countries
10.	Control on payments for unused patents	Andean Pact countries
11.	Control on package licensing	Japan, FRG, Spain, USA
12.	Control on the payment of royalties during the entire duration of manufacture of a product, or the application of the process involved without any specification of time or excessively long terms of enforcement	Mexico, Spain
13.	Control on price fixing practices	Japan, Spain, USA, Argentina, Mexico, Andean Pact countries
14.	Control on excessive prices of technology	Spain, Argentina, Mexico
15.	Control on improper or discriminatory royalties	United States of America
III.	Abusive practices either deemed to be illegal or otherwise controlled	
(a)	Territorial restrictions on exports	Japan, Spain, Argentina, Brazil, Mexico, Andean Pact countries
16.	Territorial restrictions on exports	Japan, Spain, Argentina, Brazil, Mexico, Andean Pact countries
(b)	Restrictions on purchases, output or sales	
17.	On sources of supply of raw materials, spare parts, intermediate products, capital goods and/or competing technologies	Australia, Ireland, Japan, New Zealand, Spain, United Kingdom, USA, European Economic Community, Argentina, Brazil, India, Mexico, Malawi, Zambia, Andean Pact countries
18.	On pattern of production	Japan, Sapin, Mexico, Andean Pact countries
19.	On sales and/or distribution	Japan, Spain, USA, Brazil, Mexico, Andean Pact countries
(c)	Post-expiration effects	
20.	Limitations on or payment for the use of a patented invention even after the patent has expired	New Zealand, Spain, United Kingdom, USA, India, Malawi, Zambia
21.	Limitations on or payment for the use of related know-how even after the agreement has expired	Spain
(d)	Limitations affecting the dynamic effects of the transfer	
22.	Control on the purchase of technology already available in the country	Spain, Argentina, India, Mexico

Table 2 (13) continued

Principal Issues		Countries
23.	Limitations on field of use	United States of America
24.	To use staff-designated by the supplier	Mexico, Andean Pact countries
25.	Grant-back provisions	Japan, Spain, USA, Argentina, Brazil, Mexico, Andean Pact countries
26.	Limitations imposed on the management of the recipient enterprise	Spain, Mexico
27.	Limitations imposed on the management of technological development of the recipient enterprise	Spain, Mexico
28.	Not to contest validity of patents	United States of America
29.	Authentic text of contract in foreign language	Spain, Mexico
IV.	Patent policies	
30.	Patent protected provided they are in the social interest	Peru
31.	Patents granted, as a general policy, to ensure that new inventions are worked in the country	Canada, India
32.	Compulsory licences, revocation or expropriation of patents are recognised for reasons other than non-working	Austria, Canada, Denmark, France, Finland, FRG, Ireland, Norway, Sweden, USA, Czechoslovakia, Hungary, Poland, Romania, Soviet Union, Algeria, Brazil, Colombia, India, Iraq, Israel, Nigeria, Peru
33.	Regulations on employee's inventions	Denmark, Finland, FRG, Norway, Sweden
34.	Recongition of inventors' certificates notwithstanding the grant of patents	Bulgaria, Czechoslovakia, German Democratic Republic, Poland, Romania, Soviet Union, Algeria
V.	Promotion of national technological capabilities	
35.	Incentives to export-oriented activities	Algeria, Argentina, Brazil, India, Mexico, Philippines, Rep. of Vietnam, Sri Lanka, Yugoslavia, Romania
36.	Provision regarding training of national personnel in foreign collaboration agreements	Algeria, Argentina, Central African Republic, Egypt, Gabon, Ghana, India, Indonesia, Kenya, Liberia, Libyan Arab Republic, Madagascar, Nigeria, Philippines, Somalia, Uganda
37.	Preferential schemes for national supply of goods and/or services from national sources	Argentina, Gabon, India, Andean Pact countries
38.	Measures to facilitate absorption and diffusion of foreign technology and development of indigenous technology	Brazil, India, Peru, Republic of Korea
VI.	Settlement of disputes	
39.	Specific reference in recent regulations to national jurisdiction	Argentina, Mexico, Andean Pact countries

Source: UNCTAD, The Possibility and Feasibility on an International Code of Conduct on the Transfer of Technology, TD/B/AC.11/22, 1974.

From these observations, it follows that reforms of the legal and institutional framework can tackle only one part of the weaknesses in the present system as described earlier. The supply of information and the increase in bargaining strength for developing countries should also be a major objective of multilateral measures (as well as national measures) which do not necessarily involve only industrialised countries. Thus the idea of sub-regional and regional technology centres among developing countries has been actively promoted for several years by UNCTAD and had led to the creation of three such centres. UNIDO itself is quickly developing its scheme for international co-operation among developing countries regarding information exchanges in technology.[1/] The Centre for Industrial Development (CID) operates within similar broad lines and aims at increasing the degree of technical co-operation between the EEC and the African, Caribbean and Pacific countries associated with it - acting within the framework established under the Lomé Convention - is currently exercising an important role in regard to dissemination as well as sharing of information on available technologies among the countries mentioned above.[2/] At a more limited level, the Commonwealth Secretariat assists some of the member governments in their negotiations with technology sellers.

Finally, it is worth emphasising that the experience of the socialist countries of Eastern Europe in their purchases of technology via production-sharing arrangements may be valuable in indicating the way of eliminating restrictive clauses and providing bargaining formulae. Thus far, no formal mechanism exists which can transfer this experience and knowledge to DCs; here again, international institutions may be of some help.

The remarks above justify the consideration of an international organisation whose task would be to increase progressively or mobilise technical co-operation among the various countries of the UN system, in order to abolish barriers that still exist. However, to obtain a more accurate picture about the shape of the device(s) that would be necessary, three different avenues might be considered. First, current R + D reorientations may be due to DC potentialities to increase their technological capacities rather than just their scientific knowledge. Second, a clear picture of some semi-hidden market possibilities may be provided by socialist countries. Third, this section will review some recent DC flows involving the framework of technology itself.

1/ This reference is to the UNIDO TIES scheme.

2/ The CID has been set up to implement Title III of the Lomé Convention. It is supervised by a Committee on Industrial Co-operation with 11 members from the EEC and 17 from the ACP committee. An Advisory Committee of persons with industrial experience provides for direct contacts with industry. The objectives of the Centre include the following: (a) to facilitate the transfer of technology to the ACP states for research; (b) to promote the adaptation of such technology to their specific conditions and needs, e.g. by expanding the capacity of the ACP states for research; (c) to adapt technology; and (d) for training in industrial skills at all levels in these states. Inquiries and information processed by the CID comes both from EEC firms offering know-how or new equipment embodying new technology and from ACP firms requesting information on recent technology and equipment embodying it for specific production processes. The basic budget of the CID is provided by the European Development Fund (EDF) but this modest direct allocation from the EDF to the DCs is supplemented by technologically oriented action in connection with the various industrial projects financed by the EDF in the individual ACP countries. See, Industrial Co-operation and the Lomé Convention.

2.3.4 The Potentialities from North/South Flows

Much of the preceeding discussion has concerned the inequities and problems of the North/South flows of technology. Section 2.3.2 attempted to provide an indicator of the location of technological potentials in its statistical and descriptive discussion. What needs to be focussed on is the augmentation of DC technological potentials via the transfer of technological capacities from the North to the South. Within the contemporary institutional context of the world economy, this would mean the relocation of R + D and technology commercialising facilities controlled by TNCs.

The relevance of the ensuing analysis cannot be overemphasised. Note has already been made of the extent of concentration of R + D expenditure, both between the industrialised countries and DCs and within the IC group. This concentration is reflected by the fact that the US and USSR together account for 58 per cent of global R + D expenditures. When we add the R + D expenditures of just four more countries, i.e. Japan, the Federal Republic of Germany, the United Kingdom and France, the proportion of world R + D expenditures accounted for by these countries is increased to 83 per cent. So, in the context of R + D relocation the US stands as the most important country; and in the US, the most important agent is the TNC, in view of the elements of control that have been stressed here and elsewhere in the literature.

The current position is indicated by a recent survey of 444 US-based TNCs which control about 75 per cent of US industrial R + D. Table 2 (14) presents data on the geographical distribution and affiliate spending patterns of these corporations, in selected years over the period 1966-1975. The data are important in two respects. First, there were relatively higher growth rates in R + D generated by foreign affiliates, as compared to the domestic growth rates of these TNCs, and the growth rates of total US-based R + D, in the earlier period. However, this situation was later reversed. Second, all the overseas R + D as proportion of total Transnational Corporate R + D stands at around 7 per cent. The pattern of concentration os overseas R + D is indicated in table 2 (15). It can be seen that 82.5 per cent of these expenditures were concentrated in eight countries (seven EEC countries plus Canada) and 7.9 per cent allocated over the "rest of the world", which includes Asia, Africa, Latin America (excluding Brazil and Argentina) and the other European countries, not included in this listing. It would not be conjectural to suggest that the potentials for R + D "relocation" are fairly narrow, given the possibility that only 3.5 to 5 per cent of total TNC expenditures under this head were allocated to the whole of the Third World.

At another level, much debate, often reflected in UN resolutions pertaining to industrial relocation suggests that patterns of growth would change markedly if the major corporations were prepared to relocate technological and scientific activities. Before blanket proposals and attempts at providing incentives materialise, some consideration should be devoted to the motives which TNCs may have in such relocation. The broad considerations which determine R + D location seem to be: (i) material as well as manpower

costs; (ii) the internal economies or dis-economies to the firm, from sourcing technological inputs from different locations, for integrated marketing networks; (iii) legal and institutional protection which will enable the preservation of industrial secrecy; and (iv) the infrastructure provided in a country for supporting R + D activities.

Table 2 (14): R + D expenditures by foreign affiliates of US companies, domestic R + D by their parent companies, and all industrial R + D in the United States, selected years, 1966 - 1975

Performer of R + D	1966	1971	1972	1973	1975
R + D expenditures (in millions of $)					
1. Foreign affiliates of US companies	537	1,063	1,212	1,240[a/]	1,331[b/]
2. US parent companies	11,597	14,352	15,394	15,769[a/]	17,248[b/]
3. All US industries	15,548	18,314	19,521[c/]	20,450[d/]	...
Average annual increases (%) from preceding year					
4. Foreign affiliates of US companies	...	14.7	14.0	2.3	3.7[e/]
5. US parent companies	...	4.4	7.3	2.4	4.6[e/]
6. All US industries	...	2.3	6.6	4.8	...
R + D of foreign affiliates as %					
7. Total R + D generated by companies in sample	4.4	6.9	7.3	7.3	7.2
8. R + D of all US industries	3.4	5.8	6.2	6.1	...

a/ Based on budgeted R + D expenditure in Conference Board survey.

b/ Based on projected R + D expenditures in 1972 prices reported in Conference Board survey.

c/ Preliminary.

d/ Estimated by NSF.

e/ Based on change between 1972 and 1975.

Source: Based on the Conference Board Survey.

What might be the costs and benefits in developing countries of such relocation of R + D? If R + D is directed towards local production and marketing, then more appropriate products and processes might be introduced into local markets. This is by no means a guaranteed outcome, since the innovative activity might be directed towards markets which are not directly related to the requirements of the majority of the DC population with its weak purchasing power. In terms of benefits, the local R + D activity will generally provide employment to technical and scientific manpower from the country concerned. Whether or not this represents a significant gain depends on whether such manpower is being provided with tasks which it would not otherwise have been able to perform or whether it is being diverted from other, perhaps more useful, tasks. A third possibly advantageous consideration is that local enterprises may be stimulated to engage in more technolocial search and research, and may be able to benefit from the spinoffs of skills acquired by local manpower employed by the TNCs.

Table 2 (15): Country distribution of estimated total of R + D abroad, by US-based companies; selected years 1966 - 1975

Country	Percentage distribution				
	1966	1971	1972	1973	1975
Canada	22.2	16.4	14.3	12.0	13.1
Common Market	(38.9)	(49.1)	(50.1)	(70.7)[a/]	(69.4)[a/]
Germany	22.3	30.9	30.5	32.3	29.9
France	9.1	7.3	8.2	8.4	8.1
Belgium	3.2	3.4	3.5	3.5	3.5
Italy	2.6	4.9	5.0	4.2	6.1
Netherlands	1.6	2.6	2.9	3.1	3.0
United Kingdom	24.2	18.7	18.5	19.2	18.8
Switzerland	1.1	1.6	1.8	1.8	2.0
Brazil	0.7	2.1	2.6	2.8	2.9
Argentina	1.1	0.8	0.7	0.8	0.6
Japan	0.6	0.6	0.7	1.2	0.7
Australia and New Zealand	4.1	3.8	3.6	3.6	3.7
Rest of the World	6.9	7.0	7.5	7.2	7.6
TOTAL[b/]	100.0	100.0	100.0	100.0	100.0
Total amount in millions of dollars	537	1,063	1,212	1,240	1,331

a/ Excluding Ireland and Denmark and including the United Kingdom. These three countries joined the Common Market in 1973.

b/ Due to rounding, figures may not add up to 100%.

Source: Based on the Conference Board Survey.

The local establishment of R + D activities may not be very satisfactory if it is used as an antenna with which to monitor promising research being conducted by local enterprises, or if TNCs try to internalise all of the benefits of R + D rather than diffusing them through the local productive system. As always, the main consideration is the degree to which locally conducted TNC technological innovation is successful in creating stronger and more useful linkages with the domestic system.

Where research is conducted locally, but the objectives of the research are not directed to either the resources of the requirements of local markets, then the only benefits can be in terms of possible externalities. Those externalities have been mentioned in preceding paragraphs. Similarly, the costs will tend to be those of the opportunity-cost type, where skilled manpower is used. Finally, there can be little doubt that local technological development may be significantly influenced through the attraction of foreign R + D just as much as happens as a result of the importation of foreign technology via DFI or licensing agreements. At the broadest level, it is suggested that there should be inherent selectivity exercised by DC governments in their attempts at attracting TNC R + D activities.

4.3.1 Acquisition of Technology from Socialist Countries of Eastern Europe

For the past three decades, the socialist countries of Eastern Europe have been capable of transferring their technological knowledge to the rest of the world, primarily because of long records of technological achievements stemming from their ability to implement industrial planning and also to follow adequate strategies which have, as a result, led these countries to a maximisation of their technological development. The majority of the countries from the socialist bloc was relatively backward semi-industrial countries until the end of the Second World War. After this period, the centrally planned economies of Eastern Europe began to acquire advanced technologies from other countries in order to develop and adapt them in accordance with the characteristics of their economic and social systems. These practices have helped these countries to acquire great experience. Since some of the present needs of the developing countries resemble those felt by the socialist countries of Eastern Europe some thirty years ago (to claim that these necessities were identical would be too simplistic), the accumulated technological knowledge of the socialist countries may be utilised by DCs as another and less traditional source of supply of technology. As a consequence, the choice of sources and terms of purchase - in other words, the transparency of the existing market in which technological transactions take place - will have been augmented for the developing countries. Moreover, and also in accordance with the approach followed in this chapter, through this approach the always complicated and frequently thorny question of DFI may somewhat be reduced, if technologies are purchased increasingly from the socialist countries of Eastern Europe instead from TNCs, whose approaches to technology transfers to DCs differ almost diametrically from those of the socialist countries. The latter may help achieve some of the DC aims involving the acquisition of relevant technologies, namely: to increase domestic employment for their population; to accumulate capital; to be at or at least close to the technological frontier in order to be able to augment the volume of exports; and finally to educate workers so that a growing supply of skilled manpower may eventually improve the technological and economic capabilities of the developing country in question.

Co-operation between socialist countries of Eastern Europe and developing countries in the transfer of technology has been basically carried out through intergovernmental agreements concerning various fields like scientific and technical co-operation (e.g. exchange of technical documentation, supply of engineering designs, exchange of scientific delegations), trade and payments and agreement related to economic co-operation (where technology can be embodied in the machinery and equipment or transferred via designs, technical assistance to establish the new plant). These agreements are concluded between the governments of the socialist countries of Eastern Europe and the public sector of the developing economies. The philosophy that accompanies these agreements is based on the belief by the governments of the centrally planned economies that the state sector of DCs will make better use of the technological knowledge transferred and to thus build the pillars for a most efficient way to transform the economic and social structures of the latter's economies.

The intergovernmental agreements of this type between the socialist countries of Eastern Europe and the developing countries number: Bulgaria 25; Czechoslovakia 33; German Democratic Republic 19; Hungary 42; Poland 22; and the USSR 49.[1/] Furthermore, this sort of agreement is gaining ground over the traditional one, which was mainly concerned with quantitative increases in trade between DCs and the socialist countries of Eastern Europe.[2/]

Though the bilateral intergovernmental agreements as described above are by far the greatest avenue for technological co-operation between the socialist countries and DCs, some recent trends seek more multilateral arrangements. Since 1975, through the Council for Mutual Economic Assistance (CMEA),[3/] these socialist countries of Eastern Europe negotiated multilateral economic, scientific and technical co-operation agreements with some DCs. These arrangements have developed into a tripartite industrial co-operation scheme, in which partners from not just socialist countries, but also from developed-market-economy countries and developing countries undertake industrial projects.[4/] Tripartite industrial co-operation showed that of the 132 contracts recorded, almost 40 per cent were concluded in 1973 and in 1974. The overall cost of these projects was equal to about 12 per cent of the total imports of investment goods by the developing countries during the period of 1964 - 1973.[5/] Under the auspices of such arrangements, a few developing countries with higher levels of industrial and technological development can provide assistance to other developing countries.

As regards the directions for technical co-operation established by the governments of the East European countries, technology is frequently sold in the form of machinery, equipment and complete industrial plants. In 1976, the exports of machinery and equipment to the developing countries were equal to $ 3,500 million. This represents an increase of 133 per cent over the exports at the beginning of the 1970s (see table 2 (16)). The socialist country which played the most decisive role as far as volume of exports is concerned was the USSR with a total amoung ot $ 1,730 million.[6/] The CMEA countries have provided technological assistance in this form in more than 3,000 projects in which completed transactions cover 2,300 projects.

1/ Data based on replies to questionnaires sent out by the UNCTAD Secretariat.

2/ See UNCTAD TD/B/615.

3/ Members of CMEA are the following countries: Bulgaria, Cuba, Czechoslovakia, German Democratic Republic, Hungary, Mongolian People's Republic, Poland, Romania and the USSR.

4/ The origins of these new co-operative approaches that CMEA is executing might be found in cases like the converter shop erected in the People's Democratic Republic of Algeria with the help of the USSR, France, Italy, the Federal Republic of Germany and Austria. See UNIDO ID/W.146/101, pp. 27-28.

5/ See TAD/SEM.1/2, paras 23 and 24; document prepared for the UNCTAD Seminar on Industrial Specialisation through Various Forms of Multilateral Co-operation, Tripartite Co-operation in Design and Consulting Studies.

6/ Figure obtained from Handbook of International Trade and Development Statistics, 1979, table A.10, p. 770. For a more detailed information about USSR exports of machinery, see table B.

Table 1 (17): Exports of machinery and transport equipment from socialist countries of Eastern Europe to developing countries[a]

(millions of US dollars)

ORIGIN	DESTINATION	
Socialist Countries of Eastern Europe	Developing Countries	% of developing countries/ rest of the world
1955	93	4
1960	300	8
1965	940	16
1970	1,500	16
1973	2,010	12
1974	2,420	12
1975	3,170	13
1976	3,500	13

a/ The figures in the table also cover consumer durable goods.

Source: Based on UNCTAD, Handbook of International Trade and Development Statistics, 1979, table A.10.

When the technology supplied by governmental organisations comes without parallel sales of machinery and equipment, the technological services transfers occur through organisations set up specifically for this purpose. The entities concerned are the following: in Bularia, Tehnika Tekhnokomplekt Agrokomplex; in Czechoslovakia, Polytechna; in Hungary, Tesco, Licencia, Novex and Geomineo; in Poland, Polservice; in the USSR by Litzenzintorg. While the German Democratic Republic and Hungary do not have similar specialised agencies, they supply technological services via their trade organisations responsible for the export of machinery, equipment and industrial plant.

Table 2 (17): USSR Exports of machinery to selected developing countries

(thousand of US dollars)

	Exports of machinery			
Country	1973	1974	1975	Percentage Δ 1973-1975
Afghanistan	16,550	16,026	25,362	53%
Algeria	27,593	29,031	53,296	93%
Bangladesh	12,191	10,324	7,893	-35%
Brazil	7,819	8,951	4,615	-41%
Egypt	101,059	115,748	97,742	- 3%
Guinea	40,509	9,060	9,972	-75%
India	71,974	97,876	101,370	41%
Iran	97,143	147,003	168,690	74%
Iraq	56,335	66,402	95,892	70%
Pakistan	6,189	11,626	26,020	320%
Syrian Arab Rep.	34,231	31,922	36,088	5%
TOTAL	471,613	543,969	626,940	33%

Source: Derived from USSR statistics available in the UNCTAD Secretariat.

Technological transfer from Socialist countries of Eastern Europe to developing countries have met some difficulties. Among them were financial problems relating to unsatisfactory conditions regarding payments, guarantees and utilisation of credit allocations. However, a way to avoid these problems might be to transfer technology under agreements oriented to minimise the role of money, e.g. barter arrangements: clearing agreements (by which two countries agree to exchange products not readily sold on the open market by signing a purchase and payment agreement); switch trading agreements (where one of the partners, in this case the socialist country, could trade technology for any other good from the DC); and compensation buy-back agreements.[1/] Among other identified difficulties were the inadequacies of sufficiently developed local technological capacities in developing countries, including the difficulty of obtaining reliable feasibility studies as well as the availability of skills and information services. Legal problems also exist because national and international patent systems impede the import and local development of certain technologies. Moreover, domestic regulations in some recipient countries relating to trade and civil law create uncertainties with respect to the fulfilment of obligations undertaken.

Although generalisation oversimplifies reality and requires precautions when dealing with some of the findings depicted by the study, the report prepared by the Marga Institute of Sri Lanka for UNCTAD might be worth considerting.[2/] The operation studied was an integrated package in which capital assistance, preinvestment studies, project designs, process technology training and commissioning and operation of the plant were co-ordinated aspects of a single, centrally administered programme. The Soviet agencies which were involved in this programme provided without reservation all of the required technological know-how. No continuing liabilities were involved, especially royalties or licence fees. The cost of the know-how was paid through charges for experts and other kinds of technological services provided during the implementation of the project. Further favourable aspects were that no restrictions were placed on raw material procurements or on exports, nor did any condition impose constraints on the future policies of the Sri Lanka Tyre Corporation regarding technical collaboration with other groups. Furthermore, the project was directed at satisfying those local needs related to the improvement of the domestic technological capabilities in the tyre industry.

1/ For a more comprehensive explanation concerning these agreements, see International Trade without Money, by Weigand, R.E. in Harvard Business Review, November-December 1977, pp. 28-166.

2/ The study is a careful examination of a particular project (for tyres and tubes) in which Sri Lanka receives technological co-operation from Socialist countries on an intragovernmental basis. UNCTAD TD/B/C.6/6, 1975 - Major Issues Arising from the Transfer of Technology: A Case Study of Sri Lanka.

The project also contained several negative features. They were, inter alia, of the following nature:

(a) Pre-investment studies undertaken were of similar type to those of technology sales by developing countries' enterprises, with the unavoidable result that there was a tendency to invest in large-scale plants, resulting in excess capacity. Moreover, these studies did not give enough importance to the analysis of the benefits and costs of investment with the consequence that insufficient attention was paid to the potential commercial profitability of the operation.

(b) In comparison to projects of similar characteristics established by ICs' private enterprises in neighbouring countries, the capital costs of the projects could be considered relatively high.

(c) Any detailed breakdown of prices for the major items of the plant and equipment used in the project proved to be difficult to obtain.

The above factors simply add confusion to the analysis of the extent to which this project was useful for this particular sector of this specific developing country.

It seems nevertheless that there is enough scope for an increase in the technology sales from the socialist countries of Eastern Europe to developing countries. Since many of the features of the latter are familiar to the centrally planned economies of Eastern Europe, more substantive approaches to the matter are expected to be put into practice by these countries. The socialist countries offer quite a stable framework for technological co-operation either through government-to-government accords (which has up to now been the most characteristic feature in the agreements between socialist and developing countries) and multilateral arrangements (which offer plenty of reasons to expect a large expansion of these modalities). Recent data show that the socialist countries of Eastern Europe have increased their technology sales to industrialised countries, e.g. during the 1970s, a 400 per cent increase was observed. This increase will necessarily provide socialist countries with experience which could be used to improve terms under which they sell technology to DCs. Developing countries should pay more attention to this source of technology supply since it appears that major improvements of the present trends of these technology sales between the socialist countries of Eastern Europe and the developing countries are possible.

2.3.6 Technology Transactions Among Developing Countries

Evidence is now coming to light[1/] which shows that DFI and technology exports among developing countries are increasing quite substantially. Without entering into a detailed discussion of the DFI, which in any case is still relatively small compared to that from

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1/ See, for example, O'Brien, P., Hasnain, A. and Lechuga-Jiménez, E., Direct Foreign Investment and Technology Exports among Developing Countries, which follows in this volume.

industrialised countries (in 1974, only 1 per cent of all DFI in Latin America came from other countries of the region; in Asia, as of around 1976, it seems unlikely that more than some 5-7 per cent of the investment was intra-regional, including Japan), there is nevertheless some reason to think that some of these investments may yield technological advantages to the recipient developing countries.

The scanty empirical evidence available suggests that the technology used by investing DC firms may be more adequate in the scale of production, installation of more adequate technology, higher utilisation rates for that machinery and lower use of external sources of raw materials.

There is evidence of an expansion in technology exports from one developing country to another. They cover exports of machinery and equipment, sales of turnkey plants, provision of consultancy services and some training of personnel in the recipient countries. To provile recent developments, tables 2 (18), 2 (19) and 2 (20) show exports of turnkey plants in recent years by enterprises in Argentina, Taiwan and the Republic of Korea. Though important differences exist among the three countries, the mere fact that such exports are taking place is of major importance to the prospects for increased ranges of alternatives for technology purchases, particularly for the more industrialised developing countries. The Argentinian data indicate that the total value of these exports, estimated at some $ 341 million, was equal to nearly 10 per cent of the total value of all Argentinian manufactured exports during the 1973-1977 period. Most of the contracts were with other Latin American countries, suggesting that in this case geographic proximity and perhaps linguistic identity may be important factors for determining the direction of flows. The technologies involved in these South/South transactions in the Latin American case have not been confined to simple areas. Many of the contracts cover quite complex technological areas such as integrated communications systems and a water treatment plant for industrial uses. Additional data showed that 28 of the 34 technology contracts examined were obtained by national enterprises while five affiliates of TNCs obtained the remaining six contracts. On a value basis, however, slightly more than 50 per cent of total export receipts accrued to TNC affiliates and even when the single largest contract (that won by Techint in Peru) is omitted from the sample, the average size of contract for the TNC affiliates is still about double the size for national firms. In the Argentinian case, therefore, the penetration achieved in the manufacturing sector by TNCs extends to activities related to the provision of technological assets and services. All the same, several Argentina-based companies are becoming internationally competitive and there is evidence to show that some of these companies have gained their exports of technology in international bidding.

The Taiwan data given in table 2 (19) show that in 1976 there were 58 turnkey plant exports with a value of $ 16 million. These two figures are already enough to show that practically all the exports are from small plants: indeed, of the 58 projects only three were for a value in excess of $ 1 million. The technology embodied in these exports had most often been acquired via licensing agreements originally concluded with Japanese and European enterprises though active technological co-operation with these firms was no longer

Table 2 (19): Argentina's exports of turnkey plants, 1973-1977

Year	Company	Type of plant	Thousands of dollars	Destination
1973	De Smet	Vegetable oil factory	5,525.0	Bolivia
	Nisalco	Cooked meat and extracts	200.0	Brazil
	Standard Elec.	Automatic central telephone station and external communications plant	573.9	Ecuador
	Sicom	Integral communications system	2,329.4	Chile
1974	SEL Engineering	Slaughter-house and cold storage plant	12,500.0	Cuba
	Phoenicia	Integral baking plant	2,900.0	Cuba
	Nisalco	Glycerine-producing plant	90.0	Mexico
	Emepa	15 sheds for port storage	6,775.0	Cuba
	Emepa	Structure sheds, metallic coverings and silos for fowl farms	15,940.5	Cuba
	Adabor	Metallic silos with integrated conveyors	2,329.1	Cuba
	Lix Klett	Air conditioning, ventilation and heating for a bank building	90.0	Paraguay
1975	Meitar	Processing of citrus fruit	6,200.0	Cuba
	Dosicentar	Two honey-making plants	1,490.0	Cuba
	Eximparg	Plants for extraction of vegetable oil from cotton seed	4,000.0	Bolivia
	Lito Gonella	Supply, distribution and pumping terminals for liquefied gas	1,993.3	Ecuador
	Tachint	Oil pipeline and pumping station	120,000.0	Peru
	Bago Laboratory	Antibiotics-producing plant	220.0	Bolivia
	Benito Roggio	Airport	52,000.0	Paraguay
	Nisalco	Plant for processing of water for industrial use	47.3	Uruguay
1976	Meitar	Processing of citrus fruit, pineapple and manioc	8,310.0	Bolivia
	Gale Estab.	Plant for processing and bottling of spices	1,441.0	Cuba
	De Met	Plant for extraction of oil for solvent and for treatment of sunflower seeds and soyabean seeds	746.4	Uruguay
	Harial	Plant to produce lead oxide	146.8	Venezuela
	Harial	Plant for melting and recovery of lead	105.7	Venezuela
	Cemati	Ironworks for electric installations	146.5	Bolivia
	Phoenicia	Integral bread-making plant	115.0	Chile
	Caissutti	Slaughtering and processing of fowl	188.5	Paraguay
	Giuliani	Powered balanced food factory	239.2	Bolivia
	Industrial Gases	Plant for refining fats	235.2	Chile
	Iradi	Plant for processing and storing grain	483.2	Uruguay
	Bago Laboratory	Plant for the extraction of active elements	450.0	Honduras
1977	SEL Engineering	Plant to produce sodium casein, calcium and powdered milk serum	259.9	Uruguay
	Technimantsade	Pesticide-manufacturing plant	45,000.0	Bolivia
	Latinacansult	Hospital	46,000.0	Ivory Coast
		TOTAL	340,742.4	

Source: Based on Katz, J. and Ablin, E., 1978.

Table 2 (19): Taiwan - turnkey plant exports in 1976

Type of Industry	No. of sets	Destination	Value US $ '000
Sugar Refining	1	Liberia	5,400
Cement	1	Hong Kong	1,250
Paper	7	Indonesia	3,081
	3	Malaysia	786
	1	Thailand	395
Wire and Chain	2	Indonesia	150
	3	Malaysia	350
	2	Thailand	300
Can Manufacture	1	Japan	213
	2	Indonesia	364
	3	Thailand	468
	1	Ivory Coast	151
Soap	2	Indonesia	221
Rolling Mill	1	Nigeria	820
Salt Refining	1	Thailand	110
	1	Indonesia	121
Plastic Injection Molding	3	Thailand	213
	3	Indonesia	146
	1	Philippines	113
	1	Malaysia	112
PE Woven Bag	1	Thailand	80
	1	Philippines	78
Water Treatment Plant	4	Indonesia	80
	3	Philippines	42
Non-Woven Fabric	1	Philippines	200
Dry Battery	1	Paraguay	87
	1	Philippines	68
Air-Pollution Control Equipment	1	Thailand	15
	1	Indonesia	14
Galvanized Sheet	1	Indonesia	167
Steel Pipe	1	Malaysia	209
	2	Philippines	451
TOTAL	58		16,257

Source: Rhee and Westphal, A Note on Exports of Technology from The Republic of China and Korea, mimeo, November 1978, table 2.

to be observed. It seems also that the present exports of turnkey plants from Taiwan make relatively little use of sub-contracting and embody technologies which have not been significantly adapted or upgraded in relation to the original imports. Much of the marketing of these technologies, moreover, is done through contacts with overseas Chinese communities, suggesting that they are perhaps not being achieved through successful bidding on open markets, but rather via more closed channels.

In the case of the Republic of Korea, even if the number of transactions is much smaller than for Taiwan or Argentina, the average value of the contracts is much higher. As of end of 1977, sixteen plants had been or were being constructed, with an aggregate value in excess of $ 388 million. Moreover, all the signs point to a massive expansion of turnkey plant exports in the very near future. As of mid-1978, Korean firms had been awarded 13 additional plant export contracts worth US $ 434.4 million in total value, and were in the process of negotiating contracts worth between $ 5 and 9 billion with an average contract value well in excess of $ 100 million.[1/]

1/ Rhee and Westphal, op.cit., pp. 11-13.

Table 2 (20): Korea's turnkey plant exports as of the end of 1977

Exporting Company	Year of Completion	Industry, Product or Process Classification	Contract Value ($1,000)	Receiving Country	Type of Company Exporting
Sung-Lee Machinery	1973	Synthetic and silk textile weaving mill	1,000	Afghanistan	Leading textile machinery producer
Seoul Mi-waon	1973	Glutamine-soda factory	3,800	Indonesia	Leading food-processing company
Korea Engineering	1976	Synthetic resin plant	6,000	Saudi Arabia	Engineering consulting company
Eanil Cement	1976	Rolling mill	1,580	Indonesia	Leading cement manufacturer
Dae-Han Heavy Machinery	1977	Watergate of hydraulic power plant	1,200	Taiwan	Leading engineering company
Yoohan-Kimbery	1977	Paper plant	1,000	Colombia	Leading paper products manufacturer
	Total completed	6 plants	14,580		
Henkook-Inshuro	Construction in progress at end of 1977	Glass fibre plant	650	Saudi Arabia	Subsidiary of glass fibre company
Daewoo	"	Polypropylene plant	490	Kenya	Integrated trading company
Daewoo	"	Tire factory	60,000	Sudan	Integrated trading company
Daewoo	"	Galvanised sheet plant	1,000	Sudan	Integrated trading company
Hyun Dai	"	Cement	235,080	Saudi Arabia	Integrated trading company
Won-Hyo	"	Roofing nail plant	1,030	Nigeria	Engineering company
Sun-Kyung	"	Pipe fitting plant	450	Kenya	Integrated trading company
Whasin industrial	"	Zinc smeltery	72,000	Thailand	Leading engineering company
Kang-won industrial	"	Turbine plant	2,000	Sweden	Leading engineering company
Yoohan-Kimbery	"	Paper plant	1,500	El Salvador	Leading paper products manufacturer
	Total in progress	10 plants	374,040		
	AGGREGATE	16 plants	388,620		

Source: Chung-Ang Daily Newspaper, February 24, 1978, as reproduced in Rhee and Westphal, op.cit., table 3.

Certain features of Korean technology exports are worth noting, since they are relevant both for national policies of technological development and for possible mechanisms of international co-operation. First, the exporting enterprises are among the giants of Korean industry. Second, local know-how is an integral part of technology exports, though in the larger projects it is often mixed with foreign supplies through sub-

contracting arrangements and joint ventures. Third, as already noted, government support for technology exports has been substantial, both through the general encouragement offered to large enterprises and the decentralisation of export incentives and export marketing. The overall picture is in which progressive concentration on a small number of conglomerates strong in marketing and technologies has now taken the country to the threshold of a major expansion of technological exports. The social costs of this concentration, however, need to be borne in mind before enthusiastic conclusions are drawn.

Other large and more industrialised developing countries, including India, Brazil and Mexico, are also engaged in substantial exports of technology, in all forms, to other parts of the developing world. The evidence suggests that even without multilateral policies directed towards easing the entry of these suppliers, the alternatives for the developing countries are beginning to increase substantially. Hence, future purchases of technology, and not only in so-called traditional sectors, need not be confined to the well-known markets of IC enterprises. South/South co-operation, in short, has every opportunity to expand in the next decade and so alleviate a certain number of the previously noted problems associated with technology acquisition. Some of the mechanisms through which these newer forms of technological co-operation can be stimulated will be discussed in the last part of this paper.

2.4 Evaluation of Current Proposals for Strengthening the Technological Capacity of the Developing Countries

2.4.1 The Organisational Pattern of International Co-operation

Three kinds of organisations are involved in international co-operation, i.e. governmental organisations, international organisations, and other bodies supported by private funds, governmental assistance and other means. To provide a backdrop against which present proposals may be examined, it is useful to sketch the pattern of international co-operation among these various organisations.

At the governmental level, it is useful to distinguish four groups of countries: the industrialised countries of the OECD, the developing country members of the Group of 77 and the socialist countries of Eastern Europe (the CMEA) and China. The industrialised countries have a Secretariat in the OECD as the primary institutional structure for international co-operation. This organisation has now existed for almost thirty years and provides a permanent forum and Secretariat with which to back up the proposals and negotiating positions adopted by its member countries in international discussion. In a somewhat similar sense, the CMEA provides essential secretariat support for some of the socialist countries. Among the developing countries there is, as yet, no permanent machinery in which all of them participate. However, there are important regional and subregional networks which manage to provide major inputs on technological problems of specific interest to the region concerned, e.g. the activities of SELA and the Andean Pact in Latin America, some of the assistance provided by the Arab Fund for Economic Development, some of the work within the

ASEAN, and so on. There have been various meetings devoted to the problems of developing countries as a whole, especially the Conference on Technical Co-operation Among Developing Countries (TCDC) which took place in Buenos Aires in August 1978. Nevertheless, none of these meeting has resulted in the formation of a permanent body with sufficient range and depth to undertake a thorough examination of the problems in question.

The issues have been well described by the current Commonwealth Secretary General who pointed out that "during 1977 there were over 2,000 meeting days in Geneva for UNCTAD alone. And these were quite apart from other important negotiations at the ILO, GATT, WHO and other international organisations in Geneva. In that year, which saw intensive activity in the Multilateral Trade Negotiations as well, only 56 of the 117 members of the Group of 77 developing countries has resident missions in Geneva, the great majority of them with fewer than ten staff. US staff in Geneva for the MTNs alone was in excess of 150 personnel. In the view of some people it is little short of miraculous that the developing world maintains the level of cohesion and diplomatic initiative that it currently does, given the close and efficient links that exist through the OECD, EEC, NATO, and other bodies and the growing temptations that exist among the large members of the developing world, such as Brazil, to cut and run from the group and do their own deals with richer countries on a bilateral basis."1/

No permanent fora with regard to intragovernmental co-operation seems to exist. For example, no regular meetings are held between the OECD and the CMEA countries. Generally, there is no permanent machinery for contacts among the OECD countries and the developing countries, given particularly that the Conference on International Economic Co-operation reached a dead end; there is no ongoing institution for contact among the CMEA countries and the developing countries, and likewise there is no permanent machinery for co-operation among the developing countries and China.

To summarise, therefore, a matrix of international co-operation categorised according to North, South, East and China would reveal many more empty cells than full ones. Serious consideration, therefore, needs to be given to long-term institutional arrangements if there are to be fora within which international co-operation can be developed as a continuous process. At present, negotiations tend to be ad hoc and provide more grounds for airing conflict than for resolving them. On only a few occasions are initiatives taken by the industrialised countries. Instead, the process is one in which the developing countries propose and the industrialised countries dispose.

To turn now to the activities of international organisations, there are three discernable aspects of their activities. First, some organisations have general responsibilities for international transfers of technology; in this category comes, for example, the work of UNCTAD, UNIDO and ILO. Second, various specialised agencies of the UN system have responsibilities for technology related to specific sectors; examples here would be the work of WHO, FAO and UNESCO. Third, important examples exist of interagency co-operation on particular issues where technology is a major element; an example would be the UNIDO/WHO/UNCTAD Task Force on Pharmaceuticals.

1/ Financial Times, February 6, 1979.

Finally, at a different level, are various other organisations which undertake work relating to technological problems. In the developing countries are such institutions as the Bariloche Foundation in Argentina, the Appropriate Technology Centre in Bangalore in India, as well as some other major institutions in individual developing countries whose experience may be of value to others, e.g. KIST[1] in the Republic of Korea. In the industrialised countries some organisations are concerned with co-operation, e.g. the Intermediate Technology Development Group in the UK. All of these organisations perform useful work, but the lack of an overall framework with which to harness their resources is still something of a handicap. The third part of this paper will return to this point; however, to provide a basis for considering new proposals, some of the steps which have been taken with regard to international co-operation in technology will be examined.

2.4.2 Purpose, Content and Evaluation of Current Proposals

2.4.2.1 International Proposals for North/South Technology Transfers

Analysis and policy during the past decade has focussed heavily on transfers of technology from the industrialised to the developing countries. As a result of the analyses of the weaknesses of technology markets, the efforts of government and international organisations have emphasised proposals for international co-operation to alleviate these difficulties. In summary, the purposes of the various international proposals can be described as follows.

First, to strengthen the bargaining capability of the developing countries. Proposals of two types have been made to achieve this objective. One pertains to the provision of information on alternative supplies of technology. The other applies to increasing the negotiating capability of developing countries through, inter alia, the sharing information about contractual terms and conditions in different sectors, the preparation of guidelines and manuals for negotiators, training of staff through on-the-job as well as more formal methods, in order to provide skilled personnel capable of evaluating transfer of technology arrangements and advisory services for the establishment of national and regional institutional machinery to handle technology acquisition.

Second, to provide new legal frameworks governing international transfers of technology. These frameworks are intended: (a) to improve the monetary and non-monetary terms on which developing countries can obtain technology; (b) to ensure the stability of contractual arrangements, so that long-term planning for buyers and sellers is facilitated and chances o of conflict leading to the violation of contracts are minimised; (c) to provide adequate and acceptable machinery for avoiding major conflicts and for their resolution.

1/ See page 9 of this text for a discussion of KIST.

Third, to modernise industrial property systems. The very fact that so much work has been devoted to the issue means that some social and organisational alternatives of encouraging technology generation, application and diffusion have been implicitly ignored.

The purposes of the modernisation proposals attempt:

(a) to ensure that both the current stock and future flows of patented technological information are fully utilised, where appropriate, in the production processes of the developing countries;

(b) to promote availability of information in industrial property systems at the least possible cost, with the minimum delay, and in the requisite forms, to the developing countries;

(c) to eliminate or at least curtail the abuse of patent privileges by encouraging licensing arrangements which are not devices for extending monopolistic and oligopolistic power of the holders of technological knowledge or for impeding the technological progress of the developing countries;

(d) to provide scope and incentive for developing countries to co-operate with each other in order to develop new ways of stimulating relevant innovation by their communities, enterprises, and individuals.

Three principal steps have been taken to provide negotiating framework for the achievement of these objectives:

(a) The development of international information systems of all kinds;

(b) The formulation and negotiation of an International Code of Conduct on Transfer of Technology;

(c) The revision of the Paris Convention for the Protection of Industrial Property.

These three, in turn, have formed part of the proposals made through various resolutions concerning possible organisation of a NIEO.

The General Assembly debates and resolutions on the NIEO might be grouped as follows:

(a) In the area of information, it is proposed that industrialised countries contribute to the establishment of an industrial technological information bank for regions and sectors. Further, it has been proposed within the framework of the United Nations system that an international centre should exist for the exchange of technological information and for the sharing of research findings relevant to developing countries.

(b) In the area of industrial property, the General Assembly has proposed that international conventions on patents and trademarks should be reviewed in terms of the special needs of the developing countries; that national patent systems of all countries should be

made consistent with such a revision, and that the transparency of the industrial property market should be improved through projects pertaining to information and training.

(c) The General Assembly has made various recommendations indicating that financial and technical assistance to the developing countries for direct support of their science and technology programmes should be expanded. This should be tackled through direct financial transfers, through a re-orientation of part of the R + D carried out in industrialised countries towards specific problems of major interest to the developing countries, and through encouragement to the private institutions (particularly TNCs) by IC governments in order that these corporations develop technologies which can meet development requirements.

(d) The General Assembly has emphasised the need to develop an International Code of Conduct for the Transfer of Technology.

(e) Attention has been given in resolutions pertaining to the NIEO to the need to formulate national and international policies regarding the movement of skilled personnel from developing to industrialised countries; the General Assembly does not seem to have given any consideration to the shifts now taking place of skilled personnel among developing countries.

This framework for international co-operative steps is undoubtedly extremely limited since many developing countries are obsessed with obtaining technologies from the industrialised countries. In a profound sense, the General Assembly resolutions amount to consolidating and legitimising present patterns of domination. They offer a few crumbs without changing the ingredients of the cake. Even if the General Assembly resolutions were to be implemented seriously, it is most unlikely that the forms and patterns of technological power would alter and, indeed, quite likely that inequalities within and between countries would be accentuated. Current proposals, therefore, are not tantamount to any major shift in the international economic order; what has been labelled as "new" is nothing other than a glossier version of the old.

Such as they are, UN resolutions can be evaluated in terms of what has been implemented. In the draft International Code of Conduct,[1/] the chapter headings are as follows: Preamble; Definitions and Scope of Application; Objectives and Principles; National Regulation of Transfer of Technology Transactions; The Regulation of Practices and Arrangements Involving a Transfer of Technology, Restrictive Business Practices, Exclusion of Political Discrimination; Guarantees, Responsibilities, Obligations; Special Treatment for Developing Countries; International Collaboration; Applicable Law and Settlement of Disputes; and Other Provisions. The principal issues involve a broad conception of development aims to which legal regulations should correspond and a definition of approaches which developing countries, and others, could adopt in considering their technology acquisition policies.

1/ UNCTAD, TD/Code/TOT/9, 1978.

The draft focusses on eliminating restrictive practices and establishing an adequate system to stabilise arrangements (i.e. the guarantees, responsibilities and obligations). Procedures for conflict avoidance and resolution complete the draft.

There are obvious problems and dangers associated with the elaboration of a universal legal instrument. The negotiation process has been, as was to be expected, protracted and difficult; one consequence is a tendency towards "stopping the clock" as far as the issues under discussion are concerned. In practice, the problematic being considered in Code negotiations pertains more to the beginning of the 1970s rather than to today. The principal holders of technology in the industrialised countries are continually adapting and modifying their own strategies and the instruments with which they seek to implement those strategies - these changes are hardly reflected in current debates. Moreover, the emphasis on universalities, while understandable, creates serious problems for those developing countries (mainly the more industrialised ones) which have already implemented several measures to strengthen their bargaining power. They may now find themselves with international legal standards below the levels attained in their domestic legislation, another example of the simple yet central fact of the diversity of situations involving DCs' technological development and policies. Finally, it has to be remembered that the International Code of Conduct on Transfer of Technology is not alone. The various guidelines for TNC operations, DFI conditions and the transfer of technology are leading to a proliferation of instruments. The TNCs view all such issues as part of a whole, and responded accordingly. The international law, however, involves considerable fragmentation of control and also opens up significant possibilities for contradictory approaches. Even if the preceding difficulties could be dealt with adequately, there is no institutional machinery for implementing whatever type of Code might be adopted. As with any system of law, unless there are meaningful incentives and/or enforcable penalties, then the ideas contained in the texts can neven be more than an exhortation.

The preceding remarks are not meant to suggest that the process of formulating and negotiating a Code has been without value. On the contrary, it would seem that the strongest argument which is in favour of this activity is precisely that it has educated developing country officials and governments and may continue to do so. This educational impact may manifest itself in the creation of national laws and institutions concerned with technology acquisition. Awareness of the complex issues involved may have indeed been increased because of the length of the process allowed time for diffusion.

At best, the Code provides a broad framework in which the groups involved accept some norms in certain areas of negotiations. Nevertheless the framework, as such, does not give a powerful support to consideration of what might be called the micro-adequacy of the proposals. This means that any contractual arrangement will lead to a particular distribution of risks and burdens among the parties involved as well as generating a particular set of restrictions on the activities of third parties. Consequently, the work on the Code cannot go very far in terms of a detailed examination of changes in technology acquisition methods. Thus an evaluation of the Code, as a process, suggests that something may have been accomplished, but that its value is heuristic.

Over the last 100 years, the only legal instrument of any multilateral significance in the technology field has been the Paris Convention for the Protection of Industrial Property.[1] This instrument is peculiar, since the developing countries which subscribe to the Convention do not number even half of the Group of 77. Furthermore, even then 20 members did not joint until the past quarter entury. The Convention[2] has been shaped by the interests and negotiating strategies of the industrialised countries. Until now the developing countries as a whole have had no voice in formulating this Convention.

The Convention obviously has been drafted to safeguard the interests of industrial property holders. Given that its principal objecti.' has been to create, through the so-called principle of national treatment, a system of international free trade in industrial property, there are two imbalances in the Convention: between holders and users of industrial property, the Convention is biased heavily in favour of the former; and since the bulk of legally protected technical knowledge is in the hands of private corporations, headquartered in the industrialised countries, the system is also biased strongly in favour of such countries. By its very nature, the industrial property system predicates the existence of private entities as technological innovators. The Convention pays very little attention to public interest or private obligations.

The biases just described are revealed in particular clauses and formulation of the Convention. On a series of central points, it works heavily towards maximising the opportunities for private owners of patented technology to increase their control of the terms and conditions under which such technologies might be shared. All of this would not matter so much if the content and associated practices of all developing countries have been so heavily influenced by these international rules. Moreover, ever since the original drafting in 1883, a Secretariat has worked specifically to spread information and technical advice on how to build national industrial property legislation, conforming to the Paris Convention. The industrial property system has been established and perpetuated through such efforts although the Code is now being challenged.

These points should suffice to demonstrate that the international politics of technology transfer legislation and institutionalisation have been heavily skewed in favour of technology suppliers from ICs. Therefore, it is not surprising that the reform measures which are currently being offered as the basis of the Group of 77 position on this subject, are relatively limited. Specifically, the recommendations advanced in the Group of 77 position paper argue that revision of the Convention "should recognise that all rights granted by a patent should be related to the working of the patent and guided by the following considerations:

1/ See Rodenhausen, G.H.C., Guide to the Application of the Paris Convention for the Protection of Industrial Property, Geneva, WIPO, 1968, p. 22.

2/ The Convention will be revised for the seventh time at a plenipotentiary conference in Geneva scheduled for February 1980.

- The deletion of Article 5 quater, at least as it concerns developing countries.1/

- Particular attention should be given to efforts to improve the quality of patent disclosure for granting patents in order to fulfil its basic development function and facilitate adequate diffusion of patent documentation and information among potential users, particularly in developing countries.

- The revision of Article 4 bis of the Convention, in order to incorporate the concept of compulsory exchange of information by patent offices of all orders passed by administrative and juricial authorities with regard to the validity of a patent concerning novelty, incentive step and industrial applicability.

- The principle of national treatment contained in Article 2 should not be in conflict with efforts by certain developing countries to design in their national laws types of patents or other industrial property rights whose purpose could be to foster inventive capacity, the diffusion of inventions and their effective use in local manufacture.

- The convention should recognise effective measures for granting preferential treatment to developing countries in some of the areas covered by the Convention, such as fees and right of priority.

- In the revision process, the unanimity practice should be abandoned."

It is not difficult to think of additional proposals which may be made in this field. A recent document prepared for the RIO Foundation has suggested establishing arrangements among the so-called "like-minded" countries.2/ In essence, the proposals offered cover subsidised research and joint purchase arrangements; preferential terms for the sale of various categories of patents and know-how to developing countries; subsidised sale, through the aid policies of industrialised countries of technological knowledge to developing countries, perhaps via a special fund; a register of basic technologies which could be along lines of the WHO publication which gives the formuli for the production of basic medicines.

1/ Article 5 quater of the Paris Convention provides per se for a privilege of the patentee. Control over process is enough to give monopoly to the importer and thereby control the domestic market in the patent-granting country (provided that the privileges of the patent holder include sale and use, as is the case in some developing countries). Therefore, this provision is in conflict with any attempt to eliminate the exclusive right of importation on products manufactured abroad by a patented process. Consequently, the burden of proof should rest upon the patent holder rather than upon the importer.

2/ Anthony Dolman (project co-ordinator), The Industrial and Technological Transformation of the Third World, Rotterdam, 1979.

The RIC study suggests that the "like-minded" countries could pursue the register proposal via the World Intellectual Property Organisation (WIPO) and the International Patent Documentation Centre (INPADOC) located in Vienna, which records data on almost one million patents per annum. These proposals are similar to earlier ones and do not envisage any significant shift in basic structures. It is worth noting that a country's involvement in the patent system itself presupposes that some of the questions concerning the distribution of risks and burdens among involved parties have been solved and that the system has a certain macro-stability because countries cannot, and do not, change their legal and institutional regulations often.

Various proposals have been advanced to spread information but it is not clear now if the right sorts of information are being selected, or if it actually reaches the wide range of potential users, or if it is being employed effectively. Nevertheless some of the information sources and ideas can be mentioned without evaluating them in detail:

UNIDO has done work in three major areas. The first of these is the comprehensive descriptions of technology alternatives in specific industrial sectors which are published in its series of studies entitled "Development and Transfer of Technology Series". Second, it has recently established the Industrial and Technological Information Bank (INTIB) which is designed to assist developing countries in selecting the most appropriate technology. Third, through its Technological Information Exchange System (TIES) the organisation has brought together a group of thirteen semi-industrialised and developing countries, who possess registers for the transfer of technology or thier institutional equivalents. Through a computerised information system developed by UNIDO, these countries pool information on the regulation and improvement of technology acquisition procedures. As of now, this scheme operates on a restricted basis, in the sense that developing countries which cannot provide information for the pool are not permitted to draw from it. However, UNIDO is making efforts to extend the system so that other countries also may be able to derive benefit from the practical negotiating experience of this relatively small number of developing countries.

Other information endeavours have been undertaken through the ILO which is now preparing for publication a series of technical memoranda which will document alternative (generally capital-saving) technologies in the three sectors where the ILO has concentrated its activity viz. manufacturing industry (with separate information for large-scale activities, small-scale activities and rural industries), construction and agricultural tools and equipment. These steps are aimed specifically at influencing technological choices. The advisory services provided by the UNCTAD Secretariat, by WIPO, and by other UN organisations and regional Economic Commissions also come into the category of technological information. It seems that many of the efforts made by international organisations during the past decade have made a cumbersome and unproductive distinction between the provision of information and the provision of technical assistance. While it is true that an information bank can be drawn upon by all entities interested in the acquisition of technology, good technical assistance is needed simultaneously to demonstrate how to employ the information. Even well-conceived and well-stocked information banks may have their capacity gravely underutilised unless they are specifically associated with some sort of technical assistance programmes.

Thus far the international mechanisms discussed have all referred to issues connected with technological selection and acquisition from only some enterprises in the industrialised countries. Whether these schemes relate to negotiating procedures, national legislation and institutions or provision of information, most pay little attention to the prospects for technology acquisition from medium and small-scale producers in the OECD (by this, we mean not only the smaller firms in the leading countries of this group but also supplies of technology from firms which are important in the smaller countries of the OECD), technology suppliers from Eastern European countries and China, and technology suppliers from other developing countries. There is, consequently, a significant danger that even elaborate schemes will turn out to be less effective simply because they focus on the rather limited group of technology suppliers currently dominating the market.

Recent attention has been paid to the skilled manpower supplied by developing countries to industrialised countries or what has become known as the reverse transfer of technology.[1/] The magnitude of this phenomenon is hardly in doubt, as is examplified by some observations in the RIO report. "The drain from Asian nations, particularly Taiwan and Korea, is most serious. Over 90 per cent of Asian students who arrive for training in the United States would have to build and operate twelve new medical schools to produce the manpower derived through immigration (approximately 1,200 per year). The annual dollar value of this 'foreign aid' to the United States approximately equals the total cost of all its medical aid, private and public, to foreign nations.

"The situation is not without its ironies. France takes pride in her aid to former colonies, yet the new state of Togo has sent more physicians and professors to France than France has sent to Togo. Great Britain, alarmed by the exodus of its talent to the United States, relies increasingly on foreign doctors, mainly Indians and Pakistanis, to man its National Health Service. According to official statistics, 44 per cent of its junior medical staff is foreign. There are more specialists of all kinds from other Commonwealth countries working in Britain than there are British specialists working elsewhere in the Commonwealth. There are more American-trained Iranian doctors in New York alone than in the whole of Iran."[2/]

The existence of these flows of skilled manpower is tantamount to a long standing example of structural shifts in the international system through which the elites of both industrialised and developing countries are benefiting at the cost, in the main, of the rest of the population in developing countries. There are many facets to this problem which should compel considerable caution in assessing its meaning and consequences; with regard to the real development needs of many developing countries, the so-called skills of the nationals living abroad may be of doubtful relevance to their development needs. With

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1/ UNCTAD, Development Aspects of the Reverse Transfer of Technology, TD/B/C.6/41.

2/ Tinbergen, J. (co-ordinator), Reshaping the International Order, op.cit.

these caveats in mind, proposals have been advanced for international co-operation of various kinds so as to deal with the more pernitious consequences of this phenomenon. The UNCTAD Secretariat has suggested a series of measures which include:

- Re-orientation of aid or technical assistance programmes to strengthen the possibilities for using trained personnel within developing countries;
- To set up funds encouraging R + D activities within developing countries in order to draw back skilled emigrants from these countries;
- Measures for international financial compensation with regard to flows of skilled personnel based on amendments of tax regulations and controls on remittances.

At a recent seminar held in Turkey and sponsored jointly by UNIDO, UNDP and the Scientific and Technical Research Council of Turkey, some proposals were advanced on the basis of Turkey's experience and that of certain other countries. The Turkish project, called "Retransfer of Technology to Turkey" (RTT) was developed to offer, in those sectors given priority by the National Development Plan, an avenue through which specialists of Turkish origin now residing abroad might be given the opportunity to make a contribution to development in their own country. RTT was initiated in October 1976 by the Government of Turkey and the UNDP. Over its first year of operation, 28 expatriate Turkish nationals were brought back for specific consulting assignments for an average duration of 15 days to one month. These consultants were paid their travel costs and living expenses, and mainly worked in highly sophisticated technological areas. Initial results from the scheme suggest that significant benefits may be achieved. An evaluation report on the first year of operation gave some examples including that of a consultant who, by preparing bid specifications for circulation, was able to advance the exploitation of a substantial natural gas complex by six months. This might result in a saving in excess of $ 10 million. The primary objective of the Turkish proposal is not to redress the brain drain, but to harness through the UN system advantages which could accrue to the country from the presence of skilled persons abroad. The Istanbul seminar made other suggestions which are being developed, including longer consultancy periods, international centres for advance studies which could provide focal points for the return of some of these persons, regional sharing of a pool of skilled persons coming from countries in a similar region, a labour compensatory fund, and data collection systems at the institutional level of the UN to provide registers of skilled persons ready to return to their countries and an inter-agency task force of UN organisations that could assist in encouraging such returns.

These activities have been concerned with flows of skilled persons between developing and industrialised countries. However, there are important flows of labour, the unskilled, semi-skilled and skilled categories, within developing countries due mainly (though not entirely) to the new economic impetus generated in the OPEC countries. Much more attention needs to be given to this aspect before any comprehensive proposals can be advanced. This point provides a convenient transition to the consideration of measures taken among developing countries in the technological field. These are the subject of the next subsection.

[illegible] Co-operative Measures Among Developing Countries

Efforts made by developing countries towards improving methods of technology acquisition have been, in one respect, quite similar to steps taken at the international level. Much activity has been evidenced in legal and institutional changes designed to strengthen national bargaining capabilities. Of more significance have been two features of developing country policies which deserve careful consideration. Both of them were originally embodied in major decisions of the Andean Pact (decisions 24, 84 and 85) which sought to achieve two interrelated objectives: first, the development of a comprehensive and consistent policy towards DFI, TNCs, technology sales, and the operation of internal patents and other laws: second, the attempt to build up a common market in technology among the countries of the region. It seems safe to say that, at least among the Latin American countries of small to medium size, the initiatives taken a decade ago by the Andean Pact countries represented a major breakthrough in conception and implementation of a technology policy.

The successes and failures of the Pact's activities have been discussed on several occasions and do not require further consideration here.[1/] The one point which deserves emphasis is the fact that political constraints have operated as a severe obstacle on the full exploration of possibilities within the Pact. These constraints of course in part are due to powerful external pressures, the focus of which has been to reduce or eliminate the impact of the major policies elaborated at the beginning of the decade. However, the pressures have not been merely external. It should always be remembered that the emphasis on regulation and control was the product of a particular economic and political conjuncture for the countries of the region. Internal political support was vital to the establishment and functioning of the control procedures. It might be supposed naively that all domestic entrepreneurs would be in favour of state intervention to screen contracts on their behalf. In practice, the situation is more complex. To begin with, domestic enterprises importing foreign technology were frequently enhancing their profits and their market share, i.e. they were strengthening their position at the expense of actual or potential domestic competitors. While it is true that government intervention may improve individual transactions for such importers, it might also make their dealings with suppliers more difficult. Since local users can, within fairly broad limits, always recoup what they paid foreign suppliers by increasing charges to domestic consumers, their private advantage have a negligible or even negative effect on social concerns. If importers can gain at both ends, reducing some of the rents collected by foreign suppliers and continuing to exploit domestic market power positions, partially conferred by use of foreign technology and/or products, then there are no problems. But if the situation alters and either or both aspects of their position are jeopardised, they may prefer to cling to what they have. At the beginning of the 1970s, domestic users of foreign technology seemed able to gain at both ends - but now the situation has become much more difficult and domestic oligopolists are less likely to squeeze foreign suppliers.

1/ See An Evaluation of the Andean Pact, Vargas Hidalgo, R., Lawyer of the Americas, pp. 401-423.

Co-operative steps have been taken by some developing countries aimed not only at technology acquisition but also at the possibility of developing various joint enterprises, establishing regional industrial property offices and creating information banks. The focus of the Buenos Aires Conference held in August 1978 (Technological Co-operation Among Developing Countries, TCDC) dealt with the possibility of developing further initiatives. Bilateral as well as multilateral possibilities exist and seem to be taking the forms not only of new institutions but also of encouraging existing patterns of DFI and technology export among developing countries.

2.4.3 Appropriate Technology and Appropriate Products

One of the major areas on which attention has been focussed in recent years is the relationship of products and processes originating from the industrialised countries to the resources and requirements of the developing countries. In essence, the problem can be described under the following headings:

(i) Technology and the use of domestic resources, material and human;

(ii) The linkage effects of technology in the total productive system, with particular reference to subcontracting operations and the use of raw materials available locally;

(iii) Linkages between the import of foreign technology and the strengthening of domestic technological capabilities;

(iv) The influence of technology on the environment regarding the use of non-replenishable domestic resources and the installation of industries liable to pollute the environment;

(v) The products produced with foreign technology and their relevance to the income levels and needs of the majority of the population of DCs.

Unfortunately many, if not most, discussions of appropriate technology have failed to distinguish clearly these various dimensions of "appropriateness" and one consequence has been to treat the concept as a catch-all which can be made responsible for any number of solutions to development problems. This is of little use from the analytic point of view and of even less with regard to formulation and implementation of policies. In one sense, this approach allows any and every type of measure in the technology field to be labelled as appropriateness; and it fails to give sufficient attention to items best dealt with under national policies.

Perhaps the best-known recent endeavour in this field has been the proposal for an International Mechanism for Appropriate Technology (IMAT) which originated from a meeting called in December 1977 at the ILO upon the invitation of the Government of the Netherlands. In the meeting, five priority areas for appropriate technology were identified, and it was decided that a feasibility study be undertaken to review existing mechanisms, consider the need for new mechanisms and to explore possible objectives and functions which should be carried out.

The feasibility study has now been published and it argues that a new international institutional mechanism should be set up. Five reasons are given, namely:

(i) The imbalance in global work on technology to the neglect of appropriate technology;

(ii) The limitations of current national efforts in this field;

(iii) The information gaps regarding appropriate technology;

(iv) The small size and great dispersion of voluntary effort in relation to the size of tasks; and

(v) The absence of any international institution claiming the promotion of appropriate technology as its sole objective.

These reasons indicate that the perceived role of IMAT would be catalytic and not one of conducting its own R + D. More specifically, the report suggested that IMAT could:

(i) Help identify priority areas, institutions and groups requiring support and assistance and contributions to the exchange of experience among appropriate technology institutions in different countries;

(ii) Encourage the passage from R + D to the generation of appropriate technologies through, for example, pilot plant trials;

(iii) Strengthen the delivery systems for appropriate technology by consolidating links between producers and potential users;

(iv) Disseminate information on success stories in this field as well as analyse resons for failures;

(v) Carry out other activities such as fund-raising and stimulating the private efforts of groups in developed countries towards producing more appropriate technology.

The study stresses that IMAT should neither be a governmental organisation nor should it be an agency or organ of the UN, though it should have consultative status with the UN. The general principle of operation derived from the considerations outlined above suggest concentration on a few selected priority areas including agricultural processing technologies and the establishment of self-reliant networks of groups and institutions of the type established in the United Nations University Programme on Traditional Technologies.

The feasibility study makes some detailed suggestions regarding the kind of Secretariat which would be necessary and the level of financing which would be required. It is indicated that a minimum of between $ 0.5 and 1 million would be required for organisational purposes and perhaps ten times this amount for actual field activities. A total block grant of about $ 10 million for an initial take-off period of three years is suggested and the study concludes with several recommendations for further action at a special Founders' Conference. The supposition would be that these matters will be taken up further at the

UNIDO Conference where it is hoped that the TNAT proposal would receive wide backing; however, even if it did not do so, the probabilities are that the Government of the Netherlands will provide the initial capital required for this endeavour.

The preceding remarks cover only one of a host of proposals that have been advanced with regard to appropriate technology. At root it seems clear that there are substantial gaps in the availability of information concerning particularly small-scale and rural industrialisation and the technologies for improving them. They should be a major focus of any work on appropriate technology though not the only concern of such work. Since the problems stem from political and economic systems whose very functioning creates exploitation and waste as they stimulate very particular kinds of technological and scientific endeavour, the real problems of inappropriateness are to do with social structure and not with technology as such. Palliative steps may be taken, but they will not meet the central difficulties which are due to deeper factors than technology. It is doubtful, then, that technocratic solutions within the contemporary international setting will be able to implement or even define the necessary solutions in this respect, at least in the short run.

Footnote to page 6:

2/ The issues, it must be stressed, are generic to the process of technological innovation whether or not it is viewed in the context of DCs' economies. Consider Freeman's analysis in the industrialised country (IC) context. Freeman, op.cit.pp. 307-309:

"There is another essential aspect of this function of public regulation and control. This is the question of priorities in research activities. It has already been argued that the direction of research priorities today will in large measure determine the range of real choice available to consumers in future decades. Consequently this is a question of fundamental importance in any democracy and the Rothschild approach of leaving the main priorities entirely to departmental decision-making is unacceptable. Even less acceptable is the primitive know-nothing mentality in some branches of the government statistical services which attempted to suppress the collection and publication of R + D statistics, and the perverse secrecy of much civil service discussion on new priorities in research and technology. ... The advance of science and technology must find its support and its justification, not merely in the expectation of competitive advantage, ... military or civil, but far more in its contribution to social welfare, conceived in a wider sense. The funding of R + D is extremely important for these basic goals and the strategic aims of research and innovation, i.e. policy for research, may often be more important than particular projects. ... To modify the flow of funds to research and development in such a way and they contribute more directly to the goals of social welfare and environmental improvement may not prove so difficult. It is, after all, only to reinforce trends which are already apparent in the industrialised countries. Far more difficult will be the development of institutions to assess, modify and direct technical progress in such a way as to realise the full benefits of this research, and to ensure that the social innovation mechanism functions effectively. 'Technology assessment' represents the greatest challenge both to the political system and to the social sciences in measuring, representing, displaying and imagining the benefits and costs of new technologies. ... There is a failure in the market mechanism and also of the political mechanism in relation to technical change in consumer goods and services. If this argument is at all valid then it may help to explain the apparent paradox in industrialised countries of rapidly rising per capital GNP associated sometimes with increased consumer frustration and dissatisfaction. In terms of welfare economics this would be attributable to the excessive social costs of economic growth. In terms of Marxist economics it would imply that the definition of 'productive forces' would require some refinement. The postulated harmonisation of production relations and productive forces demands a social mechanism for stimulating, monitoring and regulating innovation, which does not yet exist in any country." (Emphasis added.)

[illegible]

[illegible] provided by a well-documented study of the discriminatory attitude of the Indian Public Sector to indigenous technological capacity in the case of the manufacture of tractors in India. Here, a collaborative scheme with Czech suppliers was preferred to the manufacture of a domestically designed prototype which might have long-term competitive potential. The proponents of imported technology found unexpected support. Hindustan Machine Tools (HMT), a public enterprise, was facing temporary difficulties as a result of the recession in the machine tool industry. HMT had undertaken a large-scale programme to diversify its production in order to offset its difficulties in the manufacture of machine tools. Tractors seemed one of the most lucrative lines to take up. At one time HMT had considered the Swaraj tractor as an alternative to the Meteor tractor. But the decision had been against the Swaraj and the reasons are not far to seek. It would have taken roughly three years to establish the assembly line for the Swaraj, and the initial pre-production loss to be incurred by the producers of the tractors would have amounted to roughly Rs. [illegible] million ($ 600,000). Meteor, on the other hand, was to be a turnkey project. For the first five years, the Czechs would have provided everything, including prepared sets of components ready for assembly at a cost of Rs. 100 million (approximately $ 13.1 million at current exchange rates) in foreign exchange. This period would have been sufficient to develop the equipment and organisation to manufacture most of the components indigenously.

The directors of HMT preferred the foreign machine because it could be produced in a fairly short time. It disregarded the long-term advantages of an indigenous alternative. The production of an indigenously designed tractor would have stimulated Indian skill, which would have conferred benefits on Indian industry as a whole. The overriding objective of the HMT management was to maximise profits and minimise losses, while Indian society as a whole might have benefited more in the long run had HMT incurred short-term losses by employing indigenous instead of foreign technology. The indigenous alternative might have also turned out to be more profitable financially in the long run.

Short-term considerations should not prevail in decisions regarding the importation of foreign technology. Technology imported from advanced countries is certainly more sophisticated than Indian technology and might result in a cheaper product because it is based on mass production techniques. Indian technology is cruder but it can be improved only through the process of production and competition. The home market is still small and automated machines can replace existing forms of production only at a high capital cost. The costs of imported and assembled machines would, therefore, be much less than that of indigenously manufactured ones. However, if the aim is to increase the technological capacity and skill of Indian industry in the design and fabrication of new productive equipment and greater precision in manufacturing, the manufacture of all the components of a machine would further that objective. The fact that public enterprises were involved rather than private ones does not change the situation. Public enterprises, like private ones, have to show profits and they do not, therefore, inevitably adopt policies which are advantageous to the country as a whole." (Emphasis added.)

As this citation from the Aurora and Morehouse, Technological Innovation and Organisational Effectiveness, Swaraj and the Tractor Sweepstakes, 1974, pp. 440-441, indicates, the question of state policy is not limited to de jure control of productive or technological facilities. Rather the central issue is what vaiables are maximised by decision-making entities, and the time horizons they adopt.

CHAPTER 3: GUIDING PRINCIPLES FOR FUTURE INTERNATIONAL CO-OPERATION

3.1 The Basic Issues

Unless the planning authorities in developing countries are definitive in formulating and implementing national technology strategies, there can be no systematic development of international co-operation. Until now there has been, for the most part, a passive acceptance of the dominant role played by a small number of technology-holding corporations in the global economic system. Those entities are the ones which have formulated and implemented technological strategies in a consistent way based on somewhat clear perception of profit and power that comes from the command over the resources. It is only slowly that consciousness has grown of the need to formulate strategies by and for those nations which are currently weak in the technological field. One set of strategies, in other words, must be confronted by another; since confrontation of objectives and needs will, at the same time as it brings certain issues into sharp relief, contribute to the search for mechanisms to resolve those conflicts.

International organisations can play a role in encouraging the formulation of strategies as well as in dealing with certain aspects of imperfections in technology markets which have been and continue to be rife. This work must be undertaken at the behest of developing countries themselves. At the same time, however, international organisations can contribute to greater understanding on the part of the developed countries as to the roles which they can play in the technological development of the developing countries. Hitherto, the major industrialised countries have seen themselves largely in the role of suppliers of modern technology through the TNCs located in these countries. The complexities, not only of technological change per se, but also of its international economics and politics have already contributed in no small measure to substantial restructuring and industrial relocation in the world system, as well as to friction in relations between the industrialised North and the underdeveloped South.

To diffuse conflict and to provide a more rational ordering of technological development, the basic issue is for active formulation of national technology strategies as the bedrock on which international co-operation can be formulated. This requires a taking of positions by many groups, and not merely by some. If complaints of technological dependence are meaningful, then surely that must be so in terms of the inability of many countries and groups to formulate positions, to establish an identity and to be ready and able to exercise choices. Dependence in this sense is not something readily measurable by recourse to static indicators of financial and non-financial movements; rather, it is a question of whether decision-making entities are capable of taking a stance and of being prepared to defend their views in situations where others may have conflicting aims. Co-operation does not imply in any sense the absence of conflicts and difficulties - what it does imply is that well-defined economic and political entities be capable of exploring together the grounds on which arrangements of mutual interest can be constructed.

3.1 The Objectives of International Co-operation

The first and primary objective of international co-operation in the technological field at the present time must be to encourage the clear articulation of needs by the developing countries. This is a process of research and investigation so as to better understand the problems and possibilities confronting different societies; of persuasion in order to demonstrate how particular kinds of technology may or may not contribute to the realisation of their aims; and of diplomacy in the broader sense of convincing major actors in the world economic system that they should take positive roles with respect to the technological progress of the developing countries. This objective represents a major switch from the focus of international co-operative endeavours during the past few years. Thus far, international efforts have been a continuation of attempts to generate industrial sectors in DCs which are less heavily tied to foreign interests. They have also been a response to rapidly changing conditions in the world economic system, such that both the major corporate entities and the instruments through which they exercise control have been rapidly altered. More recently, there are some signs of a growing awareness that the new phase of international co-operation which stems from a solid articulation of internal aims. Some developing countries (as well as certain numbers of the industrialised countries) are unlikely to become producers of technologies which they can commercialise on a substantial scale within the next few years. For those countries, strategy formulation may be confined to problems of choice and acquisition. For other developing countries, however, the possibilities and the problems go further. These countries enter the areas of domestic production of technology and its export. A developing country will need support from other groups working on related issues and/or with similar objectives regardless of its level of technological development. International technology policy will be most effective when it provides systematic help to individual countries within the framework of their individual policies.

The second major objective would be to clarify the multiple senses in which technological innovation is a high-risk activity, not only for those groups responsible for innovation but also for all those who, directly or indirectly, may have to bear some of its consequences. Up till now, the focus of international mechanisms has been either on the risks thrust upon developing countries in situations where they lack information and are vulnerable to major technological shifts occurring elsewhere, or on aspects of protection against risks as perceived by contemporary technology holders. This emphasis leads to a far too simplistic categorisation of the roles which should be played by different groups, and in this sense overemphasises the conflictive issues. What has happened, in practice, has been that the technology-holders, often using their technology as part of an investment package, have been worried, inter alia, about nationalisation threats, investment guarantees which appear to be too weak, insufficiently strong industrial property laws and limitations on their possibilities to collect and repatriate economic rents deriving from ownership of technology. From the perspective of technology users, and in particular of governmental bodies, all of these items which private firms see as risk-creating elements are viewed as raising costs and risks for the country. The result has been the presentation of issues as a zero-sum game played within the highly confined space of North/South flows.

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The position adopted here is that the costs and risks issue is actually much more complex and that it cannot be presented in terms only of countries. Rather, it requires attention to social class, location and sectoral considerations, and that the cost risk combinations are subject to continuous change, not only through the introduction of fresh technologies but also through shifting patterns of production costs and people's needs. These can alter the perceived balance of advantages and disadvantages from employing particular technologies. In this setting there is a real need for much more detailed analysis of the impact of technological change.

The third major objective should be towards making the direction and nature of technological change more relevant to development needs. This is, to an important extent, a question arising from the location of control of resources for the production of new technologies, as well as control over their utilisation and distribution. This remains an abstract statement in face of the huge unknowns with respect to the kinds of products and processes which would best meet people's needs in different economic and political circumstances. The only technology set seen at work in the industrialised world, in the contemporary era, has been the set of capitalist technologies which have been developed on calculation of private profit, linked with various forms of political and social control. Some of the developments which have taken place under this regime may be useful in alternative social systems, and some of them may not. There is insufficient evidence on the organisational and economic aspects of these systems to provide a basis for generating alternative technologies. International co-operation may play an important role here in providing informational flows to promote awareness in this area of ignorance.

The fourth objective should be the reinforcement of countervailing power in technology markets. That reinforcement can take two forms: first, a reduction of obstacles to entry for new suppliers of technology and perhaps the provision of incentives to entry; and second, further improvements of the ability to negotiate more effectively with existing technology suppliers. In both senses the guiding principles would be to make technology markets more competitive and transparent. This, of course, is an extension of steps taken so far and should be done with much greater awareness not only of the technical and economic requirements, but also of the politics of technology.

The four objectives just described set the stage for the proposals advanced later. Yet before spelling out those proposals, any statement of guiding principles has to recognise that there are serious constraints on international co-operation which require consideration.

3.3 Constraints on International Co-operation

International co-operation cannot be treated as something which is by definition "a good thing". At a basic level, international co-operation obviously has some economic costs. Further, it involves risks. On the one hand, there are material risks in that the expected returns of the co-operative activity may not materialise. On the other hand, and perhaps more serious, there are political risks in that some countries may be unwilling to join with others because of fears of various kinds of domination by certain actors or

countries which might be promoted by the co-operative scheme. Finally, the notion of co-operation can be used either as a diversionary tactic to take attention away from more serious questions, or the practice of co-operation may become institutionalised in such ways as to remove the possibilities for fresh initiatives and imaginative approaches, thereby confining activities to mundane and relatively uninteresting areas. All three constraints ought to be recognised from the outset.

Co-operation schemes themselves have several dimensions, and the degree to which various countries may be prepared to enter such schemes may depend on the particular dimensions involved. In a broad sense, countries can share three things: information, commodities (in exchange or trade), and power. These three forms are not unrelated, but with respect to technology the bulk of sharing thus far has taken place through trading processes of one sort or another. This has been supplemented to some degree by a sharing of information. Up till now, the sharing of power which can come from technological control has certainly not taken place between industrialised and developing countries.

The dimensions of co-operation just described represent a mirror image of the objectives set out in the preceding subsection. So far, international co-operative mechanisms have aimed at changing the distribution of the benefits of exchange, and have sought to extend the realm of information sharing. Only in a few cases has there been a serious attempt to introduce some aspects of the sharing of power.

For technology, as countries develop strategies of lesser or greater degrees of complexity, so the forms of co-operation involved may be more or less elaborate. To proceed by analogy with international trade, there are several degrees of co-operation. Where there is no trade, some initial contacts are necessary along information lines before some exchange networks can be established. When many of the "natural" barriers to trade have been removed - in the sense that transport and communication systems have been developed and producers and users are reasonably well informed about opportunities - then situations emerge where substantial protection is employed for political and/or economic purposes. From this stage, various kinds of bilateral and multilateral negotiations take place with a view to modifying and reducing some of these barriers. The basic form of such negotiations would be bilateral discussions designed to increase trading opportunities among the countries involved. Multilateral trading negotiations, with most-favoured-nation provisions represent a further stage, in which the idea is to link bilateral steps to increased contacts with associated third parties. Then may come the recognition that the negotiating entities are unequal in their economic power, in which case notions of preferential arrangements of various sorts enter the picture. At the same time, some sets of countries may feel (as has been the case for most of the OECD countries during recent decades) that there are opportunities to be gained through the removal of commercial barriers to trade in industrial products. This leads to free trade areas, where protection is eliminated among members of the area but where each of them is left free to adopt its own policy vis-à-vis third parties. This, in turn, is then extended to customs unions, where even the independence with respect to non-members is removed, and to common markets which allow freedom

of circulation within their borders not only for commodities but also for labour and finance. The final stage occurs when countries go beyond the trade conception and begin regular arrangements with regard to joint purchasing and joint production activities.

Technological co-operation could be envisaged to fit into equivalent categories. It is possible for countries pursuing even limited technological strategies to participate in some co-operation integration schemes. However, the nature of these co-operative mechanisms is constrained not so much be the particular strategy involved as by the degree to which any country is prepared, at a given time, to engage in it. The countless obstacles and disappointments which have been well documented about integration schemes among developing countries tend to show that many of the problems were attributable to a blind adoption of arrangements which were not suited to the economic and political situations of the countries concerned. Among the OECD countries, the development of trading relations in the past three decades has been achieved on the basis of productive systems reasonably well established in most countries belonging to the organisation. In other words, the various forms of co-operation in the exchange sphere have followed upon the existence of substantial domestic productive capacity. To apply the same kind of logic to the situation of developing countries, where these productive capacities are either not yet installed or, if they are, they may not be under the control of the countries concerned, is to tackle things the wrong way around. It is therefore useful to devote a great deal of attention towards co-operation aimed at augmenting technological capabilities in developing countries. To some extent, there will have to be some sharing of power as well as information at this rather early stage, with the sharing of exchange stemming from the other two activities.

In the light of these observations, some of the proposals that will be outlined in chapter 4 are intended to cover more basic issues. These may have sufficient flexibility to provide for the interests of countries with a relatively wide range of development levels and socio-economic systems. The rest of the proposals are more limited in their applicability. They involve a greater degree of co-ordination and commonality of interest, thereby requiring a closer situation and viewpoint for participating countries. The extent of participation by a particular country in a particular scheme will depend entirely on the perceptions of tis policy makers.

CHAPTER 4: PROPOSED NEW MECHANISMS FOR INTERNATIONAL CO-OPERATION

4.1 Analysis of Current Proposals

Technology strategies can cover four major areas, which are: (i) choice of technology; (ii) acquisition of technology from abroad; (iii) production of technology; (iv) sale of technology.

Policy proposals should be relatively modest and politically realistic. International co-operation is valuable, not as a goal in itself, but only to the extent that it can help the attainment of greater degrees of technological development for the developing countries. The proposals are also selective. An attempt has been made to address those issues which, at the present time and bearing in mind the co-operative mechanisms which have already been instituted by various governments and international organisations, appear to be amendable to international co-operation and capable of offering benefits at relatively low cost to the developing countries. The measures proposed are possibilities, i.e. their aim is to offer a little more freedom to manoeuvre to those developing countries which may wish to avail themselves of it. This seems a straightforward assumption to make, since no international organisation has the power to oblige involvement in these schemes. Countries will participate only to the extent that they believe that the scheme has something to offer them. The criterion of possibility biases to some extent policy considerations in favour of more modest proposals. As will be seen, however, it does not necessarily remove from consideration some more adventurous schemes for which the arguments appear to be particularly strong at the present time.

The issues that could be addresses may be classified in the following way:

(i) The need to collect, classify and disseminate technical, economic and legal information.

(ii) The need to improve the competitiveness of international technology markets with particular attention being paid to ways in which technology suppliers from the socialist countries of Eastern Europe, from China, from the developing countries themselves and from the medium and small-size enterprises in the industrial countries can be given more opportunities to become involved in markets.

(iii) The need to improve the negotiating potential of developing countries as buyers of technology through, inter alia, the development of adequate multilateral institutional mechanisms.

(iv) The need to remedy at least some of the inadequacies of existing financial arrangements for developing countries to choose, acquire, produce and sell technology.

(v) The need to eliminate the discriminatory technology purchasing practices of multilateral and national public agencies and to encourage them to extend preferential treatment to developing country suppliers of technological goods and services.

(vi) The need to provide an adequate cushion against the substantial risks faced by developing countries entering technology markets whether as prospective or actual buyers, sellers or producers.

(vii) The need to reduce the fragmentation and repetitive nature of R + D activities of developing countries.

Several United Nations bodies (UNCTAD, The World Bank, ILO, UNESCO, and UNIDO itself) are currently working in the field of technological co-operation. Other international bodies work in fields related to the technological sphere. A considerable body of suggestions and ideas has been put forward by some groups within the past three years. Of these, the following should be mentioned:

- The RIO Foundation;
- The LUND Group (an expert group which originally met under the aegis of UNCTAD. one year ago, it advanced a set of ideas which could be taken up as part of a programme oriented towards what UNCTAD has called "the technological transformation of the developing countries");
- The Pugwash Council;
- The Development Assistance Committee of OECD;
- The Technological Policy Group of the Andean Pact which recently has advanced draft proposals for a system of financing of the technological development of the developing countries.

The lists of proposals advanced by these various groups and organisations suggest that there is considerable correspondence of views on issues pertaining to international co-operation. The specific ideas reviewed and advanced in the present study constitute a selective listing of current thinking. The criterion for choice has been to consider those proposals which are more consistent with the argument of this chapter.

Existing international co-operative proposals cover:

(i) Multilateral action to improve the terms of transfer of IC technologies to DCs;

(ii) Information sharing at the scientific, technical and legal levels;

(iii) Direct and indirect assistance to the development of indigenous technology and know-how in DCs;

(iv) The relocation of some IC R + D activities to DCs;

(v) Training programmes for DC personnel in other DCs or in ICs;

(vi) Nonmarket methods of upgrading the "prestige" of R + D oriented towards meeting DC needs.

The following pages contain a review and analysis of the existing proposals, as a backdrop for the new proposals advanced in the latter part of this chapter.

The initial framework of the current proposals were first advanced in the UN General Assembly Resolution on the New International Economic Order.[1/] The proposals on scientific and technological co-operation could be summarised under thirteen heads:

(i) Developed countries should contribute to the establishment of an industrial technological information bank and also consider the possibility of regional and sectoral banks. It should be noted that the General Assembly added the clause that the information banks should involve "in particular, advanced technologies". The General Assembly proposal speaks of a "greater flow of information to developing countries", making it clear that this proposal must be distinguished from proposals directed to co-operation on a South/South basis.

(ii) The establishment of "an international centre for the exchange of technological information for the sharing of research findings relevant to developing countries". The General Assembly clearly had in mind that such a centre should be established within the framework of the United Nations, since the following sentence requests an examination of the institutional arrangements "within the United Nations system". This is linked with a specific recommendation in this direction, listed under (xii) below.

(iii) Developed countries should significantly expand their assistance to developing countries for direct support of their science and technology programmes. This recommendation directly corresponds to Target II of the UN World Plan of Action previously mentioned, although the specific numerical target of the World Plan (0.05% of developed countries' GNP) is not directly specified.

(iv) Developed countries should substantially increase the proportion of their research and development devoted to specific problems of primary interest to developing countries. This corresponds to Target III of the World Plan of Action. Although, once again, the numerical target (5% of total R + D) is omitted, it should be noted that in respect of both proposals (iii) and (iv) the General Assembly Resolution specifically states that "feasible targets" should be "agreed upon". This, however, has not so far happened.

1/ Resolution adopted at the Seventh Special Session of the United Nations General Assembly, September 1975.

(v) Establishment within the framework of the United Nations system of an international energy institute, to assist all developing countries in energy resource research and development. The Resolution left a final decision open until a preliminary study by the Secretary General and further report to the General Assembly. The inclusion of this proposal was largely due to the impact of the oil price adjustments of 1973-74.

(vi) International co-operation in evolving an international code of conduct for the transfer of technology, corresponding, in particular, to the special needs of the developing countries. This work has proceeded intensively and an agreed code is almost within sight, although there is still disagreement on its precise legal status.

(vii) International conventions on patents and trademarks should be reviewed and revised. It is specified that this should meet "in particular, the special needs of the developing countries".

(viii) Linked with the previous proposal there is the related proposal that national patent systems of all countries should be brought in line with such a revised international patent system.

(ix) The developed countries should facilitate access to developing countries on favourable terms and conditions to relevant technology information. The Resolution emphasises specifically new developments and the adaptation of technology to the specific needs of developing countries. It also specifies that this applies to "advanced and other technologies", thus avoiding any special orientation towards appropriate technology in the narrower sense of intermediate or informal-sector technology.

(x) The developed countries should encourage the private institutions which have developed advanced technologies to provide effective technologies in support of the priorities of developing countries. The specific orientation towards advanced technologies in this context is understandable since the "private institutions" concerned are mainly multinational corporations.

(xi) Developed countries should improve the "tranparency of the industrial property market" though projects in the field of information, consultancy and training for the benefit of developing countries. This recommendation is also addressed to the relevant organisations of the United Nations system. Although the nature of this proposal is not exactly clear, it may be assumed to be addressed to the need - already mentioned in this paper - of strengthening the bargaining capacity of developing countries in negotiations involving matters of technology.

(xii) The technology and experience available within the member countries of the United Nations system should be widely disseminated and readily available to the developing countries. This responsibility is placed upon the Secretary General of the United Nations. It is linked to the problem that there is no single United Nations agency specifically and

[illegible] with matters of science and technology. Except for the small UN [illegible] of which is high level, the technological functions are partly with the UN, partly [illegible] with the various UN agencies, including also, on a project basis, the World Bank and the Regional Development Banks. This is a matter certain to be [illegible] at UNCSTD.

(xiii) The General Assembly emphasised the need to formulate national and international policies to avoid the 'brain drain' and alviate its adverse effects. This matter was already been mentioned as an important element of international co-operation in science and technology.

The RIO Report[1] and subsequent RIO Foundation publications attempt to combine the concerns of the UN resolution with material from technical studies on scientific and technological development. These cover ten heads:

(i) The establishment within the UN of a Council on Science and Technology and Advisory Group of Independent Scientists (an enlarged ACAST).

(ii) The establishment of a world technological authority whose principal purpose would be to centralise functions of various international organisations in the science and technology field.

(iii) The establishment of an International Bank for Technological Development which would give financial backing to the generation and diffusion of appropriate technology.

(iv) Preferential terms for the sale of patents and know-how to developing countries.

(v) Registers of technological knowledge to be developed by UNCTAD and UNIDO.

(vi) High quality research institutes, with training programmes to be set up at national, sub-regional and regional levels for the developing countries. The financing of these institutes is stated as one of the main objectives of North/South financial transfers.

(vii) A UN Council on Science and Technology which should attempt the organisation of R + D programmes through the UN system.

(viii) The availability of subsidies for the transfer of technological know-how to developing countries.

(ix) A pool or register of technological information to be used by developing country governments in their negotiations on technology transfer.

(x) The forthcoming UNCSTD Conference should consider improving the efficiency of the UN system with regard to the generation and diffusion of appropriate technology.

In a recent report published by the RIO Foundation[1] a series of proposals is presented relating to international technical co-operation, with special reference to the possible role of the so-called "like-minded" countries. The core of those proposals may be summarised as follows:

(i) A register of voluntary technical advisors for DCs, who would pay particular attention to (a) negotiations with TNCs; (b) industrial extension services; (c) local consulting services; (d) a programme designed to utilise the experience of retired executives and managers. On this last point the report says that "The experience of Sri Lanka with respect to retired managers might also be noted. Persons with relevant skills - those in short supply but needed for the attainment of national development objectives - are invited to retire in Sri Lanka. They bring with them not only their expertise but also their pensions and savings which, in many cases, can be quite considerable. Whilst actively pursuing this retirement programme, Sri Lanka exercises considerable care in selecting persons whom it believes can contribute to its development efforts: of the 5,000 persons who have so far been considered. only 500 have been given permission to settle in the country."

(ii) New training programmes involving industrial training and exchange programmes.

(iii) Research co-operation. In this area the study is particularly useful since it provides proposals of a slightly more detailed type. To begin with, it focusses on the importance of twinning arrangements, recognising that these arrangements have advantages and disadvantages so that a careful conception is essential. The report underlines the significance of the activities of the Swedish Agency for Research Co-operation with Developing Countries (SAREC) and notes that several of the developing country papers prepared for the UNCSTD Meeting refer to the importance of SAREC-type institutions. First, it is noted that financial support for these twinning arrangements must be extended. Second, research on new technologies should be instituted and it is emphasised that such research would be of benefit to the "like-minded" countries as well as to the developing countries. Among the areas of possible co-operation mentioned are small-scale energy modules based upon solar, wind, biogas and geothermal technologies; small-scale and decentralised electrification systems; low-energy housing and transport technologies; rediffusion systems; and technologies to exploit marine resources. The study correctly points out that one of the advantages of such co-operation is that programmes would be less constrained by the provisions of the international industrial property system. The new technologies, of course, cannot be considered in isolation from their commercialisation, since experience shows that the latter frequently costs much more than the former. To help overcome these problems, it is suggested that the "like-minded" countries could set up a special fund for the acquisition of newly developed technology. Alternatively, and perhaps additionally, the funds could be channelled through UNIDO's proposed International Centre for Appropriate Technology (ICAT) or through the International Mechanism for Appropriate Technology (IMAT) scheme.

1/ Dolman, A. (project co-ordinator), The Industrial and Technological Transformation of the Third World, January 1979, pp. 31-39.

Third, there should be research into technologies of special interest to the developing countries. These technologies should include matters relating to five guiding principles, i.e. greater use of local raw materials; reduction of waste and recycling of waste products; saving on scarce factors other than capital, e.g. water; increasing the possible range of variations in the degree of mechanisation of the production process, variation which can apply either to the core of process itself or to ancillary activities; and encouragement of substitution in production between different raw materials and other inputs. Fourth, co-operative enterprises should be established for adapting foreign technologies as well as developing indigenous technological capacities.

(iv) The creation of an Early Warning System designed to alert developing countries to those scientific and technological advances which could have a significant impact on their development.[1/] The report describes the proposal in the following terms. "Governments and enterprises routinely collect information on economic and technological developments. In attempting to distill and disseminate the information relevant to the Third World, the "like-minded" countries could seek to pioneer a warning system which could later be expanded to much broader international proportions. One of the main functions of an early warning system could be to indicate technological advances on a sectoral basis, enabling developing countries to identify promising areas for future investment. Lack of such information has prevented developing countries from more equitable participating in global economic growth. In future, information on such areas as macrobiology, nitrogen fixation, raw material testing and processing technologies, energy technologies, technologies for the exploitation of the 'international commons' will become increasingly important and will help enable countries define the 'technological challenge' in the next few decades."

(v) Encouragement of the activities of small- and medium-size enterprises. The report indicates that in the Nordic countries and the Netherlands such enterprises are generally competitive and frequently employ advanced technologies and techniques. It seems that they have not yet been adequately involved in formal transfer programmes because they lack the capacity to enter into negotiations and co-operative programmes. A series of suggestions are made for involving these enterprises in the transfer process.

(vi) On the TNCs, the report suggests, rather like the Lund proposals, that there should be incentive and taxation policies related to transfer or non-transfer of technological knowledge; fade out joint enterprises; measures for enabling developing countries to obtain equity in the industrialised countries and their enterprises; and Codes of Conduct.

1/ See also UNCTAD/TT/9, 1978, Technological Transformation of the Third World, p. 14, pp. 59-62.

A group of experts, originally meeting under the aegis of UNCTAD, and subsequently referred to as The Lund Group,[1] proposed a set of ideas which should be taken up as a part of a programme towards what UNCTAD has called "the technological transformation of the developing countries". The Lund proposals are as follows:

(i) Agreement on international action on restrictive business practices to prevent TNCs from using their monopolistic and oligopolistic positions to inhibit the spread of technological knowledge and skil s to the developing countries.

(ii) A system of positive incentives to those TNCs which transfer "appropriate" technological knowledge and skills to developing countries, and a system of taxation to be levied on those which do not.

(iii) Joint research by industrialised and developing countries on specific problems of the latter. There is also a call for the active participation of developing country research workers and institutions in the process of seeking solutions to relevant problems.

(iv) The establishment of an international association for technological development to be financed by the revenue of an international seabed authority, as well as by direct contributions from international financing agencies. This proposal does not fix any specific funding target but it states that "some kind of initial goal would probably be helpful as a target in pledges for a five-year period, after which its effectiveness should be evaluated". The four main purposes of the association are: the sharing of technological knowledge and skills: support for the acquisition by developing countries of appropriate technology; support of joint technological development projects involving more than one developing country; and assistance to regional and sub-regional technology development agencies as well as to national agencies in the least developed countries.

(v) A higher percentage of UN-administered assistance (including that through the UNDP and the World Bank) should be allocated to technological development within, and co-operation among developing countries. The target proposed is 50% for "development projects with a significant technological component", to be achieved by 1990 in annual steps of five per cent during th third development decade. It is stated that this should be done "within the framework of country programming".

(vi) More UNDP support for strengthening indigenous technological capabilities in developing countries. Three major priorities are listed relating to improved decision-making; better information and access to foreign technologies and assistance to create new appropriate technology.

(vii) Strengthening international mechanisms to further the development and dissemination of technologies most appropriate to meeting basic needs. In broad terms, this idea is the same as that contained in the IMAT proposal.

1/ Edquist, Ch. and Edquist, O., Social Carriers of Technology for Development, Discussion paper no. 123, Research Policy Studies, Lund University, Sweden, October 1978, pp. 20-21.

(viii) The initiation of five international co-operative research projects on global problems where it may be anticipated that the research would be long-term and probably continue throughout the 1980s. No specific projects are suggested but pollution of the upper atmosphere is given as an example.

(ix) Launch priority projects for technology development in a limited number of sectoral subject areas. Industrialisation is included as one of the five areas selected for the UNCSTD agenda by the Preparatory Committee. This also takes up unimplemented proposals from the World Plan of Action as is specifically recognised by the Lund Group. The subject area of industrialisation as recommended by the UNCSTD Preparatory Committee gives special emphasis to the production of capital goods.

The Pugwash Council[1/] has recently proposed action for international co operation which covers an extremely wide range of issues.

(i) To promote the systematic exchange of information concerning experience in science policy and planning among DCs in order to build a scientific and technological infrastructure, and promote the acquisition, development and application of scientific and technological knowledge. In this regard regional and subregional information centres are called for.

(ii) To set up machinery to facilitate the dissemination and exchange of scientific and technological knowledge and experience originating in the developing countries so that the comparative advantages and specialisations of various countries and sectors can be fully utilised.

(iii) To make appropriate institutional arrangements for the training and exchange of scientific and technological personnel.

(iv) To promote technology projects between developing countries having common requirements due, inter alia, to similar natural endowments and sectoral structures of production.

(v) To establish associations of research councils and joint R + D centres in areas of common interest and to develop machinery for the exchange of recently developed scientific and technological knowledge.

(vi) To pool scientific and technological resources and capabilities towards the achievement of collective self-reliance with regard to technological development.

1/ Pugwash Newsletter, Vol. 15, No. 5, May 1978.

The need for TNCs to:

(vii) Contract a part of their own R + D needs with local R + D centres.

(viii) Permit their personnel to engage in part-time R + D work in local high-level education and research institutions.

(ix) Make available their own R + D facilities for training of scientists and technologists from outside the affiliates.

(x) Organise technical training programmes for personnel of local sub-contracting firms and local distributors of their products.

In North/South transactions:

(xi) Priority should be given to projects which contribute most to the building up of local scientific and technological capabilities in developing countries.

(xii) The choice and mode of implementation of collaborative projects should accord with the development priorities that have been determined by the developing countries themselves as reflected in the commitment of their resources. IC governments and agencies should therefore channel their funds for co-operative projects through the national authorities of DCs.

(xiii) Training programmes for DC nationals should be provided in those areas and disciplines for which there is a clear need in the developing countries, as determined by DCs themselves.

(xiv) The leader of a project undertaken in a developing country should be a national of that country and responsible for its management and technical control. When this is not possible, the first phase of the project should include the training of managerial and technical directors.

(xv) The choice of any foreign consultant required by the DC partner in a collaboration scheme should be made by the country itself and not be imposed by the IC partner.

(xvi) Sponsoring agencies in ICs should stipulate that any scientific and technological co-operative project in DCs should be undertaken jointly with local institutions where they exist.

(xvii) Collaborative projects carried out in IC laboratories or institutions should involve scientists from the participating DC, and they should ensure that the results of such projects flow to, and are applied in, the DC concerned on a preferential basis.

(xviii) When the results of collaborative research can be commercially exploited, the DC partner should have the priority in patenting and use of these results.

(xix) The dissemination of raw data collected in a developing country in the course of a collaborative project should be at the discretion of the developing country partner.

(xx) Collaborative projects should be viewed and integrated within the framework of a long-term development programme as defined by the developing country.

(xxi) Collaborative programmes should not be used to exploit DCs as testing grounds for new scientific concepts or technical innovation where such work cannot be carried out in ICs.

(xxii) Whenever a collaborative project involves research in drugs, chemosterilants, pesticides, etc., in a DC, these trials should conform not only to the current regulations and ethical requirements in the DC but also to the regulations of the IC and/or those accepted internationally (unless an explicit decision to the contrary is taken by the developing country partner - as was the case with DDT in some countries).

(xxiii) Identification and assessment of the ecological implications of collaborative programmes should be a part of the programme itself. Collaborative research conducted in a DC should be not only in accordance with the DCs' own environmental standards, but with international environmental standards as well.

(xxiv) Collaborative programmes should allow for mechanisms other than the "expert-equipment-training" package, especially when the "expert" component is unnecessary.

(xv) Scientific and technological co-operation should not be used to impose any particular political or economic system on a DC.

It is of course one of the distinctive features of the Pugwash Group, which largely consists of scientists, to give greater prominence to, and be better informed about, the specific role of scientists and technologists as professional groups as well as individuals in the process of creating technology, and hence to go into greater detail in this direction than mere governmental proposals do.

(xxvi) Co-operative projects undertaken with the involvement of international agencies should be derived from the national plans and/or priorities of the DCs, and provide for flexibility in regard to changing conditions.

(xxvii) Co-operation under UN auspices and with other international organisations should ensure upgrading of the policy-making and managerial capabilties, and of the infrastructure necessary for the growth of science and technology.

(xxviii) Such projects should have a substantial component aimed at enhancing internal scientific and technological capabilities and self-reliance of DCs, and for rectifying their technological dependence on foreign entities.

(xxix) Inputs of organisations of the UN system should be co-ordinated so as to have greater impact on the overall national development programmes of DCs - vertically with other projects of the same organisation, and horizontally with relevant projects of other UN organisations.

(xxx) International organisations should provide all possible support to DCs to ensure that local scientific personnel take over as soon as possible responsibility for continued functioning of a project launched through international co-operation.

(xxxi) Greater use should be made by international organisations of the expertise in the DCs, including consultancy organisations of all kinds.

(xxxii) Training is best accomplished within the milieu of the developing countries themselves. Where outside scientific and technological training is needed, existing facilities and capabilities should be exploited first. In the case of training in DCs, adequate steps should be taken to ensure that the scientist returns to his own country, unless political persecution may be involved.

(xxxiii) Scientific and technological co-operation programmes of international organisations should not lend themselves to the commercial promotion of industrial products or processes.

(xxxiv) International organisations should not depend on TNCs for major funding of any part of their activities. Whenever contribution is made by TNCs, it should be entirely without strings, and the nature and scope of the contribution should be made public.

(xxxv) International organisations should not act as proxy for research projects at the insistence of a third party. In such cases, complete information about the interest of the third party should be made available.

In summary, the afore-mentioned proposals are limited to primarily dealing with international co-operation: the first six are related to collaboration among DCs; proposals (vii) to (xx) are directed to arrangement co-operation between DCs and TNCs; (xxi) to (xxv) involve more directly national governments, funding agencies and scientists; finally, the last ten proposals try mainly to depict some of the roles that international agencies might play. The Pugwash proposals conclude with a special recommendation for regional centres among DCs as "valuable instruments for pooling resources, talents and facilities and for working out problems of mutual regional interest through a network of collaborating institutions from all participating countries." Since this recommendation is separately listed and not placed in the first group dealing with collaboration among developing countries,

[illegible] aimed at the regional aims at regional centres in which both developed and [illegible] countries or [illegible]. But there is also specific reference to the building [illegible] self-reliant' areas [illegible], which suggests that the proposal also includes [illegible] which represent collaboration among [illegible] only.

The Development Assistance Committee of the OECD has made some proposals in its 1977 Review, which contains a special chapter entitled 'New Trends in Scientific and Technical Co-operation'.[1] The suggestions might be regarded as a good indicator of the position of the Western industrialised countries. The section itself is specifically oriented to the field of appropriate technology, and emphasises that, in the OECD conception that appropriate technology calls for advanced science, creative thought and sophisticated engineering ideas. The notion of appropriate technology should not, according to the OECD, be associated too closely with ideas of intermediate technology or with low cost and rudimentary methods. The OECD argues that appropriate technology does, though, include the scientific study of traditional solutions and practices. As is to be expected, the proposals made are heavily oriented towards activities in which OECD-based institutions can participate. A reasonable list of these proposals seems to be:

(i) Joint collaborative science and technology research projects between institutions in OECD countries and the developing countries.

(ii) The incorporation of collaboration with the developing countries into the national scientific structure and policies of the OECD countries. The incorporation should extend to involvement with special bodies such as the Canadian IDRC or the Swedish SAREC; with specialised overseas research establishments; with special overseas divisions in R + D departments; collaboration with aid and science ministries, and so on.

(iii) More funding for large science centres to increase the attention to appropriate technology for developing countries.

(iv) Intensified training of developing country scientific and technological personnel, both inside and outside the developing countries, with emphasis on new forms of academic and experimental approaches, including also the training of auxiliary semi-professional personnel.

(v) Aid to include basic research as well as R + D for direct practical application.

(vi) More financial support for inter-professional links between universities in OECD member countries and their counterparts in developing countries through research projects, exchanges of information and equipment, reciprocal visits, and in general the re-orientation of part of the research in universities in the OECD countries towards problems of interest to the developing countries.

1/ See, Development Co-operation: Efforts and Bodies of the Member of the Development Assistance Committee, 1976 Review. Report by Williams, M.J., Chairman of the DAC, OECD, November 1976, pp. 53-68.

will [illegible] of the [illegible] member countries should be given more flexibility in their existing behaviour so as to be able to call in additional scientific and technological resources to meet problems arising in all projects.

The emphasis of most of the OECD proposals seems to be in the direction of science as such rather than industrial applications in technological projects, and there is also a great deal of attention given to the university in the hope that this institution will provide an adequate environment within which problems can be tackled.

Another source from industrial countries is a Committee of Experts (all eminent scientists) set up by the Council of the Royal Society of London in a report prepared for the UK Ministry of Overseas Development for consideration by UNCSTD.[1] This differs on some points from the report of the OECD Development Assistance Committee just discussed. The Royal Society report states that "the developing countries will gain more from the development of technological capabilities than from scientific expertise", and recommends that international co-operation should be concentrated on building up "a cadre of highly proficient technicians to develop and apply technology at the local level". This recommendation is supported by the view that fundamental research barely yields results from immediate application within the time span suitable for developing countries, and that moreover the results of fundamental science are usually freely available through the scientific network. Hence, quite logically, the report concentrates on improved participation and full access by scientists and high-level technologists of developing countries to the scientific network of information combined with aid for local application of technology, with special concentration on the training of technicians.

The other recommendations of the Royal Society report supplement rather than contradict those of the OECD. They include strong emphasis on 'centres of excellence', with international support concentrated upon such centres; great emphasis on training of technicians and the raising of their status, with proper titles "restricted to those whose qualifications and experience merit them".

A recent draft proposal for a system of financing for the technological development of developing countries has been advanced by the head of the Technology Policy Group of the Andean Pact.[2] The proposal attempts at relating three factors.

(i) A financial transfer from the industrialised countries to the developing countries which should be equal to a certain percentage of the trade balances in manufactures (excluding armaments) which those countries enjoy with the developing countries. This financial transfer would be used directly and independently by the developing countries.

1/ Some Observations on the Role of Science and Technology in Developing Countries, paper prepared in connection with the UN Conference on Science and Technology for Development, The Royal Society, August 1978.

2/ Luis Soto Krebs, Propuesta de un Sistema de Financiamento para el Desarrollo Tecnológico del Tercer Mundo, 1978, draft mimeograph.

(ii) It is proposed that this financial transfer be distributed among the recipient countries in such a way that the less technologically developed among them receive proportionately more than the others.

(iii) Part of the cash transferred should be dedicated to the development of joint technological projects among the developing countries.

The proposal is important since it draws on the experience of the Andean Pact countries, and it recognises that the problem of financing is one of the critical issues for technological development. In particular, the proposal emphasises that the quality and continuity of financial assistance is as important as the amounts involved. For this reason, financial transfers are related in a flexible way to trade balances in manufactured goods. Projections of these balances for the developing countries as a whole are probably not subject to large degrees of error, and consequently they provide a reasonable basis on which estimates of future financial flows can be made. Thus, developing countries would be able to calculate their likely cash receipts in future years and thereby improve their planning of technological activities. The proposal suggests that a UN agency be made responsible for collection and transfer of the sums of money and handle the question of proper distribution among developing countries. The proposal mentions four areas for which these funds should be assigned.

(i) The improvement of basic and applied knowledge required for the assimilation, adaptation and creation of necessary technological processes.

(ii) The development of engineering, design and construction capacity for processes and machinery needed in technological innovation.

(iii) The development of local capacity for the utilisation of imported and domestically generated technologies.

(iv) Technical and administrative training necessary in order to ensure adequate functioning of selected technologies.

It is noted that the Andean Pact countries have already made an important beginning in this area, and that further attempts are being made to develop such a system with regard to other countries in the Caribbean and Latin America. The proposal is thus not based simply on theoretical arguments, but emerges from tentative practical applications. Based on calculations for 1969-1973, and on the assumption that the percentage of the trade balance which should be transferred would equal 2 per cent, it has been calculated that the sum of money involved would be approximately $ 217 million.

In the UN system, current proposals, though in a somewhat preliminary stage of formulation, have been advanced by UNCTAD.[1/] These are divided into three categories, i.e. (a) ideas for action at the national level in the developing countries; (b) ideas for action at the national level in industrialised countries; and (c) ideas for action at the international level. To look at these in turn:

1/ UNCTAD, op.cit., 1978, pp. 10-21.

(a) Action at the national level in DCs -

(i) To strengthen national policies and institutions for technological development;

(ii) To design and create new technology systems;

(iii) To reorient systems for science education and technology training;

(iv) To create an Early Warning System to alert the DCs to scientific and technological advances in ICs with significant potential impact on DC economies.

(b) Action at the national level in ICs -

(i) General co-operative assistance to be provided to DCs;

(ii) Mutual consultation with DCs to take measures to reduce global unemployment;

(iii) Tripartite consultations between DCs, IC governments and IC labour movements to audit and regulate the allocative behaviour of TNCs to control the application of technology and other TNC practices to prevent divestment and the creation of unemployment;

(iv) Abstinence by ICs from interference in the internal affairs of DCs in order to permit free intra-DC co-operation;

(v) Technological and fiscal policies to promote full domestic employment;

(vi) An increase in the scope of legislation on restrictive business practices to include the overseas operations of TNCs, in order to provide a freer environment for the transfer of technology to DCs;

(vii) The provision of incentives to TNCs which do make a serious effort to transfer technological knowledge and skills to developing countries, with the taxation of those which do not, to support the technological development of developing countries, and the ending of public subsidies through tax and investment policies for TNCs which transfer socially and economically inappropriate technology on terms designed to perpetuate the technological dependence of developing countries;

(viii) The undertaking of research on specific problems of developing countries, with the problems being selected jointly by developing and developed countries, and with the research involving the active participation of developing country research workers and institutions, so they can benefit from the experience of working on the solution of their own problems.

(c) Action at the international level -

(i) Creation of an international association for technological development, under the control of DCs, in order to be able to devote special attention to their problems;

(ii) Using an annually increasing percentage of UN-administered development assistance for technological development within and co-operation among DCs;

(iii) Providing greater UNDP support for strengthening indigenous technological capabilities in DCs;

(iv) Restructuring the World Bank to make it more responsive to the goals of technological capabilities in DCs;

(v) Strengthening international mechanisms to further the development and dissemination of technologies most appropriate to meeting basic human needs;

(vi) Initiating five decade-long international co-operative research projects on global problems;

(vii) Launching priority projects for technology development in a limited number of sectoral subject areas.

The proposal for an International Mechanism for Appropriate Technology (IMAT) originated from a meeting of 31 experts on international action for appropriate technology, convened at the invitation of the Netherlands Government at the ILO in December 1977. This group agreed on the urgent need for the promotion of appropriate technology. It identified five high priority areas for appropriate technology, including rural industrialisation. The meeting concluded that although UN organisations concerned were making increased efforts in promoting appropriate technology (AT), nevertheless existing international mechanisms needed to be supplemented for the purpose of promoting AT. It recommended, therefore, a feasibility study to review existing mechanisms, consider the need for a new mechanism and to explore the objectives and functions of such a mechanism.

This feasibility study, carried out by three experts,[1/] has now been published, together with the report of the original group of experts.[2/] The feasibility study firmly declares the need for a new international mechanism, for five reasons:

(i) the imbalance in global work on technology to the neglect of AT;

(ii) the limitations of current national efforts;

(iii) the deficiencies in the flow of information about AT;

(iv) the fact that no international institution now has as its sole objective the promotion of AT; and

(v) the fact that the magnitude of voluntary efforts is too small in relation to the massiveness of the task and that such voluntary bodies, usually originating in developed countries,[3/] often lack the necessary international and developing-country components.

1/ Paul-Marc Henry, Amulga Reddy, Frances Stewart.

2/ IMAT - A Feasibility Study by a Team of Specialists, report to the Netherlands Minister for Development Co-operation, The Hague, 1978.

3/ For example, VITA (USA), ITDG (UK), GRET (France), TOOL (Netherlands).

It is emphasised throughout that the role of IMAT is to be supportive and catalytic, i.e. it would rarely take an exclusive role in any project, and specifically, it would not develop its own R + D programme. The proposed functions of IMAT are:

(i) Helping in the identification of priority areas for efforts in appropriate technology.

(ii) Identifying institutions and groups which require critical support for the successful development and dissemination of appropriate technology.

(iii) Providing suitable assistance by way of information, funds,equipment, training, experts, etc. to these institutions.

(iv) Assisting the passage from the research to the development phase in the generation of appropriate technologies, e.g. through pilot plant trials, and from the technology generation phase, e.g. through pilot demonstration projects.

(v) Strengthening appropriate technology delivery systems by facilitating direct contacts between the producers of appropriate technologies and the users of such technologies.

(vi) Contributing to the generation of an atmosphere in which the prestige of appropriate technology is enhanced.

(vii) Facilitating the exchange of experience among appropriate technology institutions/groups in different countris, sub-regions and regions.

(viii) Disseminating appropriate technology "success stories" as well as insights into causes of failure of hardware and/or software.

(ix) Assisting the creating of a new national or sub-national institution when circumstances make such institution crucial to national appropriate technology efforts.

(x) Studying ways in which private efforts on generation and transfer of technology might be made more appropriate, both with respect to technology generated by advanced countries, and with respect to technology developed by local firms in developing countries.

(xi) Reviewing developments in the field of appropriate technology including socio-economic aspects.

(xii) Carrying out all other activities, such as fund-raising and monitoring of the effectiveness of its own efforts to enable it to discharge the above functions.

The feasibility study emphasises that IMAT should be non-governmental and while it should not be a UN agency, nor an organ of the UN, it should be associated with the UN as a consultative group, with category A status. The study also lays down 12 detailed guidelines or principles of operation. The most important of those principles, apart from again emphasising the catalytic nature of IMAT, are:

(i) IMAT should concentrate on a few selected priority areas - appropriate agricultural processing technologies are suggested.

(ii) IMAT should aim at the establishment of self-reliant networks of groups and institutions, of the type established in the UNU Programme on Traditional Technologies.

(iii) IMAT should concentrate on existing institutions as "growth poles" for AT work, but at the same time help the weakest countries and regions to establish institutions.

The feasibility study also makes quite detailed proposals on the secretariat required (to be supplemented by ad hoc panels of exports), on location (a developing country is suggested), the Governing Body (20 or 30 eminent contributors to the field of AT), and the Executive Council (jointly from the secretariat and Governing Body).

The level of finance is also discussed. A minimum of US $ 0.5 - 1.0 million is required for the secretariat and other organisational purposes and at least 10 times this administrative expenditure is envisaged for actual field activities. The report turns down the idea of a definite target figure for the ratio of administration to other expenditure, since in many cases IMAT should initiate AT activities without having to finance them from its own resources. A total block grant of around US $ 10 million for an initial take-off period of three years is suggested. The sutdy concludes with recommendations for further action at a special Founders' Conference, but this is presumably now held pending until the UNCSTD Conference.

It will be noted that the IMAT proposal is worked out in more concrete detail than the more general lists of proposals previously discussed. It is a more or less direct outcome of the discussions at the ILO World Employment Conference in 1977, where the Group of 77 endorsed the establishment of a Consultative Group on Appropriate Technology and an International Appropriate Technology Unit.[1] However, the proposal of the Group of 77 provided that these mechanisms should be "integrated with the ongoing activities of the United Nations system". This seems to differ from the IMAT proposal, which provides for a non-governmental mechanism not fully integrated with the United Nations system. Most western industrialised countries, however, did not support these two proposals at the time of the ILO Conference. The Workers Group at the ILO Conference emphasised that these

1/ ILO World Employment Conference, Programme of Action, para 62.

bodies should be tripartite in character - this is not provided for in the IPAT proposals and in any case the question does not directly arise in view of the non-governmental character of the proposed IPAT. A more detailed description of the two proposals for a Consultative Group on Appropriate Technology and for an International Appropriate Technology Unit is contained in the ILO report forming the basic document for the ILO World Employment Conference.[1] The more detailed functions for the International Unit coincide to a considerable extent with those of the subsequently developed IPAT proposal.

Even this listing of proposals recently advanced and, to some extent, currently under negotiation, suggest that on the one hand there is considerable correspondence of views on issues pertaining to international co-operation and, on the other, that the number of proposals currently being discussed is quite large. In the next section, there is a selective list of proposals on issues which merit serious political consideration. The first of the sub-sections which follows considers some approaches towards traditional channels of technology transfer; and the second raises some possibilities for new areas of international co-operation.

4.2 New Proposals for International Action

The preceding proposals are oriented towards overcoming actual or potential market failures in the sense that impulses thrown forth by the price system do not automatically result in the fulfilment of certain needs. The major areas for action thus far contemplated aim at creating new legal instruments, weakening existing juridical barriers to technology flows, or overcoming "gaps" in knowledge. The mechanisms proposed here attempt to fill areas not covered by existing proposals or to advance on the level of co-operation already reached by the existing or proposed mechanisms. The "gaps" left by the existing mechanisms are in the areas of:

- Articularion of DC needs;
- Clarification and alleviation of risk burdens in technology-generating activity;
- The creation of marketing potential for DC producers and suppliers of technology.

International co-operative mechanisms may have a limited role to play with respect to the first item. Here, the most fruitful area for international action may lie in conducting analytic or empirical studies designed to enhance understanding of the content and formulation of technology policies. The actual articulation of needs will be in the context of national implementation of technology policy which, like economic planning or industrialisation strategy, is a consequence of the political economy of national development efforts as well as the conceptions and capacities of governments and non-governmental actors operating at the national level. The second and third items, however, offer potential scope for more direct international co-operative effort.

1/ Employment, Growth and Basic Needs, A One-World Problem, ILO, Geneva, 1976, pp. 150-154.

The resources invested by a country increase both in quantity and in quality as it attempts to enhance its technological capacity. This investment of national resources makes individual economies or sectors of economies more susceptible to risks posed by the actions of actual or potential competitors. International co-operation may be able to distribute the risk burdens by matching sectoral attempts at technology generation and possibly harmonising or distributing them across countries. Also, international co-operative mechanisms, backed by information and finance, could attempt to undertake search and brokerage functions, in order to co-ordinate specific demands with specific source of supply. The objective would be to introduce a greater rationality in the process of technological innovation in DCs and for DC needs in other parts of the world. These observations form the basis of the International Technology Brokerage Organisation mechanism. In addition, it is recommended that DC exports of technology be directly supported by financial assistance from the Technology Export Finance mechanism.

4.2.1 International Centre for the Joint Acquisition of Technology

A key problem for developing countries seeking to develop a technology-purchasing strategy is the acquisition of the necessary know-how. That know-how in part comes from the collection and organisation of information on technological availabilities, from information on similarities in developing country demands for technologies, and from the provision of technical assistance, so that the information can be used in the most efficient way. In this sense, the objective of the International Centre for the Joint Acquisition of Technology would be to realise the economies of scale associated both with information and with negotiation. In this field, we are not beginning from zero since some important initiatives have been taken through the UN system in recent years.[1/]

The situation in the pharmaceutical industry gives a few insights into some of the possibilities and problems which could be associated with the establishment of such a centre. Many areas of technology may not involve the same amount of standardisation as exists in the drug industry, and operation in several sectors certainly places heavy demands on acquiring staff and finance. On the other hand, some features of the pharmaceutical experience could be utilised in establishing such an organisation. Those features might be summarised as follows:

(a) Establishment of basic lists of equipment and technologies on a sector by sector basis.

(b) Establishment of quality guarantee and performance certificates to be issued either by the Centre itself or by reputable independent organisations. On the basis of such certificates, lists of potential suppliers could be drawn up.

1/ See UNCTAD TD/238, May 1979, p. 46.

(c) An extremely powerful element in the joint purchasing procedure would be the fact that a supplier winning such a contract would, in effect, be winning a master contract, i.e. be winning the chance to supply many countries at the same time and possibly the right to supply over extended periods of time. Obviously the prospects of contracts of this nature would provide the Centre with strong leverage in bargaining over terms and conditions.

(d) In those sectors where technology can be embodied at different levels, a joint purchasing organisation can progressively extend its activities into increasingly complex fields. There is no need for the organisation to be static, but rather its activities should be sensitive to changes in international market structures as well as to shifting internal requirements. What this means in practice is that a well-conceived joint-purchasing scheme can also be the springboard for policies of assimilation, modification, replication, and creation of technologies. In most industrial sectors one does not have clear-cut separations between producers and users of technology. Rather there are graduations where technology is used to a greater or lesser degree. Once this is recognised, a dynamic conception of technology strategy becomes evident with joint work on purchasing as the inroad for joint activities in other areas.

(e) Purchasing activity can be expected to yield learning by doing. In other words, the staff working with the Centre would gradually acquire specific sectoral expertise. This expertise could provide the basis for the formation of an International Consultancy Service for Technology Acquisition. This Service could be financed by and operated through the UN system and specific attention should be given to making UNIDO the executive agency for this purpose.

Joint acquisition is a first, but central, step in getting developing countries to co-operate in technology strategies. By its nature, the Centre would be open to countries with different political and economic approaches to technological development since all may stand to gain from savings in acquisition costs.

4.3.2 Preferential Selection Agency for Developing Country Suppliers of Technological Services

Substantial growth has taken place in the capability of consulting and engineering organisations in the developing countries to provide technical services outside their national territories. Notwithstanding the numerous difficulties in the market for such services, the skill and cost levels which can be offered and maintained by some developing country organisations mean that they enjoy a competitive position in several fields and sectors vis-à-vis the developed countries. However, the purchasing practices of national and international public agencies which utilise such services are gravely deficient in the opportunities which they give to developing country enterprises.

To encourage the international projection of the DC technological capabilities, a series of specific measures is required:

(a) A thorough registry should be compiled, classifying the consulting organisations in developing countries according to the types of project capability, the number of projects they could handle at any given time, and the financial conditions under which they are operating (this last point is extremely important since a major impediment to the effective functioning of many consulting agencies in developing countries has been the irregularity of demand which has placed heavy burdens on their financial carry-over capacity).

(b) The negotiation of fresh guidelines for the implementation of projects by international organisations, especially the World Bank. The ways in which these organisations choose enterprises to carry out their projects have up to now effectively discriminated against developing country suppliers and bar entry for an important segment of the international consulting market. This impediment stretches beyond the direct practices of international organisations since the aid policies of industrialised countries frequently include severe tie-in clauses which eliminate local consulting and engineering enterprises from participation in industrial projects.

(c) Even in cases where it is not possible for any one DC consulting enterprise to undertake a project, efforts should be made to seek consortia of several DC enterprises which can learn to work together as they jointly obtain experience on important projects. To carry the argument further, if it is not possible even for consortia of such enterprises to be given project control, then they should be associated with firms from industrialised countries as part of the international contracts.

(d) In order to encourage the growth of consulting firms in those developing countries which at present have very few, consideration should be given to preferential arrangements which would allow many DC enterprises to participate in such markets.

(e) In harmony with the International Centre for the Joint Acquisition of Technology proposal above, new procedures should be developed to encourage DC governments and public sector enterprises to direct their purchases towards DC consulting and engineering firms. In this way, stronger bonds can be made among the developing countries and possibly one may envisage complementarity arrangements which would permit the technical skills of some enterprises to be linked with resource and production possibilities of other enterprises in different countries.

(f) Efforts should be made to increase the transparency of consulting and engineering design markets by modifying, as far as possible, the strong connections which exist (especially in the chemicals sector) among the enterprises holding processes and those supplying technological services. Often, a particular project can only be carried out through the use of special processes and those processes, in turn, are leased exclusively by the process holders to consulting firms which are either their affiliates or have concluded special

arrangements with them. Monopoly over the right to use a single process easily may give a consulting enterprise control over many stages of the design and implementation of turnkey projects, and thereby drastically reduce the degree of competitiveness in the markets for the project as a whole. International organisations should also examine such factors in depth when evaluating and studying tenders for projects.

The considerations just outlined have several institutional implications:

(i) International organisations, particularly the World Bank, should alter their practices regarding selection of consulting and engineering design organisations. This would directly contribute to the competitiveness of particular sets of markets for technological assets and services. It would also directly enhance the technological capabilities of at least some developing countries.

(ii) Registration procedures for the organisations whose services might be employed would have to be developed. This might be done by an agency involved in technological development, such as UNIDO.

(iii) Harmonisation of the procedures described with the purchasing practices of developing country governments is required, and UNIDO should be involved directly in this liaison activity.

The critical aspect of this proposal is that it is directly operational, on the basis of enterprises already functioning in developing countries. Its implementation depends only on the relatively simple institutional steps which have been described here. It is, therefore, a proposal for international co-operation which can be implemented immediately.

4.2.3 Redeployment of TNC Research and Development

The problem of "technological redeployment", broadly analogous to the issue of industrial redeployment, will be essential to the achievement of the Lima target. The attraction of TNC R + D is relevant only to a few developing countries. Those are the countries which have relatively large internal markets, advanced industrial structures, good education systems with substantial numbers of local, skilled personnel available, and some local technological capability. For these countries the relocation of R + D may offer benefits as long as it can be ensured that the results of innovation are directed to producing goods, techniques and experience relevant to local needs and are widely diffused as far as local-market-directed R + D is concerned and that it creates favourable externalities as far as internationally directed R + D is concerned. This latter means that, wherever the product and process innovations are aimed at the international requirements of the TNC, the skills developed should nevertheless be usable elsewhere in the domestic technological structures. Both these requirements call for appropriate national policies covering the product range and market situation of TNCs; to the prices effectively charged for use of domestic skilled labour, finance, and material inputs; to the regulations governing

licensing and technology; to policies directed towards scientific advances; and to other policies as well. Once again, the prospects for effective international co-operation depend upon the articulation and implementation of sensible domestic policy.

Assuming that national policies are adequate, the co-operative measures as between industrialised and developing countries would have to include the following elements (which would effectively impose obligations on the developing countries hosting such R + D). First, stability regarding the terms on which such investments are made; second, freedom of activity within the R + D establishment once it is set up; third, the provision of adequate infrastructural facilities; fourth, the provision of technical and financial assistance, including full access to other R + D establishments, by the TNC parent companies as required (similar assistance could be given by the IC governments concerned).

When international co-operative measures are established among developing countries, they should satisfy the following conditions: first, TNC R + D should be allocated rationally among developing countries with special emphasis on avoiding subsidy wars (or "beggar-thy-neighbour" policies) to attract the facilities. There is, in other words, a danger that these restructuring attempts could lead to "R + D zones" in the same way as export-processing manufacturing zones and tax-free zones for international banking and financial purposes have proliferated. The extent to which such policies could be followed successfully by several developing countries simultaneously is severly limited. Therefore, co-operation among them is a sine qua non for acceptable restructuring. Second, benefits of R + D results must be distributed in local markets on terms which are fair both to innovators and recipients. Third, since developing countries themselves now have a number of enterprises which are becoming international, if not transnational, in scope, such enterprises should be encouraged to locate their research activities as broadly as possible. The available evidence suggests that because of the nature of technological assets held by such developing country enterprises, R + D will not become important for some time. Nevertheless, it is important that developing countries make due allowance for this eventuality.

Although such new international mechanisms can be established to deal specifically with the relocation of R + D, a better bargaining point might be to tie this kind of relocation to the more general relocation of production facilities. In other words, there is scope for a package proposal which includes, but is not confined to, relocation of R + D. An example would be the provision, perhaps through UNIDO, of information and assistance on the relocation of industrial plant and of R + D. In one sense UNIDO could act as a brokerage organisation which collects information on offers and demands and attempts to bring the two together. The experience acquired by UNIDO's Investment Co-operative Programme Office in this field should be utilised in order to improve the quality of the arrangements needed for the achievement of a more effective relocation. UNIDO could help negotiate agreements and provide guidelines for them. In a much broader sense, UNIDO effectively could assume significant policy weight in the whole relocation process. These possibilities need to be discussed and evaluated with various parties involved.

4.2.4 A Patent Examination Centre

During the 1970s, evidence of the conflicting aspects of the revision of the international industry property system was detected at national and international levels, suggesting a greater breadth in the issue than generally assumed.[1/] In particular, two types of co-operation will have to be considered more accurately, one among industrialised and developing countries and another among the latter group of countries. Also, present usage of patent documentation and trademarks made by the developing countries should be illuminated.

Patent laws have been established in 120 countries, of which 84 are DCs. However, these patent laws are based on laws and practices carried out by the developed countries, or worse, were inherited from the colonial period. Of the 3.5 million patents[2/] in existence, only about 6 per cent (200,000) is granted by developing countries (some five sixths of the patents are held by foreigners and only one sixth - or a mere 1 per cent of the world total - by nationals of the developing countries). International action has recently focussed on a much needed change of the patent system. In this connection, some DCs and ICs have already started to change their national patent legislation.[3/] The relevant consideration in the present context was expressed by the governmental experts from developing countries. Members of the Group of 77, meeting under the auspices of UNCTAD in late 1977, noted with regard to industrial property that "the immediate and continuing task of the system should be to provide in the shortest possible time the broadest possible technical assistance to help developing countries strengthen their scientific and technological infrastructures and to train their specialists".[4/]

Various steps have been taken during the present decade to increase accessibility to patent documentation. Before the 1970s, processing procedures in patent examination offices delayed accessibility to patent documentation by three or four years. A great achievement in overcoming this problem was the creation of the International Patent Documentation Centre (INPADOC) in Vienna.[5/] The Centre was founded on 2 May 1972, on the basis of an agreement between the Republic of Austria and the World Intellectual Property Organisation (WIPO) in Geneva. It provides for worldwide concentration of patent documents. Its task is to record the bibliographic data items of patent documents and then to analyse

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1/ For a report on this, see UNCTAD TD/B/AC.11/17/Rev. 1, 1975; The Role of the Patent System in the Transfer of Technology to Developing Countries.

2/ Figure calculated from statistics published by WIPO.

3/ See UNCTAD TD/B/AC/1/19/Rev. 1, para. 404, p. 64 for details.

4/ See UNCTAD TD/B/C.6/24/Add. 1; TD/B/C.6/AC/314/Add. 1, para 1 (b), p. 5.

5/ INPADOC is solely owned by the Austrian Government. Therefore, its legal form is that of a limited liability company and it appears in the Commercial Register of the Vienna Commercial Courts under the name "INPADOC, Internationales Patentdokumentationszentrum Gesellschaft m.b.H.".

the recorded information to provide information services. INPADOC gathers information on the bibliographic data of patents from only 45 countries: only 11 are developing countries. Yet significant practical problems associated with the institutional process of acquiring and using patents still have to be surmounted. ICs have a far more adequate and sophisticated administrative device for evaluating and monitoring the granting, use and termination of patents taken out in their territories. But these operations require skilled people in many diverse fields. It is doubtful whether, even if they could, DCs should devote scarce human resources to efforts which basically award protection to foreign investors. However, given that most DCs are involved in the system, technical information on these matters is required. Therefore, the need for an International Patent Examination Centre is felt. The Centre would serve to realise the economies of scale associated with the spread of technical and legal information[1/] on what are, after all, the same patents in different countries. Moreover, this information would represent a genuine transfer of knowledge from the ICs and thereby save time and other resources for DCs.

Such a Centre would not need to confine its activities to patents. Important issues are raised by the current debate on appropriate products. Two rather different issues are involved here: one relates to the advertising of products which, although not intrinsically dangerous, have pernicious effects when utilised by people living on low incomes; the other issue relates to products which are found to be inherently dangerous, after extensive examination in the ICs. Most, though not quite all, of the problems under these two headings arise in the chemical and food industries. It may be difficult at an international level to grapple with the advertising problems, but the second aspect could be handled via international exchanges of information. The Food and Drug Administration (FDA) of the US, for example, has far more sophisticated procedures for examining and testing products than does any other agency in the world dealing with similar sets of items. The activities of the FDA are not limited to isolated tests of products but include frequent re-evaluations of items in relation to their characteristics and their efficacy in accomplishing their stated purposes. If the FDA and/or similar agencies in some other ICs were to make available their findings to DCs on a regular basis and at virtually zero cost, this information could be of considerable value to these countries in two vital areas - food and health. Thus, at practically no cost, DCs would be better equipped to deal with some of the worse abuses which have been found in recent years and are related to the deluge of new products appearing on DC markets.

A Patent Examination Centre could readily be assigned the task of disseminating this information by translating the material into the various languages of the UN, assembling and classifying it for each reference (experience on this matter might be drawn from the "Agreements of Co-operation" that INPADOC, with the help of WIPO, is carrying out with national industrial property offices and other organisations), calling meetings at which interpretation and use of the results could be improved. The implementation of this international co-operative measure depends upon the willingness of the ICs to share what is, in

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1/ To overcome such constraints, the Centre could provide the organisation of courses for nationals of DCs concerning the use of patent documentation as a flow of technical information. These courses could be organised both where the Centre be placed and also at national levels in the DCs.

most cases, public information in those countries, but is, all the same, by no means easily accessible to DCs. Given the emphasis that IC public and private institutions often placed on the establishment of adequate international technical standards, such a Centre ought to be welcomed by IC interests since it would give them an opportunity to extend some of their domestic standards to the international arena. Agreements, such as those concluded in November 1978 between WIPO, UNIDO and, on this particular occasion, the Austrian Patent Office concerning the availability for users of the Industrial Inquiry Service and of UNIDO's Industrial and Technological Bank, might be taken as a model for more frequent co-operative contacts of the kind described above between UN organisations and with those entities that are active within this specific field.

With respect to co-operation among developing countries, the following measures need consideration. In the field of patents, developing countries should take cognizance of the particular kinds of technological development taking place in their enterprises and, in particular, recognise that innovation should be stimulated even where it may not be the same as that occurring in industrialised countries. This means, among other things, that the criterion of universal or absolute novelty which is applied in patent regulations should be modified so as to offer industrial property protection to the kinds of technical progress being realised by developing country firms. This recognition should extend to the provision of preferential registration of technological innovation originating from developing country enterprises. It could be done through special patent regulations among developing countries. The Patent Examination Centre could cover these particular technologies, co-operate with the African Intellectual Property Organisation (OAPI), and collect the patent documents issued by the various Latin American countries. The Centre could be helped by WIPO and INPADOC under a spirit of collaboration since the latter two regions are not thoroughly covered by existing organisations.

The following proposals are not so much "mechanisms" as policy targets for effecting changes in the overall environment in which technology transfers take place. In relation to trademarks, single trademarks can be registered in as many countries as the other chooses and for all countries following the Paris Convention procedures nationals and foreigners owning trademarks enjoy equal treatment. Of the 4 million trademarks in force in the world, only 27 per cent of the global stock were registered in DCs in 1974.[1/] Furthermore, growing transnationalisation and concentration of trademarks in the hands of some ICs are the striking features of the present trademark landscape. Therefore, it must be recognised that a serious obstacle to penetration by developing country firms of markets anywhere in the world is the existence of such protectionist features. Since much of the expansion of manufactured exports from developing countries is tied to the use of trademarks which are the property of IC enterprises, it is difficult for DC firms to create their own markets. In view of these characteristics, to avoid complementing the activities of TNCs and regional joint ventures, and to overcome the lack of infrastructure for sales efforts, DCs could

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1/ Data taken from the Impact of Trademarks on the Development Process of Developing Countries, UNCTAD Document TD/B/C.6/AC.3/3, June 1977.

group together to sell under common trademarks, jointly sharing the cost and risks of developing new markets. In addition - as was described in the Mexican Trademark Law of 1975 - twinning arrangements could be made whereby foreign and national trademarks would appear together on articles sold, with the eventual fadeout of the industrialsed country trademark. It would then become possible for market expansion to come under the effective control of the developing countries themselves. This step should of course be extended to cover products sold on the basis of joint production arrangements among developing countries. In this way all could gain from the expansion of export markets.

4.3 Other Possibilities for International Co-operation

4.3.1 The International Technology Brokerage Organisation

Possibilities for acquisition of technologies by DCs, whether via DFI, joint ventures, turnkey projects or in the form of unpackaged purchases of plant, equipment or know-how, depends critically on their knowledge of markets and transaction opporutnities. In order to enhance this knowledge, co-operative action could be directed at:

(a) Dissemination of information on the availability, quality and prices of non-TEC IC and DC technologies on the one hand, and the interests and requirements of DC purchasers on the other.

(b) The availability of alternative legal and institutional structures through which technologies may be acquired.

(c) Negotiation facilities which enable buyers and sellers to arrive at an acceptable arrangement for transfer of technology. For DC purchases, generally, the dominant objective in negotiation has been to avoid the unfavourable features observed in transactions associated with ICs and at the same time to seek conditions which maximise the internationalisation and diffusion of the acquired technology.

The International Technology Brokerage Organisation is intended to centralise information and at the same time provide sectoral project-level negotiating fora based on needs to provide DCs with a critical minimum level of information in bargaining possibilities; to facilitate the emergence of new entrants in technology markets and to provide a moving force to implement alternative methods of technology transfer. Work in this field has already commenced by UNIDO's INTIB and TIES which could provide a data base for the International Brokerage of Technology.

A precedent for this sort of brokerage organisation can be found in proposed or actually functioning regional organisations. In Latin America, the Instituto para la Integración de America Latina (INTAL) has proposed the Servicio Latinoamericano de Cooperación Empresarial (SEC),[1/] aimed at smaller Latin American firms seeking to enter

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1/ See Business Latin America, 20 December 1978, p. 407. Also SELA has recently created an information office RITLA (Red de Información Tecnológica Latinoamericana) in order to identify, evaluate, select, adopt and systematise technologies in accordance with the requirements of the Latin American countries. See Comercio Exterior, Vol. 28, nu. 9 Septiembre de 1978 and Evaluación de la Ciudad de La Paz, nos. 293/294, May 1979, p. 16.

joint ventures or other technology transfer arrangements with other entities in the region. SEC offers multi-level services ranging from the provision of information on collaborative possibilities and legislative requirements in different countries to market surveys and financial possibilities for Latin American firms wishing to expand to other countries.

A similar organisation is the EEC Centre for Industrial Development which matches requests and offers for co-operation among small and medium-sized European firms and those potential ACP partners who might be willing to start joint ventures with these firms from the Common Market.[1/]

The conception behind this Technology Brokerage extends the SEC and the EEC centre-type institution. It is envisaged that the brokerage function performed by this institution will involve inter-regional co-operation. Furthermore, the scope of its activities will encompass non-TNC entities which generate technology in the North, and public and private DC entities. Finally, in actually participating as a party in negotiations, this facility will play a more direct role in project implementation. The information activities of the brokerage will span:

(a) Supply: Banks of non-TNC technology sources in the North as well as public and private sources in the South. This information may be gathered directly as well as through data bank interlinks with other national, subregional, regional and international sources. Specific sectoral data will be collected on sectors chosen on the criteria of their relevance to basic development needs.

(b) Finances: Sources of finance for technology transfers including IC governmental untied aid and/or other sources of international finance.

(c) Demands:

- For specific final technologies by various DCs with as much information (organised on a standard format) as possible on the social and economic objectives of the acquiring entities;
- By DC entities wishing to reproduce technologies which have already been produced elsewhere;
- By DC entities seeking the know-how to modify existing technologies, in response to specific problems.

(d) Legal/institutional information: This would consist of specialised knowledge on various possible transnational instruments which should be available for evaluation in relation to the constraints posed by financial conditions, the objectives of transacting parties, the legal requirements of the countries of origin and destination, and the technical capacity of the acquiring economy.

1/ See, for instance, Business Opportunities, ACP-EEC Information Service, no. 9, March 1979, p. XXVII.

With its accumulated information and expertise, the brokerage should seek to achieve the most suitable transfer terms both in relation to prices and the modality of technology transfer.

The brokerage organisation would operate on a non-profit basis and be relevant to the sales of existing or newly developed technologies. It would be complementary to the co-operative endeavour for joint generation of new technologies under the auspices of the International Industrial Technology Institute discussed below.

4.3.2 International Industrial Technology Institute

The most obvious feature of the present industrial technology environment for DCs is the dispersion of sources of innovation and their application in industrial production mainly through the market. Large numbers of bodies are involved in the selection, generation, assimilation, adaptation and diffusion of technologies. These are mostly private enterprises, together with a few public sector corporations, research institutes and government co-ordinating departments, which are either national or regional in location. Consequently, there is no one international body for industrial technology concerned with DCs. The principal source of industrial technologies is North-based TNCs, from which they can be purchased by DCs, embodied in equipment, packaged in DFI or unpackaged. Dispersion means that the major functions below are not being handled in any systematic manner: DC governments and enterprises need a focal point.

The proposed Institute would fill the need for a focal point for DC governments and enterprises involved in improving their industrial technologies. It would not initiate or implement technological development, but would provide these services.

(a) Monitoring and providing information regarding terms and conditions of acquiring available technologies; modifications to imported technologies, new technology advances in DCs and ICs, and research efforts being undertaken by DCs particularly in generating energy-saving technology appropriate to the resource endowments and needs of these countries.

(b) Financing to catalyse ongoing and new research efforts through supplementary funds (seed capital), to organise the exchange of experience, and to assist dissemination and diffusion of tested technologies through market and public channels. Stimulating technology flows between DCs would be of particular concern.

(c) Evaluating and sifting priorities in research efforts, pointing out the dangers of duplication and ensuring the minimum concentration required for effective implementation.

Three major streams of industrial technology would be of concern to the International Industrial Technology Institute:

(i) Modern, mainstream technologies imported from the ICs - These are the bulk of industrial technology, mostly acquired on commercial terms. The problem is in selection of sources and processes, acquisition on the most favourable terms, transfer and diffusion among domestic users, assimilation, adaptation, replication, and export. The need is to supply government technology planners with information on alternative sources and terms, to locate DC enterprises that have successfully unpackaged and modified/adapted these technologies to DC conditions, to identify the factors that have led to their success, to study their transferability to other DCs, and to facilitate their transfer and export. Specific obstacles to DC-produced technology transfer and export may also be identified by the Institute, which can initiate proposals for their removal, rather than undertake corrective measures itself.

(ii) Modern new technologies produced in the South - These technologies, produced mainly by public corporations and research bodies, meet local needs and optimise local resources (e.g. nutritional supplements, tropical drugs, alcohol engines). The Institute would help to strengthen these efforts through financial support and scientific inputs from other countries.

(iii) Intermediate, small-scale, new technologies generated in the South - These would emerge from research (a) originated by nationally and regionally based bodies with their own workshops, testing and production facilities (e.g. Las Gaviotas in Colombia, and the Regional Centre for the Transfer of Technology in Bangalore, India) and (b) guild on traditional skills and technologies to increase their productivity. The fields covered by (a) and (b) would be oriented basically towards the consumption needs of low-income groups in cities and rural areas (e.g. cooking utensils and energy sources, furniture, construction materials), as well as simple tools for cultivation and irrigation, weaving, carpentry, blacksmithy, leatherwork, artisanal occupations. The Institute would essentially undertake the same set of activities as under (ii) - i.e. supplementary finance, technical inputs, organisation of exchange of experience, creation of propagation and distribution channels, co-ordination of efforts to avoid duplication and enhance concentration.

The Institute should attempt to seek and promote the application of technologies in the following areas:

(1) Energy

Where necessary, attempts should be made to seek alternatives to fossil fuels and to investigate their applicability in developing countries, e.g. mini-hydro plants, solar energy, bio-gas plants. Production processes should be sought and promoted which combine human and mechanical energy in such a way as to result in a net saving of fossil fuel inputs.

(2) Human Needs Development

Co-ordinated activities with other institutions should be undertaken for the development of indigenously available construction materials, nutritional supplements, drugs and health care systems, mass communications (e.g. audio-visual systems) which are more appropriate to the needs and incomes of developing country populations, especially those in non-metropolitan areas.

(3) Agriculture-Related Technology

Consideration might be given to the development of energy-saving methods of cultivation, irrigation, pest-control and the production of fertilizers based largely on organic matter.

(4) Mining and Mineral Processing

Technologies for mining and mineral processing which are appropriate especially for countries with smaller endowments and to the need to adopt energy-saving methods of extraction and processing.

At the initial phase of the Institute's working, priority could be given to (1) and (2) and subsequent activity could be expanded to (3) and (4). Within Human Needs Development, specific emphasis may be placed on construction materials.

The underlying concepts of this proposal have been advanced in many other fora. What is important, though, is the particular co-ordinating role that the Institute would play in the stimulation of technological innovation.

Given its service function, the Institute would have to act as a non-profit making, autonomous body, that could be affiliated with the UN system of Specialised Agencies. It would act on demand of DC governments, public sector corporations, private enterprises and a wide variety of non-governmental organisations including research centres, voluntary service organisations and co-operatives of DC producers and consumers. It could charge service fees for some of its services (e.g. information supply on activities concerned with the commercial stream of technologies) in order to provide others free of charge (e.g. generation and improvement of "village-level" technologies).

Since the Institute is not intended to have a large staff of its own, it will make use of the agents of technological innovation in the South as follows for the three streams of technology concerned:

(i) For imported Northern technologies, loose consultative bodies of foremen, engineers and managerial staff from productive enterprises could be sponsored by the Institute, to provide inter-developing country exchanges of experience in technological innovation in particular industrial sectors.

(ii) For South-based technologies, expert assistance would mainly be sought from representatives of industry ministries of the developing countries, public and private sector corporations, research institutes and departments for co-ordination of science and technology.

(iii) The intermediate technologies would require the most flexible organisation based on study tours and exchanges of skilled personnel, lightly capped by representatives from non-governmental centres and institutes (such as the Intermediate Technology Development Group, London).

In order to co-ordinate the three wings of the Institute's activities, to encourage interaction between their activities and to set overall priorities, a Board of Directors with rotating DC membership (divided among governments, private enterprises, and scientists/engineers in an independent capacity) would be assisted by a small evaluation unit that would draw on the monitoring activities of the Institute.

Financing should be left as flexible as possible, with the option of absorbing trust funds for specific projects, contributions from international organisations, bilateral government inputs, and private voluntary donations, apart from the fees charged for some of the Institute's services.

Liaison with other national, regional and international bodies engaged in similar activities is absolutely critical to the Institute's effectiveness. For instance, in the third stream of technologies, the Institute would collaborate closely with the recently sponsored US-based Appropriate Technology Institute. For its monitoring function, it would rely heavily on the services of UNIDO's Industrial Technology Information Bank and Technological Information Exchange System.

4.3.3 Technology Export, Financing and Insurance Agency

So far we have regarded the physical and intellectual capabilities to increase the capacities that the South possesses for augmenting and fostering the generation and utilisation of appropriate technologies. Measures to improve them have to be supported by the financial device envisaged here, a Technological Export, Financing, and Insurance Agency.

As noted above in this paper, technology exports among developing countries have grown significantly in recent years.[1/] A major problem with this trade, however, is the inadequacy of financial support. Several developing countries have already attempted or are trying to offer financial assistance to those corporations which export technology in various forms. The purpose of this proposal is to provide international financial mechanisms aimed at three areas of weakness in present financial arrangements. Those areas are:

(a) Export and import credit arrangements for both buyers and sellers of technology in developing countries;

(b) Insurance facilities which would allow adequate cover for the transactions;

(c) Financial guarantees for tenders and other forms of international bidding for technology contracts.

This agency would, in addition to financial mechanisms, be required to provide assistance in the harmonisation of legal arrangements governing trade in technology among developing countries and to assist, where necessary, in the negotiation and amplification of these arrangements.

1/ See, also, for example. O'Brien, P., Hasnain, A. and Lechuga-Jiménez, E., Direct Foreign Investment and Technology Exports among Developing Countries, reprinted elsewhere in this volume.

To begin such an agency would require sufficient financial inputs, through the UN system and/or the proposed International Industrial Finance Agency[1/], to permit leverage in the technology markets. As is well known, credit, insurance, and guarantee systems allow the realisation of economies of scale and hence a relatively small input of financial resources through an agency should be sufficient for several technology exporters to receive support. At the same time, international action of this type ought to provide more acceptable risk coverage for those cases where developing country exports of technology have to compete with prospective sales from the industrialised countries. At present, IC exporters of technology have a real or imagined edge not only with regard to the technical conditions of production, quality of product and compliance with delivery dates, but also with respect to their financial acceptability. This proposal is basically directed to the second of these points and also to some of the points relating to technical questions, e.g. delivery dates. It has been repeatedly emphasised that the inequalities in technology markets have dimensions extending beyond simple technological issues. In particular, the problems of marketing and financing have received some attention. The purpose of this Agency is to deal with the financial aspect with a view to reducing inequalities in the other areas.

Legal and informational requirements would be an integral part of the operations of the agency. Among the more important aspects of these activities would be:

(a) Harmonisation of legal standards to ensure that technology export through direct foreign investment does not discriminate against developing country suppliers.

(b) Harmonisation of legal regulations affecting non-investment sales of technology, e.g. turnkey projects.

(c) Agreement on the types of corporations which would be eligible to use the facilities of this agency, e.g. it would be necessary to exclude affiliates of transnational corporations operating in developing countries.

(d) Compilation of registers of developing country enterprises able, either singly or jointly, to supply technology to other developing countries. This device could serve as a co-ordinating agency linking government enterprises and private firms in developing countries.

1/ For details, see Industry 2000 - New Perspectives, pp. 123-129.

DIRECT FOREIGN INVESTMENT AND TECHNOLOGY EXPORTS AMONG DEVELOPING COUNTRIES: AN EMPIRICAL ANALYSIS OF THE PROSPECTS FOR THIRD WORLD CO-OPERATION

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INTRODUCTION

In 1971, the Tanzanian delegation to the Non-Aligned Summit Conference stated:

"Further, we often act as if we are afraid of the problems of co-operation or taking action which might upset one or more powerful external economic force. We do not welcome new approaches to these problems, and therefore we fail - both nationally and jointly - to give serious attention to working out the practicability of new ideas on how co-operation can be made effective, or how specific problems can be solved. Even when these new ideas originate from citizens of the industrial economies we sometimes reject them on grounds of unorthodoxy! (At other times we allow a very reasonable suspicion to prevent our giving proper attention to the proposal being made, as distinct from the national origin of the proposer!).

And it is not only in world international affairs that things are agreed in principle without action following. Among ourselves as Third World nations similar failures occur. Many of our joint ventures in trade, planning, or particular enterprises are struggling for existence - where they have not already become moribund. This is not for lack of potential; it is because the need to pool economic power in order to expand it is recognised in principle but ignored in practice when it has short-term costs.

It is essential that we should face up to our weaknesses in relation to co-operation among ourselves and in relation to our approach to the rest of the world. For until we have done so, and taken steps to overcome them, we shall make no progress in securing major change. We shall continue to achieve a new factory here and a new structure there; but we shall also continue to be 'the poor' of the world, whose interests can be largely disregarded."1/

Current debate on international policies for technological development focuses almost exclusively on the relationships between the industrial heartland in the North and the periphery in the South. Specifically, the debate revolves around four issues:

(i) The capacity of institutions which appropriate and advance technology and production in the North, to disseminate these to the South.

(ii) The distribution of economic benefits, to various claimants, arising from North/South flows of technology.

(iii) The appropriateness of Northern technology with reference to specific Southern economic problems.

1/ Presentation by the Tanzanian delegation to the Non-Aligned Nations Summit Conference, Lusaka, Zambia, September 1971. Reprinted in IDOC International, North American Edition, No. 43, March 11, 1972.

(iv) The possibility of improving upon the results of North/South interaction as it takes place via the market mechanism. Even if it is agreed that there is a necessity for non-market mechanisms to improve economic outcomes in favour of one or the other transacting party, there is considerable debate on the forms and scope of specific institutions required to handle specific problems.

The debate has influenced research and policy in international fora for almost a decade. The familiar picture of the international system to which attention has been directed depicts a strict hierarchy of countries in the international division of labour. Southern countries are regarded as locations for production which is relatively intensive in the use of unskilled labour, while Northern countries retain control over higher stages of the ranking. The institutional structure through which the system is organised corresponds to the most advanced form of capitalist development - Transnational Corporations (TNCs).

This picture is beginning to show some signs of change. Bits and pieces of evidence, of diverse kinds and from several places, suggest that the hierarchical pattern is becoming a bit blurred, with Southern entities starting to operate in economic territories hitherto regarded as the strict preserve of entities located in the North. This aspect of the international economy has yet to be researched systematically, or to enter the purview of international policy-making fora. What are the dimensions of this change? What are the reasons behind it? What are its likely consequences in broader geo-political as well as more narrowly economic terms? Should some or all of these changes be supported by international co-operative mechanisms on a South/South basis? If so, what could such mechanisms contribute and how should they be established?

This set of notes is intended to accomplish the following:

(i) To present a factual description of emerging South/South interaction through flows of technology, embedded in Direct Foreign Investment (DFI), the sales of technical assets and flows of skills.

(ii) To offer possible reasons as to how and why these patterns are emerging.

(iii) To outline some observed and potential results of these developments.

(iv) To provide ideas on the kinds of international institutions that may be established to encourage (where appropriate) the growth of these processes.

Our policy judgements are based on evaluations of relative advantages and disadvantages emerging from different scenarios and to arrive at these judgements we will draw on the criteria drawn forth by the discussion on North/South relations mentioned above. Merely to suggest that developing countries (DCs) may be breaking into a hitherto

rigid framework implies that we are expounding a conflict view of the world economic system. Those holding power have created institutional and legal structures designed to optimise the use of that power and simultaneously erect barriers to entry against possible newcomers; those attempting to break up the prevailing order are actively trying to fashion new instruments with which they can establish their own claims to valuable resources. Barriers to entry, and with them the means selected to bypass or overcome those barriers, will vary from industry to industry, as a function of technical production processes and/or legal restrictions. This implies that methods of surmounting barriers to entry must necessarily be predicated on:

(i) detailed knowledge of the production processes including the internalisation of the capacity to improve on existing techniques, and

(ii) the creation of legal codes and institutional mechanisms which enable the barriers, so identified, to be surmounted.

Our central thesis is this: capitalist power is now highly concentrated, spans the whole globe and has managed its internal organisational problems through the development of a transnational structure based on modern communications technology and old-fashioned feudal power chains. What capitalist power has not yet succeeded in doing is mobilising public entities and policies for the exclusive benefit of the TNC sector. The terrain of conflict, therefore, is the public realm: what shall be its scope, through what mechanisms will it operate, for whose benefit and at whose expense? In the industrialised countries (ICs), we have seen a transition from the minimum-profile state, whose activities were confined to setting up a handful of legal and institutional conditions adequate to lubricate the early phases of strong competition among smaller enterprises, to a welfare state in the dual sense of providing all the infrastructural support for the expansion of larger-scale capital as well as certain social conditions relating to health and education of the labour force. We are arguing that both forms of the state are now outmoded. Transnational capital in the ICs is now searching for ways to refashion the state in order that its policies and institutions become streamlined to the imperatives of a global economy. In short, both the nature and predictability of the extra-corporate activity now have to be subjected to the corporate demands. The fact that corporations have internalised considerable portions of trade which formerly were conducted at arms-length has been repeated ad nauseam. Less frequently is it pointed out that this internalisation is only a manifestation of a far more sophisticated corporate control strategy based on a deep understanding and manipulation of the sensitive areas of production and distribution. The latter is achieved by devices which have very little to do with ownership of capital itself. Of the essence in this new vision of control is the capacity to condition the interference of the state i.e. to ensure that state intervention contributes to, rather than detracts from, mechanisms for generating and distributing surplus.

In DCs, too, the state is at the heart of conflict though for different reasons. In those DCs which have a reasonably advanced industrial sector, public corporations are seen as instruments through which local capitalists and entrepreneurs can possibly join the

international oligopoly. Control over public entities is thus vital, primarily because such concentration of power is regarded as the most promising method for competing with external capital.

Despite the present haziness of the phenomena under study in a global context, their maturation may or may not benefit all parties involved. Confronted by this uncertainty, we also rely on an a priori political judgement that

(i) collective self-reliance is desirable in equalising the power differentials between the North and South in the international oligopolistic structure, and

(ii) when new flows promote collective self-reliance, the political implication should be counted as a major benefit in evaluating them.

Finally, the paper does not discuss explicitly the distribution of economic benefits within countries since they pertain to national policy which is outside the purview of the study.

CHAPTER 1: FOREIGN DIRECT INVESTMENT AMONG DEVELOPING COUNTRIES

Evidence of direct investment among developing countries is still sketchy.[1/] Recent tabulations published by the Centre for Transnational Corporations (CTC), based on statistics from some developing countries, give a rough guide to the situation among Latin American countries and among Asian countries. No systematic data pertaining either to the intra-African situation, nor to the intra-Third World matrix (e.g. how much Indian corporations are investing in Nigeria, Argentinian corporations in Asia) appear to be available. International sources, such as the International Monetary Fund (IMF) Balance of Payments Yearbook, have not registered much information on direct investment debits for developing countries.[2/] This suggests that only sources from national or industrial sectors will yield substantial data. Since such detailed coverage has not been completed, we consider only the CTC tables.

The data suggest that (i) probably only a small number of the more advanced developing countries are investing abroad, and (ii) geographical proximity may be an important consideration in deciding where to invest. In value terms, Indonesia is the largest recipient of this type of investment, with a 1976 stock from six other countries in the Economic and Social Commission for Asia and the Pacific (ESCAP) region amounting to almost $ 1.3 billion or slightly larger than the total foreign investment (FI) in the country coming from Japan. Intra-regional direct foreign investment (DFI) is far greater in Asia than elsewhere and Hong Kong is an investor on a much bigger scale than any other developing country with 1976 stock above $ 750 million, most of this in Indonesia. These statistics do not tell us:

(i) how the investment is divided among 100 per cent affiliates, other majority-owned affiliates, joint ventures, and minority shareholdings;

(ii) what the sectoral distributions are;

(iii) to what extent the investments are genuinely from domestic corporations in the countries concerned as opposed to being the product of domestically located affiliates of TNCs;

(iv) to what degree public-sector corporations may be involved;

(v) what rates of return (or income from direct investment) might be generated by these investments, and

(vi) the rates of growth of the investments.

All these are issues on which further research may throw some light.

1/ Opening his discussion of the Latin American experience, Díaz-Alejandro states: "Quantitative evidence that may be used to convince the skeptic that we are dealing with an important phenomenon is not easily found. Some of what is happening is at the fringes of local law or of recent origin." See Díaz-Alejandro, Carlos F., Foreign Direct Investment by Latin Americans, in Multinationals from Small Countries, Tagin Agmon and Kindleberger, C. P. (eds.), 1977.

2/ This does not mean that the IMF may not possess such data; often it exists but is not published for diverse reasons.

Table 1 (1): Intra-regional direct investment stock, Latin America, by host country and by country of origin, 1971 and latest available year
(millions of dollars)

Countries of origin	Host Countries: Argentina 1974	Brazil 1971	Brazil 1976	Chile 1974	Colombia[a] 1971	Colombia[a] 1975	Ecuador 1971	Ecuador 1976	Mexico 1974	Venezuela 1970	Venezuela 1974
Argentina	-	7.5	13.3	0.1	0.1	0.9	-	4.5	5.3	...	11.2
Brazil	9.1	-	-	5.2	0.4	2.0	-	4.4	7.2	...	1.6
Chile	-	-	-	-	0.1	0.1	-	-	-	...	0.7
Colombia	0.9	-	-	-	-	-	2.7	7.9	-	...	1.2
Mexico	1.0	2.6	6.9	5.3	1.4	7.5	-	4.0	-	...	4.7
Peru	0.9	-	-	0.8	0.3	0.8	-	1.4	3.6	...	-
Uruguay	2.2	8.3	12.0	-	4.6	4.7	-	-	-	...	2.1
Venezuela	0.1	4.2	9.0	1.7	10.5	19.3	3.4	10.3	1.8	-	-
Latin American Free Trade Area	-	-	1.0	-	0.3	0.3	-	-	3.5	...	-
SUB-TOTAL	14.2	22.6	42.2	13.1	17.7	35.6	8.1	32.5	21.4	6.7	21.5
Panama	80.6	80.1	275.0	...	36.4	53.7	...	4.0	119.3	...	...
Bermuda	...	12.2	39.0	...	0.7	1.0	...	-	...	...	...
Netherlands Antilles	...	75.2	192.0	...	13.4	20.2	...	-	...	...	...
Bahamas	...	21.7	66.0	...	13.7	10.0	...	-	...	...	...
Other	...	-	39.0	...	1.2	3.9	...	-	...	...	...
TOTAL	...	211.8	653.2	...	83.1	124.4	...	36.5	...	...	...

a/ At end 1976 the stock of DFI from LAFTA countries had risen to $ 50 million, of which $ 21 million were from Venezuela. In the same year the accumulated investments from Panama had reached $ 56 million, from the Netherlands Antilles $ 21 million and from Bahamas $ 11 million. See Tendencias y Cambios en la Inversión de las Empresas Internacionales en los Paises en Desarrollo y Particularmente en America Latina, Joint Unit ECLA/CTC, Working Paper 12, September 1978, Table 21.

Sources: United Nations Centre on Transnational Corporations, based on,
for Brazil: Banco Central do Brasil, Relatorio Anual, 1971 and 1977;
for Colombia: Banco de la Republica, Reporte Anual, 1971 and 1975;
for Ecuador: Banco Central del Ecuador, data obtained from the Institute for Latin American Integration (INTAL), 1977;
for Argentina and Chile: INTAL, Las Empresas Conjuntas Latinoamericanas, Buenos Aires, 1977.

Table 1 (2): Intra-regional direct investment stock,[a/] Asia, by host and origin, circa 1976
(millions of dollars)

Origin	Host country or territory			
	Thailand[b/]	Indonesia	Philippines[c/]	Hong Kong
Malaysia	5.0	42.7	0.3	-
Hong Kong	10.9	728.3	32.0	-
India	2.4	19.4	0.7	-
Philippines	0.9	272.1	-	3.4
Singapore	2.2	115.6	2.1	13.4
Korea, Republic of	-	107.4	0.1	-
Thailand	-	-	-	29.7
Other Asian developing countries	22.1	102.9	4.0	7.3
Japan	74.5	1,216.6	161.6	56.8

a/ The data for Hong Kong and Thailand refer to assets as reported in the sources listed above; the data for Indonesia refer to approved projects as of 1976.

b/ 1975.

c/ As of June 30, 1978.

Sources: United Nations Centre on Transnational Corporations, based on,

for Thailand: Board of Investment, Planning Division, 1976;

for Indonesia: Indonesian Financial Statistics, Bank of Indonesia, 1977;

for the Philippines: data from Central Bank Approved Direct Foreign Equity Investments, February 21, 1970 to June 30, 1978, statistics supplied to authors by the Central Bank of the Philippines. The data refer to inward remittances which had actually been made as of the latter date;

for Hong Kong: Trade, Industry and Customs Department, Hong Kong, 1977.

The CTC tables show that in Asia there is a fairly clear-cut separation between those countries which are suppliers of investment and those which are receivers. In Latin America there are signs of a much closer two-way relationship, with all of the larger Latin American countries (Argentina, Brazil, Colombia, Mexico, Venezuela) participating both as senders and receivers. It seems that Panama, Bermuda, Netherlands Antilles and the Bahamas are used as bases from which industrialised country investments are made to other parts of the region; other Latin American countries may also use them to some extent as investment bases but we will not include this possibility in our analysis.

More generally, the statistics shown here are quite likely to underestimate the total flows, particularly from those developing countries where strong exchange controls and licensing procedures tend to discourage the outflow of investable resources. The reasons may include:

(i) failures to record investment flows, either in the country of origin or the country of destination;

(ii) exports of machinery and equipment might be paid for in the country of destination via the issue of equity to the exporter;

(iii) under- or over-invoicing could be used to finance the build-up of equity participation, either in the countries with which trade is conducted or elsewhere;

(iv) failure to make proper allowances for any stocks of such investment which may have existed prior to systematic efforts to gather information (e.g. what valuations are given to investments of the Argentinian enterprise Bunge y Born which has been operating in Brazil for half a century?).[1/]

Despite the statistical difficulties just listed, further insight can be gained by looking at developing countries involved most actively in the DFI process, either as countries of destination or origin.

1.1 Indonesia

In a recent study Wells states: "Indonesia reports 288 foreign-owned projects as being 'realised' between 1967 and 1975. Of these, 64 originated from other developing countries. Hong Kong, Singapore and Taiwan accounted for 48 of the projects. Ten came from other South-East Asian countries and six from developing countries outside the region. Of the projects from industrialised countries, 50 were US and 80 were Japanese. Data on these projects were available from application forms (in some cases updated to reflect what was actually done) in the Capital Investment Board. ... The data was supplemented by interviews in Indonesia and Hong Kong. The interviews confirmed the patterns reported in this paper and also indicated that the importance of investment from other developing countries in Indonesia is understated in the reported data. Many foreign-owned projects are simply not registered as foreign. The unregistered projects seem to have characteristics similar to those of the registered projects."[2/] Similar information reported in Business Asia[3/] shows that from 1967 to June 1974 foreign investment approvals amounted to approximately $ 3.5 billion, of which a little over 15 per cent came from Hong Kong and Singapore, while the "Others" category (most of which is probably attributable to developing countries) accounted for just over 20 per cent. On a sectoral breakdown, 44 per cent of the approvals were in manufacturing, with almost 19 per cent in textiles alone; as will be seen later, there are reasons to suppose that most of the investment in textiles emanates from other developing countries.[4/]

1/ It may also be in a country's interest to underestimate the outflows. Thus a report on Bank of Korea (BOK) data on DFI in 1976 says: "According to BOK sources, high-level officials had ordered US $ 53.8 million in deferred-payment and service exports dropped from the end-1976 total to prevent puffed-up statistics from arousing concern over Korean aggressiveness in host countries." Business Asia, August 12, 1977, p. 252.

2/ Wells, L.T. jr., and W'Ella, W., Appropriate Technology from Neighbours: Developing Country Investors in Indonesia, mimeo, October 1978, p. 1.

3/ August 30, 1974; a later issue of the same weekly (October 14, 1977, pp. 324 and 325) takes the same data through to August 1977 and shows that Hong Kong, Philippines, Singapore and Taiwan accounted for 18.7 per cent of all approvals. Actual investment through the period averaged only 40 per cent of the "approved" figure.

4/ Thus, the same source reports that Honjak Investment Co. of Hong Kong took 85 per cent of the equity in a $ 21.5 million integrated textile mill.

On a trend basis, tentative evidence indicates that investments in manufacturing have been increasing and, because of the sectoral distribution of those investments, it is also possible that the share of developing countries in the total is increasing. Thus, "the 1973 approval pattern indicates significantly increased foreign interest in Indonesia's manufacturing sector. Approvals rose fully 133 per cent, and now account for 74.3 per cent of the value of total applications submitted. More than half of these proposed manufacturing investments are in textiles. Other manufacturing sectors experiencing substantially increased foreign investor interests include chemical and rubber manufacturing, metal products, non-metallic mineral and basic metal production."1/

1.2 Thailand

Data on total investment in Thailand are obtainable through the Thai Board of Investment; series are published for Applications, Promotion Certificates and Firms Starting Operations. If we use the last category, which has the advantage of referring to projects actually implemented, we find that in the period 1974-1977 the respective figures for each year were 84, 52, 83 and 48. Though the number of projects starting up is not broken down according to Thai and foreign, we do know that in 1974, 12 per cent of the registered capital was foreign-owned while by 1977 the relative share had doubled to 24 per cent.2/ Available figures do not allow us to state with any precision how much of the foreign-registered capital is controlled by developing country enterprises but a recent commentary on the 1977 statistics notes that, while 42 per cent of foreign investment was Japanese and only 2 per cent US, "much of the remaining investment came from other Asian countries."3/

Lecraw4/ conducted a questionnaire survey and analysis of 200 enterprises operating in Thailand (both local and foreign), of which nine were from India, six from Taiwan, two from Singapore and three from Malaysia. He cites statistics from the Thai Board of Investment which indicate that developing-country firms (or, more precisely, those firms labelled as developing-country firms in his table)5/ rarely show majority ownership. These partial estimates suggest that there is developing-country investment in Thailand though possibly it is not yet very large and predominantly takes the form of joint ventures with more than 50 per cent of the equity remaining in Thai hands.

1/ Business Asia, March 22, 1974, p. 94.

2/ Business Asia, February 17, 1978, p. 54.

3/ Ibid, p. 55.

4/ Lecraw, D., Direct Foreign Investment by Firms from Less Developed Countries, Oxford Economic Papers, October 1977.

5/ Ibid, table 2, p. 448.

1.3 Hong Kong

This appears to be the one Asian developing country which is both a country of origin and a country of destination for intra-developing country DFI. As a country of origin, evidence indicates that Chinese entrepreneurs based in Hong Kong have invested in such countries as Indonesia, Philippines, Singapore, Nigeria and Ghana though "it is not yet possible to make reasonable estimates of the total volume of the foreign investments of Chinese Hong Kong firms".[1/] The government of Hong Kong imposes no restriction on outgoing capital and collects no data on the foreign direct investments of its companies. One is left with only the piecemeal data reported by host countries. Indonesia, for example, reports $ 214 million of realised investment from Hong Kong. It is suspected that the annual outflow of investment by Hong Kong's firms in 1977 exceeded foreign investments coming into the country.

As will be elaborated later, there are also reasons to suppose that protectionist policies in the industrialised countries may be encouraging Hong Kong firms to locate production activitics elsewhere in Asia. Thus, "since the European Economic Community (EEC) has been keen to give poorer developing countries quotas in excess of their capacity, Hong Kong can take advantage by investing plant and expertise in these countries, as it may be doing in Sri Lanka."[2/] At the same time, it should be remembered that the remarks in the preceding paragraph relate only to Chinese entrepreneurs and that we do know of DFI made by Indian enterprises long established in Hong Kong. In sum, therefore, available information almost certainly underestimates, perhaps by a large margin, the amount of Hong Kong's DFI in other developing countries.

We have some data on the cumulative total of foreign industrial investment in Hong Kong as country of destination at the end of 1975. At that time, of 290 foreign-controlled plants operating in the country, 24 were known to come from other developing countries (Thailand, Singapore, Taiwan and Philippines) while probably most of the 16 classified in the category "Others", in fact, came from other developing countries. These investments amounted to around 15 per cent of the total cumulative value of foreign investments in the country.[3/]

1.4 India

As a recipient of direct foreign investment, India has a long and chequered history. That history is relevant because India is now investing in other developing countries but does not receive any investment from them. Notwithstanding the numerous (and well-justified) complaints that successive governments have failed to implement rigorously

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1/ Wells, L.T., jr., Foreign Investment from the Third World: The Experience of Chinese Firms from Hong Kong, Columbia Journal of World Business, Spring 1978, p. 4.

2/ Focus on Hong Kong, International Herald Tribune, Supplement, September 1978, p. 35.

3/ Business Asia, February 13, 1976, p. 53.

legislation designed to confine investment and technology transactions to high priority sectors and "first-shot" imports,[1/] the thrust of policy has been towards operating at or close to the technological frontier and accepting institutional packages (mainly foreign investment) in which that technology has been wrapped. Given the relatively high level of technical and scientific skills available in the country, the investment pattern has thus been dominated by transactions with industrialised countries. Other imports of technology and large-scale heavy industry projects have been organised through bilateral arrangements with the countries of Eastern Europe.

It is this same foreign investment pattern which now provides the basis for a considerable portion of India's own direct investment abroad. The policies to protect technological activity within India and the steady assimilation and development of skills have given the country a relatively strong position vis-à-vis other developing countries and the opportunity to export venture capital, technological assets and services, and skills. A commentary published at the end of 1977 refers to "the proposition canvassed for quite some time, both in business and official circles, that India has already reached what is euphemistically called the midstage of industrial development compared to a large part of the Third World. This is supposed to offer the basis of a new economic relationship between India and many countries of the Third World. ... The idea which is exercising a great deal of fascination in these circles is that India is now ready to take on a new and more 'advanced' role in relation to many other developing countries. Many of the delegations of officials and businessmen which have been going to explore prospects of exports to the developing countries have tended to make their judgement of the possibility of trade and economic co-operation with these countries on these lines. By far the most outspoken in this regard has been the report of a delegation of the Federation of Indian Chambers of Commerce and Industry led by K.N. Modi which after its return from a visit to Kenya, Nigeria, Ghana, Liberia and Senegal, proposed that the majority equity participation by Indian investors should be allowed in joint ventures abroad. The equity participation could be even 100 per cent in some cases. So far equity participation has been limited to only 10 per cent and the policy has been not to permit a majority share in ventures abroad. It is also suggested that participation in the form only of supply of goods and services from India should no longer be insisted upon, as in the case at present, and Indian businessmen associated in joint ventures should be ready to float global tenders for supply of capital goods, etc, and invite Indian suppliers to compete on that basis. The delegation was accompanied by a senior officer of the Industrial Development Bank of India (IDBI) and took the initiative to extend to Kenya a commercial credit on competitive terms, 9 per cent rate of interest for nine years, the first of its kind. Extension of such lines of credit is necessary, according to him, to back up the export of Indian goods and services in the face of stiff international competition, especially in the case of joint ventures in which Indians will have equity participation and which call for global tenders

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1/ Relevant evidence is provided by the frequent surveys of foreign collaboration agreements carried out by the Reserve Bank of India. Also see Subrahmanian, K.K., Approach to Foreign Collaboration, Economic and Political Weekly, April 8, 1978.

for the supply of equipment and technical services. It is suggested that IDBI will do more of such business in support of Indian exports.

"According to Modi, all these suggestions were being favourably considered by the government and definite decisions on these lines would soon be forthcoming. The fact is that the delegation was merely an instrument for articulating these suggestions and proposals which are in an advanced stage of being formulated and accepted within the government."1/

The foregoing suggests, as indeed has been the case, that policies and institutions frequently have operated against foreign expansion by Indian private sector enterprises although, as will be shown later, public-sector firms have been encouraged to increase their technological activities abroad. Among the limiting factors the following seem to have been important:

(i) the tight controls on investment through equity capital thereby canalising the direct investment into the equipment, services rivulets;

(ii) the failure to provide any tangible assistance to would-be foreign investors, either in the form of public assistance in seeking markets or insurance guarantees against losses and nationalisations without compensation that are so common in public policies of developed countries towards DFI, and

(iii) inadequate attention by the government to problems faced by Indian business in particular markets where India's business history differs significantly from that of would-be recipients.

Thus, "the Philippines provides yet another kind of hurdle for India. In the words of an Indian industrialist, "Malaysia has so much in common with India. Both were British colonies, and the British influence is still lingering. The law, business language, financial instruments, government, bueaucracy etc. are all similar. There is also a substantial amount of Indian population in Malaysia. Even the engineering specifications are based on the good old 'British Standard Specifications'. The Philippines is a different wicket. It has been under American influence for a long time, with more than a sprinkle of the Spanish language, culture, and habits. To make it tougher for us, their engineering specifications are based on American standards. Even the electric power used is of a different cycle and voltage; this could provide further constraints to the kind and variety of Indian equipment that can be taken from here."2/

1/ See B.M., India as Capital Exporter, Economic and Political Weekly, December 1977, pp. 2079-2080.

2/ Balakrishnan, K., Indian Joint Ventures Abroad, Geographic and Industry Patterns, Economic and Political Weekly, Review of Management, May 1976, p. M.36.

It is against this background that the spread of Indian DFI has to be viewed In a pioneering paper, Balakrishnan has examined the characteristics of Indian joint ventures abroad from 1960 to 1975. He notes that "a decade and a half after the maiden unit was set up in Ethiopia - a textile mill by the House of Birlas - and after the successful installation of only a handful of units each year since then, in 1975 there was a perceivable spurt in activity. In a single year, 23 units were commissioned for commercial operations."[1/] By end 1975, 65 joint ventures were functioning, another 65 were under implementation while 105 of the grand total of 233 proposals which had received Indian government approval had been abandoned during the preceding decade and a half. According to data published recently by Sharma, by end 1977 the number of approvals had risen to 322, of which 135 were operating and 82 were in various stages of implementation.[2/] Combining these data with those of Balakrishnan suggests that no more projects were abandoned in the past two years, which could mean that administrative procedures governing approvals are now more rigorous (in the sense of eliminating early projects whose risk of failure is high) and/or that firms themselves are being more successful in actually starting up their operations. End 1975 data reveal that the approvals had been given to more than 200 enterprises in 43 countries - unfortunately, we do not know the enterprise distribution of projects actually realised.

The destinations of investments can, following Balakrishnan, be summarised as in table 1 (3).

Table 1 (3): Indian joint ventures abroad - global distribution by broad geo-political areas (as on January 1, 1976)

Broad geo-political area	Number of Countries	Proposals Approved		In Production		At Various Stages of Implementation		Abandoned after Approval	
		No	Indian Equity Rs/Million	No	Indian Equity Rs/Million	No	Indian Equity Rs/Million	No	Indian Equity Rs/Million
South East Asia	7	86	226.131	33	98.748	37	112.109	16	15.274
Africa	11	64	173.491	16	52.094	8	25.750	40	95.647
Middle East	11	30	35.169	2	0.715	11	18.011	17	16.443
Advanced Countries	8	27	46.157	10	25.154	5	0.881	12	20.122
South Asia	3	23	34.357	4	0.712	2	0.500	17	33.145
Latin America and West Indies	3	3	2.618	-	-	-	-	3	2.618
TOTAL	43	233	517.923	65	177.423	63	157.251	105	183.249

Source: Balakrishnan, op.cit.

1/ Balakrishnan, K., op.cit., p. M.35.

2/ Sharma, K.K., Joint Ventures Abroad, Financial Times, Survey on Indian Industry, August 14, 1978, p. XXIII.

Sharma's figures taken to end-1977 indicate that the value of Indian equity then was Rs. 497 mn (around $ 80 mn) which were yielding estimates earnings through dividends, technology fees, managerial fees and royalties of some Rs. 158 mn (around $ 25 mn).[1/]

The sectoral distribution given by Balakrishnan is as follows:

Table 1 (4): Indian joint ventures abroad - distribution by broad industry classification

Industry Classification	Number of Joint Venture Proposals: In Production	Under Implementation	Abandoned	Total	Illustrative Products
Engineering					
- Semis	4	4	9	17	Foundry, Rolling Mills, etc.
- Consumer Durables	3	-	9	12	Sewing Machines, Blades, Bicycles, etc.
- Non-Durables	13	14	20	47	Cylinders, Pumps, Diesel Engines, Auto Parts, Steel files, Pipes, etc.
- Sub-total	20	18	38	76	
Oils, Chemicals, Drugs	8	14	20	42	Incl. Palm Oil and Soaps.
Textiles	13	6	10	29	Spinning, Weaving, Garments; incl. cotton, jute, synthetic.
Electricals	3	8	12	23	Motors, Fans, Cable, Electrical Accessories, Graphite products.
Hotels and Restaurants	5	5	1	11	
Consulting and Construction	3	4	2	9	
Wood, Pulp, Paper products	4	2	3	9	
Sugar, Cement, Cement Products	2	1	4	7	
Miscellaneous	7	5	15	27	Glass, Leather, Flour Mills, Stationery, Canning, Mosaic Tiles, etc.
TOTAL	65	63	105	233	

Sharma notes that "so far, more than 60 per cent of the machinery exported to launch the joint ventures is for such well-established areas in India as textiles, sugar, cement, chemicals and paper machinery (textiles head the list with 23 projects in as many countries). More sophisticated items like electric motors, transformers, switchgear equipment and related engineering products account for about 25 per cent of the exports for setting up joint ventures."[2/] He goes on to indicate that future prospects, both by industry and destination, are "bright for Indian entrepreneurs in areas like leather, polyvinylchloride (PVC), vegetable oil, pharmaceuticals, diesel engines, light engineering goods, electric fans, radio sets, sewing machines, automobile ancillaries, rubber goods, steel products, electrical equipment, bicycles, and other consumer durables that developing countries currently import from the West at considerable cost. Feelers have come from countries like Argentina,

1/ Sharma, K.K., op.cit.

2/ Sharma, K.K., op.cit., p. XXIV.

Brazil, Iraq, the United Arab Emirates, and Kuwait for setting up joint projects for manufacture of nuclear reactors, mining equipment, construction materials, cement, diesel engines and the like."[1/]

Thus far, the information on investments in individual countries is not very detailed. References to Malaysia, however, state that 58 of the projects approved by the government (or about 15 per cent of total approvals as of end 1977) were in that country though at least 20 of these have been abandoned (on a projects-implemented basis, so are some 11 per cent in that country). In a mid-1978 interview the Malaysian Deputy Premier and Minister for Trade and Industry pointed out that both Malaysia and India had "a lot to offer each other in partnership towards mutually beneficial investment". It was further noted that, at that time, India had over 40 investments in the manufacturing sector in Malaysia and the list was growing. Among the Indian enterprises investing in Malaysia are Kirloskar Electric Company, Phaltan Sugar Works, Godrej and Boyce Company, Birla group, Tata Oil Mills, Chemical Construction Company, Lakshmi Textile Exports and Gaware Nylon.[2/]

Before leaving this rough sketch of evidence on Indian corporation's DFI, we may note that, for well-known political reasons, little evidence of South Asian co-operation exists. India is notable for minimising its investments with its close neighbours.[3/]

1.5 Republic of Korea

The remarkable growth of the Korean economy has been accompanied by powerful state support for the small number of business houses which dominate its economy (for 1978, just two conglomerates, Hyundai and Lucky, are expected to account for more than 17 per cent of the GNP). In one of its numerous references to this phenomenon, Business Asia commented in 1977: "Direct foreign investment by major Korean firms presents other international companies with a new source of potential threats and opportunities. The threats, however, outnumber the opportunities. Korean investments aimed at penetrating new markets or overcoming protectionist barriers in existing markets pose one problem, while those aimed at procuring stable supplies of raw materials present another. Both kinds of investment are strongly backed by the Korean government. Fast-growing Korean investment in marketing offices and manufacturing operations means international companies can expect increasing competition both in their home markets and in third country markets. More Korean companies are establishing offices in key export markets to ensure that their products are marketed as aggressively as possible. At the same time, marketing operations are springing up in countries and regions where Koreans have never had a significant presence (e.g. Africa and Latin America). In addition to marketing offices, Korean

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1/ Sharma, K.K., op.cit.; some additional material can be found in Multinationals on the Move in India, Financial Times, December 1, 1978, p. 35.

2/ Material in this paragraph is based on Ramesh Jaura, The Malaysian Way, Economic and Political Weekly, June 17, 1978, p. 987.

3/ For comments in this regard see Balakrishnan, K., op.cit.

companies are establishing manufacturing operations both in countries that may erect barriers to their exports, and in those judged good export bases for penetration of protectionist markets. This means companies can expect to face rising competition from Korean products manufactured everywhere - not simply Korean exports."1/

By end June 1977 Bank of Korea statistics indicated that the stock of Korean investments was $ 85.3 million in 210 projects. Of this, Asia topped the list with $ 51.5 million while in Africa investments were $ 13.2 million. It is expected that "developing countries in the Middle East, Africa and Central and Latin America will receive an increasing share of Korean capital. Investments in these countries are already being strongly advocated by the Korea Chamber of Commerce and Industry as a result of its President's tour early this year. In most cases, Koreans are expected to provide manufacturing technology, part or all of the capital requirements - and increasingly more semi-processed products."2/ Lest it should be imagined that these phenomena are of just the past two years, between only January and October of 1973, Korean enterprises won 41 construction contracts in 15 developing countries. Even then Korean officials were stressing that these were not cases of exporting cheap labour but rather "we always use as much local labour as we can. We use only our technicians and supervisors and equipment - in short, our engineering ability."3/ This suggests the attainment of a degree of technological maturity comparable to that of some of the ICs.

1/ Business Asia, August 12, 1977, pp. 251-252. Evidence additional to that given in this and the subsequent paragraphs of the text is contained in the Quarterly Bulletin of the Export-Import Bank of Korea, March 1978, p. 7: "Overseas Branches of Korean Firms Number 1,415. According to statistics released by the Bank of Korea, the overseas branches and offices of domestic enterprises numbered 1,415 as of the end of March, an increase of 36 over the 1,379 at the end of last year.

"It means that Korean enterprises are increasingly setting up branches and offices overseas, reflecting the fast expansion of external transactions in manufacturing and construction industries, among others.

"By region, the Korean firms have nearly half of the total overseas branches and offices in the Asian region, where they established 663. North America came next with 405, followed by Europe with 228. The rest are in Latin America, Africa and Oceania.

Overseas Investments Top $ 100 Million.

"According to figures released by the Bank of Korea, overseas investments by domestic firms as of the end of February totalled $ 101 million involving 237 projects. The figures showed that Korean investments abroad increased 34.9 per cent as against the $ 74.9 million recorded in the year before. In number of projects, Korean investments abroad amounted to 237 as of the end of February, up 42.8 per cent from the 166 projects registered a year earlier. By industry, the overseas investments included $ 27 million for forestry, $ 20 million for trading, $ 16 million for manufacturing, $ 10 million for construction, $ 8 million for fisheries, $ 2 million for transportation and storage, and $ 18 million for others.

"Regional distribution of the investments was $ 51 million for Asia, $ 19 million for North America, $ 5 million for Europe, $ 8 million for Central and South America, $ 2 million for Oceania, and $ 16 million for Africa."

2/ Business Asia, August 12, 1977, pp. 252-253.

3/ Business Asia, November 30, 1973, p. 381.

Additional data, differing slightly from those just presented, have become available in a recent study by Rhee and Westphal.[1/]

Table 1 (5): Direct foreign investment (cumulative) by Republic of Korea as of end 1977 (by region)

Region	Percentage Share
Asia	67%
North America	19%
Africa	10%
Other Area	4%
TOTAL	100%[a/]

a/ Based on an aggregate value of $ 71.2 million spread over 229 activities.

Source: The Maeway Business Journal, June 18, 1978, as reproduced in Rhee and Westphal, op.cit.

They note that the 1977 stock was 25 per cent higher than that of the preceding year and that "there is every indication that the future growth rate will be as high or higher."[2/] By value, 20.6 per cent of this investment was in manufacturing although only 17 of the projects (about 8 per cent of the total) were in this sector; another 19.8 per cent were in trading, while most of the remainder were aimed at securing access to diverse raw materials and food supplies e.g. in forestry, fishing and minerals.

The regional distribution shown in table 5 is striking, with two thirds of the DFI in Asian countries and almost one fifth in North America. Many of the investments seem to be joint ventures, several of them in the manufacturing area designed to increase demand for Korean products in other developing countries and one of them (a joint-venture textile mill planned in Ghana) being an example of DFI to ensure market access to the industrialised countries. In line with our earlier observations, Rhee and Westphal comment that "the latter project is particularly interesting because a major share of the output is to be exported to the European Common Market, which imposes import restrictions on textile products originating from Korea. It is unknown whether other joint ventures have been established to cope with the export restrictions imposed by the developed countries on Korean textile products, though there are indications of another such project being considered in Latin America."[3/] The same reasoning may be behind the information reported by Lall that "some Korean firms have even applied to Portugal for permission to set up an electronics plant there."[4/] Some DFI is linked to the enormous success of Korean enterprises in the construction field[5/] and it is reported that "in order to take advantage of complementary

1/ Rhee, Y.W. and Westphal, L.E., A Note on Exports of Technology from the Republics of China and Korea, mimeo, November 1978.

2/ Ibid, p. 21.

3/ Ibid, p. 23.

4/ Lall, S., Third World Technology Transfer and Third World Transnational Companies, mimeo, July 1978, p. 11.

5/ Where their expertise is by now recognised everywhere.

demands stemming from big construction projects in the Middle Eastern countries, a Korean firm is planning to build a joint-venture plant producing construction materials in this area."[1/]

Certainly the evidence indicates that powerful state support in a very tightly knit economy has provided the basis for incredible expansion. That the objectives are by no means limited to intra-developing country DFI is underlined by a further observation concerning the Lucky conglomerate, whose chairman believes that, to circumvent possible protectionism that might hinder future growth, he "must strongly consider producing in countries such as the US - where we hope to sell - probably with equity participation from US manufacturers."[2/]

1.6 Singapore

Fragmentary information provided to us by the Singapore Chinese Chamber of Commerce and Industry indicates that DFI from that country may be geographically more dispersed than suggested by the data in table 1 (2) above. Thus, the flour milling company Prima Ltd. has a 40 per cent stake in the $ 40 million Prima Ceylon project in Sri Lanka; Acma Electrical Industries Ltd. and Setron Electronics Ltd. both have DFI in Bangladesh; and Keppel Shipyards is operating in the Philippines. Lall reports that "a large number of Singapore firms operate in Malaysia to serve the local Chinese community by making noodles and pickles, as well as operating small engineering works and textile factories."[3/]

1.7 Philippines

Very little information is available, and the likelihood is that there is still but a trickle of DFI from the country. The major exception is the San Miguel corporation, famous for its beer, which has affiliates in Hong Kong and the US besides substantial interests in Spain. It is noteworthy in that the effectiveness of the investment is dependent on the company's success in promoting its brand name - in a market where there is bound to be strong competition from other brands. Very few other examples of developing-country DFI in a brand competitive field are to be found.

We understand that some other Filipino companies have investments in Southeast Asia, but they are all joint ventures with extensive involvement of American, Japanese, Australian and European capital and little, if any, participation of domestic capital in the host countries. The diffusion of national identity implicit in these organisational patterns is of course advantageous to the Organisation for Economic Co-operation and Development (OECD) investors who can thereby benefit from the ASEAN integration moves.

1/ Rhee and Westphal, op.cit., p. 23.

2/ Business Asia, June 2, 1978, p. 174.

3/ Lall, S., op.cit., p. 11.

Some of this DFI may be an institutional vehicle to export technology though we do not have any detailed information on this. Some Filipino engineering firms are supplying technical services in Bangladesh and Sri Lanka but we are unable to say whether similar skills are being sold as part of the DFI arrangements.

1.8 Latin America

A path-breaking analysis of the Latin American experience has been conducted by White, Campos and Ondarts.[1/] Their examination reveals several major aspects of the investment pattern which can be summarised as follows:

(i) DFI from the Latin American Free Trade Association (LAFTA) countries into Brazil, Colombia, Ecuador and Venezuela during 1975 was around $ 127.5 million, the two largest investors being Venezuela and Argentina.

(ii) A study of 200 mixed enterprises (or joint ventures) shows that 37 of the operations were located in the Northern part of Latin America and 163 in the Southern part. Investments were strongly concentrated in zones, 80 per cent of the foreign investors in the North came from the North while in the South the corresponding intra-zone proportion was 89 per cent.

(iii) No fewer than 21 of the 25 countries of Latin America were recipients of intra-regional DFI; on the whole the larger countries, save Brazil where there is considerable Argentinian DFI, were the focus of few or the joint ventures.

(iv) Most (81.5 per cent) of the joint ventures were bilateral operations.

(v) Of 177 instances where the sector of operation could be identified, three quarters were in manufacturing. This pattern may contrast strongly with the situation in Asia where at least the smaller countries devote a fair part of their DFI to non-manufacturing activities.

(vi) A division of the numbers of joint ventures into those with public capital, those with private, and those with some mixture of the two reveals that 69 per cent of the cases refer to private sector activities. These percentages, however, are unweighted by size of operation and thus clearly understate the impact of public sector DFI, which tends to be in large-scale projects in the infrastructure and basic industry sectors. By the same token, though, this also tells us that almost certainly the vast majority of joint ventures in manufacturing are in private hands.

(vii) A tabulation of 46 cases of joint ventures shows which countries were responsible for initiating the projects. In 29 of the 46 cases the initiative came from the foreign partner rather than the host country. Of these 29, 19 originated from only four countries

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1/ While, E., Campos, J. and Ondarts, G., Las Empresas Conjuntas Latinoamericanas, INTAL, Serie Estudios Básicos, No. 1, Buenos Aires, 1977.

(Argentina, Brazil, Mexico and Chile). It is noteworthy that in no case did any of these four countries initiate projects in their own territories. At the other end of the scale, six small countries (Bolivia, Honduras, Nicaragua, Ecuador, Paraguay and Uruguay) initiated 11 projects where they were hosts but none abroad. Of the 11 projects, public rather than private initiatives were responsible (a 9-to-2 split).

(viii) A ranking of eight Latin American countries by absolute size of intra-regional stocks of DFI in 1975 correlates more closely with GNP per head than with absolute size of GNP.

The history of industrialisation in Argentina has provided the base for DFI from that country, some of it of long duration.[1/] Statistics on 47 major foreign-affiliated firms in Uruguay as of end 1976 showed that five were Argentinian; figures for the top 39 corporations in Brazil in the same year showed that two were Argentinian. In the context of the Río Plata Basin Treaty, signed almost 10 years ago, it was reported that "Argentine-Paraguayan economic co-operation has expanded considerably since the establishment of the Plate Treaty. The industrial-integration agreements provide for broad fields or areas of integration for private firms located in both countries, particularly in cellulose, citrus fruit, synthetic fibres, hand-operated machinery, domestic appliances, shipbuilding, low-cost housing, processed wood, cement, and dairy products. Operational agreements have been concluded for agriculture, forestry, manufacturing industry and mining, as well as for co-operation in the development and execution of technical and scientific exchange programmes. To implement such projects, a permanent Argentina-Paraguayan office for investment and industrial complementarity was set up in June 1974, and it is now processing projects calling for the installation of fertilizer, cellulose, aluminium and cement plants in Paraguay."[2/]

As shown by the preceding summary of points, inter-governmental agreements (bilateral and multilateral) within the region have provided the setting for much of the DFI. At the same time Brazil has also been involved in several arrangements elsewhere via a similar route. Examples are the agreement to establish a soya-oil processing plant in Iran; the interest of Cia. União dos Refinadores in the Kuwait Sugar Company, formed to refine, pack and sell sugar imported from Brazil; the establishment of a joint company by Brazilian, Maltese and Libyan interests to sell Brazilian timber in Europe and the Arab countries from a finishing plant established in Malta.[3/]

These brief remarks serve to underline the markedly different context of DFI within Latin America as compared to Asia. No doubt the long and turbulent history of integration efforts in the region is inextricably bound up with the character of DFI; certainly much

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1/ For example, Bunge y Born in Brazil. The CTC study Transnational Corporations in World Development, New York, 1978, shows that in 1976 Latin American parent companies had 203 affiliates in the region and that 34 per cent of these were controlled by Argentinian corporations (see CTC, table III-27, p. 231).

2/ Bank of London and South America Review, December 1977, pp. 646-647.

3/ Data taken from ibid., various issues.

of the DFI is associated with the attempt to create new corporate entities in which governments play a major role (i.e. organisations which can genuinely be called multinational). Perhaps it is not surprising that hitherto many of these new entities have been aimed at infrastructure activities; but this trend is changing as several countries try to move into branches of both light and heavy manufacturing. One consequence of the prevailing emphasis, however, has been that it is not easy to find evidence which permits evaluation of the relative merits of local investment, industrialised country DFI and LA DFI in manufacturing. The analysis of the following section therefore draws mainly on Asian experience.

To put all this in perspective, we may note that in 1974 only one per cent of all DFI in the region came from other Latin American countries; more than 70 per cent came from the US.

1.9 A Tentative Analytic Perspective on DFI Among Developing Countries

The flow of DFI among developing countries may be analysed under four headings: (i) stimuli to DFI, (ii) advantages and disadvantages of DFI, (iii) obstacles to DFI, (iv) implications of DFI. Before considering issues according to this classification, one general point deserves emphasis. The enterprises undertaking the DFI are not yet TNCs on any generally accepted (and acceptable) definition of that term. Specifically lacking is integrated movement accross national boundaries of management, marketing and technology, which are packaged in the conventional TNC. Many of the arguments usually raised in relation to TNCs, and particularly those stemming from the integrated nature of the financing activities of these firms, should not be casually transferred to the DFI phenomenon we are examining. This does not necessarily mean that, ceteris paribus, there is a relative bias in favour of accepting this kind of DFI instead of the TNC sort. Issues are to be studied on their merits; we can think of reasons why developing countries might be as wary of non-TNC DFI from other developing countries as they are of the TNC packages. Rather, the point is that we need a different optic if we are to formulate sensible policies. How different that optic is may be judged from the arguments which follow.

1.9.1 Stimuli to DFI

From the perspective of countries of origin, five stimuli seem to be operative. First, inadequate domestic markets push investing firms abroad. These firms could, of course, try direct export of their products but may prefer the DFI because of limitations to foreign trade.[1/] Second, developing country firms exporting to industrialised country markets may be encountering barriers because of country-quota systems and other non-tariff obstacles which can be circumvented by transferring manufacture to developing countries.

1/ Díaz-Alejandro, op.cit., p. 172 states that "much of the LA DFI into smaller countries is triggered by the erection by those countries of barriers against goods imported from the larger ones."

We have already mentioned recent references to such location-switching by Hong Kong firms to Sri Lanka. Wells has commented: "But defensive investments by Hong Kong firms have a twist uncommon to foreign investments by firms from industrialised nations. Hong Kong has long exported manufactured goods to the richer countries as well as to the poorer ones. For the richer markets, Hong Kong's comparatively cheap labour was an important factor. In the early 1960s the richer countries began to impose quotas on the export from Hong Kong. Moreover, by the later 1960s labour costs in Hong Kong were rising sharply. In response, Hong Kong firms sought production sites in other, lower-wage countries and in countries where quotas had not yet been set. The goal, of course, was to continue to supply the markets in the advanced countries. The textile manufacturers, for instance, set up plants in Singapore (some 15 plants in 1963 and 1964), Taiwan, Macao and Thailand."1/ Wells goes on to note that, although he "identified no Hong Kong firm that was, on its own, attempting to build a system of several affiliates that were integrated to gain economies of scale and lower costs" and despite the fact that "the usual Hong Kong-based foreign investment seems designed to serve the domestic market, with little or no integration with other affiliates", nevertheless "some integration exists for the subsidiaries established to escape quotas, but operations are integrated only to the extent that the Hong Kong offices allocate export orders to particular plants."2/

Third, as the above quote suggests, the presence of cheaper labour may be an incentive to developing-country investors. The search for cheaper labour continues to be a central motive force driving the international division of labour. Until now, however, arguments have remained confined to the old North/South split, equating managerial control with presence in the South. That pattern is beginning to crack. Within the South are labour-cost hierarchies which, if present differentials in growth rates among developing countries persist, are likely to become more rather than less pronounced. Part of the restructuring of the system is being generated within the South and follows age-old lines: geography has never been a good basis for distinguishing among capitalists.

Fourth, diversification of risk, particularly in the sense of creating buffers against possible fiscal or other inroads by governments in countries of origin, seems to encourage direct foreign investment. No reason prevents that investment from going to industrialised countries. As Díaz-Alejandro has noted: "A Brazilian firm has found its way to Texas; Irish officials of that country's Industrial Development Authority report interest on the part of a Mexican textile firm and an Argentine engineering company in taking advantage of Irish incentives for inflowing direct investment."3/ However, the chances are that, in the majority of cases, the direct foreign investment will be to developing countries since only there is it likely to yield substantial returns as well as provide the required degree of diversification.

1/ Wells, Columbia Journal of World Business, op.cit., p. 41.

2/ Ibid., p. 42.

3/ Díaz-Alejandro, op.cit., p. 174. Such investment could easily spread to Florida, as is hinted in the following remark: "Latin Americans are increasingly interested in investing in Florida; individuals have already bought up a handful of small banks, while many more are buying real estate and property developments", Financial Times, supplement on Florida, p. I, 29 September 1978. Our estimates elsewhere in this paper show that about one fifth of Korean DFI goes to North America.

Fifth, as a result of the relatively variable business climate in the country of origin, DFI from DCs will tend to be particularly attracted to countries or regions which offer low-risk profile (especially in the case of government policy) and stable costs. It would also require an assured supply of skilled labour and management which could not easily provide from the firms' internal resources.

Sixth, the establishment of joint ventures in other developing countries is one way an enterprise may improve its market position in relation to powerful and locally embedded TNCs. Obviously this argument is relevant only for those sectors where TNCs have or are likely to obtain interests. The argument is probably going to apply more to Indian and Korean investors in Asia and Argentinian and Brazilian investors in Latin America, since only these countries seem to have investors with some capability (at least at present) to compete with TNCs in more complex production activities. The argument may be expected to become more important, however, as more developing-country corporations move into sectors where TNCs command strong positions. Alas, our present knowledge of the impact of TNCs on developing countries' market structures is scanty so the quantitative implications are hard to assess.[1/] In his study of investing firm behaviour in Thailand, Lecraw interviewed both TNCs and developing countries' investors and came up with a much longer list of 13 motivations for direct foreign investment. Though we think that the main reason for DC DFI can be confined to those listed above, the Lecraw table reproduced below offers some fascinating insights into the differences between the big corporate entities and the normally much smaller DC firms. A glance at this table strongly suggests that we are dealing with two different populations. Not only do motivations differ greatly, but TNCs tend to emphasise a few items while DC firms express a groader range of motivations. Consistent with current conceptions of the sources of power wielded by TNCs, we find that technology and marketing rate highly: these instruments combine with the standard tariff jumping to account for almost all the motivations given any weight by TNCs.[2/] With DC firms, the picture is quite different: risk diversification is the major factor (this has virtually no relevance for TNCs) while such factors as business associates in DCs and the limiting strength of home markets play important roles. Marketing and technology, on the other hand, do not enter the picture. So the Lecraw results, conditioned as they are by the specific country and investors involved, tend to support the view that DC DFI and TNC behaviour should not be classified together.

1/ A recent survey paper concludes: "For more empirical work is needed on both direct linkages and industrial structure and performance before we have a clear picture of what TNCs do and how best to use their presence to promote development. There are many unwarranted generalisations which are accepted unquestioningly by writers on TNCs and by concerned policy-makers, about their good effects, or bad ones, on domestic enterprises and industrial structure and performance. The evidence does not bear out any strong statement on either side; all it provides is a need for caution and further research." Lall, S., Transnationals, Domestic Enterprises and Industrial Structure in Host LDCs: A Survey, Oxford Economic Papers, July 1978, pp. 241-242.

2/ Thus meshing well with the evidence and analysis regarding motivations of TNC DFI set out in Lall, S. and Streeten. P.P., Foreign Investment, Transnationals and Developing Countries, London 1977.

Table 1 (6): Motivations for foreign direct investment in LDCs

		MNEs	LDC firms
1.	Threats to existing markets	8	6
2.	Diversification of risk (capital conservation)	1	7
3.	High local return	3	6
4.	Investing accumulated local funds	1	3
5.	Exploit experience with high technology production	8	1
6.	Exploit experience with labour-intensive technology	1	5
7.	Relatives or countrymen-business associates in LDCs	1	5
8.	Export capital equipment	2	4
9.	A source of cheap labour	3	1
10.	To export to the developed world	2	1
11.	Use marketing expertise	7	1
12.	Small market at home	2	6
13.	Circumvent tariff and quotas in developed countries	1	2

Note: Numbers are average rating by firms in the group on a scale of 1 = no importance, 10 = very important.

Source: Lecraw, op.cit., p. 444.

1.9.2 Advantages of DFI

In talking of advantages, two dimensions need to be distinguished: for whom, and relative-to-what alternatives. In the former, we again need to distinguish the international distribution of advantages (country of origin and country of destination) and the internal distribution in terms of benefits to the state (tax revenues) and benefits to various private entities. No attempt is made here to elaborate all the points; rather we adopt the position that (i) a realised investment has no impact on third countries, in the sense of depriving them of the opportunity to engage in an investment that they would like to have undertaken, (ii) that the government in the country of origin is indifferent to the outflow investment, (iii) that the investing enterprise is in fact obtaining whatever benefits it expected to realise when making the investment, (iv) that internal distributional issues in the country of destination are guided by the broad objectives of retaining as much of the accumulated surplus as possible within the country and of having a production pattern geared towards relatively fuller use of labour and capital, (v) that the DFI does not deprive local capital of actual or potential opportunities of profitable investment. These assumptions thus confine the 'for whom' question to the areas of production techniques and factor utilisation rates in the destination country and to inter-country financial flows. To this extent, then, the dice are being loaded before we throw them on the "relative-to-what alternatives" table. A critical view of the for whom issue within a country of origin has

recently been presented with respect to India, where the government is actively engaged in promoting investment abroad by Indian businessmen. This is testified to, for example, by a report of a recent speech by the External Affairs Minister to the Calcutta Chamber of Commerce in which he revealed that his ministry was strengthening its economic wing in order to enable it to identify opportunities for Indian businessmen to set up joint ventures in other countries. Five broad policy measures have been taken:

- The government is considering setting up a separate organisation to help locate projects and provide other services for intending Indian investors abroad.
- Regulations governing investment abroad by Indians have been relaxed over the last year or so.
- The government would welcome investment abroad in industrial projects as well as in consultancy, trading, wholesale and retail marketing and service ventures like hotels and restaurants.
- There has been an abolition of the requirements that investment abroad by Indian businessmen must only be in the form of supply of Indian plant and equipment and know-how.
- Cash remittances for investment in business ventures abroad are now being permitted.

According to the commentator in this article, "apparently this is yet another fallout of the government's inability to harness the country's rising foreign exchange reserves for speeding up the growth of the domestic economy.

"The public justification for the government's efforts on behalf of Indian businessmen wishing to invest abroad is that such investment promotes exports of Indian equipment and know-how." As the commentator observes, this is a characteristic of all private foreign investment, whether from the developed capitalist countries or from the developing ones. "However, for a country like India, it is important to keep clear the distinction between the export of goods and services and export of capital. Indian private investment abroad, even in the form of export of equipment and know-how, constitutes export of capital. Such exports nevertheless qualify for the numerous export incentives, including cash subsidy. Does the country, then, have a surfeit of capital as to justify its export with the help of public subsidies?" The answer to this question would vary depending on whether private profit or public benefit are taken into account. In circumstances of limited domestic markets, constrained by a highly skewed pattern of income distribution, the appearance of excess industrial capacity will dampen the potential for domestic private and public investments. "In these conditions, investments abroad can make a significant contribution to the well-being of the particular company or business house concerned - even though, from an overall national point of view, there is little sense in exporting capital out of a capital-scarce economy. The official support in many forms which is being increasingly extended to Indian private investment abroad must thus be seen as part of the overall

trend of government policy of leaving investment, production and other economic activities to be determined by market forces and by private profit calculation."

In the context of international co-operation, the author feels that "a notable consequence of the official patronage extended to Indian investment abroad has been the influence this has had on the positions taken by the Indian government in international forums on such issues as the need for, and the extent of, government control and regulation of foreign private investment in and import of technology into Third World countries. More and more, on such issues the government of India's position has moved closer to that of the developed countries. For instance, in its report on the recently-ended four-week negotiations in Geneva on an international code to regulate transfer of technology, 'The Economist' noted with satisfaction that India was a 'notable moderate' at the conference, supposedly because it has realised that '(its) own know-how is an exportable commodity'. However, if one takes the most grandiose view of the likely scale of investment abroad by Indian companies, it is obvious that India will remain overwhelmingly a net importer of capital and technology for a long, long time. The so-called 'moderate' positions of the Indian government on basic issues pertaining to economic relations between the Third World and the rich countries have thus little to do with national interests, though they may suit a handful of Indian businessmen."[1/]

Conventional analysis treats the problematic of alternatives as essentially a matter of reform - how can we juggle among various actors, given the prevailing institutional structure and distribution of power. For purposes of these preliminary notes, and simply as approach to the issues, we will follow the same procedures. We will examine possibilities within new structures at a later stage of the work. The conventional method is used chiefly because the nature of available data does not permit any assessments of what might happen under changed structures; to a lesser extent our choice is governed by the fact that the structural-change dimension is still being explored. Definite conclusions concerning the role of intra-DC investment have yet to be reached. In essence, we consider the response of three groups of decision-makers, all responding to the private-profit motive, and focus on the consequences of their decisions in the productive sphere. The three groups are local enterprises, TNCs and DC investors.

The first advantage for DC destinations might be more appropriate technology, in the senses of scale of production, installation of more adequate machinery as well as higher utilisation rates for that equipment, and lower degrees of reliance on external sources of raw materials - in short, fuller use of domestic labour, capital and raw materials. Some evidence supporting these points is available. Type of equipment, scale of production and use of local labour seem to be closely related. Wells argues that the spread of second-hand machinery has both 'push' and 'pull' factors, with the former accentuated by the poorly developed international markets for second-hand machinery, particularly in the textile business. Thus, "Hong Kong firms were motivated to search for foreign opportunities

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1/ The discussion on pages 25 and 26 drawn from Capital to Export?, Economic and Political Weekly, Review of Management, November 25, 1978, p. M.107.

to make use of equipment no longer suitable for Hong Kong conditions. Many plants in Hong Kong had been established at least a decade earlier with simple, labour-intensive machinery. As wages rose in Hong Kong, the costs of operating with this equipment grew to the point where the companies could no longer compete abroad. With poorly developed international markets for second-hand machinery, a number of Hong Kong companies sought opportunities to use their equipment elsewhere. In a few cases, a Hong Kong businessman would learn of an opportunity and purchase an outdated factory for use overseas. Indonesia, with its very low wage costs, was a favourite place for such equipment: it could continue to be used competitively there. But second-hand plants went as far as West Africa. Much of this equipment was repainted, labelled as new and imported illegally into foreign markets."[1/] He goes on to point out that "little new equipment is available for the small volume production required in most developing countries where Hong Kong firms have invested. On the other hand, some second-hand equipment is quite suitable for low-volume manufacture. ... In some cases, Hong Kong firms have designed special pieces of equipment for low-volume production. Their foreign operations are outfitted with new machinery based on these designs. In most cases, that machinery is built in Hong Kong."[2/] Wells gives another example of a Hong Kong manufacturer of aluminium household utensils (Hong Kong's production is around one third the volume of output in Japan). "When the firm set up operations in another Southeast Asian country to produce aluminium household utensils at about 80% of the volume of its home factory, it exported some of its used equipment. It also sent simple new machinery it had made in Hong Kong according to the designs it was already using for low-volume manufacture."[3/]

Evidence on capital/labour ratios drawn from Indonesia indicates that they are almost twice as high for industrial-country as compared to developing-country investors. This finding comes from a fairly large sample (272 projects, of which approximately 24% were from DC firms) with a high industry overlap (at the three digit level, 20 of the 25 industries had firms from both groups).[4/] Data for Thailand indicate that K/L ratios for DC firms were some 40% lower than the ratios for both TNC and local firms, suggesting that of our three categories of decision-makers, the DC firms make the most use of local labour relative to capital. Moreover, other figures for Thailand show that the capital utilisation by DC investors is again far higher than for both the other groups (48% of estimated 'full' utilisation in the DC investor case, 27 and 26% for the other two groups). Turning to the raw materials use, we find that the import content for DC firms was 39%, for local firms 65% and for TNCs 76%; the production process thus seems to tie non-DC investor producers far more to external sources.[5/]

1/ Wells, Columbia Journal of World Business, op.cit., pp. 41-42.

2/ Ibid, p. 43.

3/ Ibid.

4/ Wells, Appropriate Technology from Neighbours, op.cit., calculated from page 2 and table 3.

5/ Figures drawn from Lecraw, op.cit., table III.

The second advantage concerns the net foreign exchange impact over time of the totality of the operations of the three groups of firms. Apart from the initial investment of capital (which, as we have seen, may be in kind rather than cash), the relevant financial variables are: receipts from exports, expenditures on imports, repatriation of profits, royalty payments, purchases of machinery and equipment from abroad, and repatriation of earnings by expatriate staff. The transfer pricing activities of TNCs, where there is reason to think they will occur, would be captured by value figures on traded items: illegal exports of cash are of course possible, but we have no evidence of these and, in any case, the incentives to illegality may not differ significantly among the three groups of enterprises. Data from the Thai sample mentioned earlier show the following:

(i) exports are negligible for all three groups of firms;

(ii) by far the lowest propensity to import raw materials exists in the case of the DC investor firms (1/c above figures);

(iii) recorded rates of profit repatriation were 27% of equity for TNCs and 3.7% for DC firms;

(iv) royalty fees as a percentage of sales were 3% for TNCs and 0.2% for DC enterprises (apparently there were no outflows under this heading for local firms);

(v) though we have no direct information on machinery costs, we do have data on the country of origin of machinery used disaggregated by nationality of the firm operating in Thailand. For IC firms (from US, Europe and Japan), the origin of machinery was from the OECD group of countries in at least 90% of the cases; for Thai firms the proportion was 83% while for Indian firms it was only 22% and for other DC investors 45%. Since equipment imported from OECD sources is almost certainly a good deal more expensive than that acquired from other places, there is a high probability that the DC investors spend far less in foreign exchange for machinery than either the IC (mainly TNC) firms or the local enterprises.

The overwhelming impression from these findings is that DC firms are much better than TNCs as far as financial impacts over time on the recipient country are concerned. There are also various indicators which suggest that they may be less of a foreign exchange drain than local firms. This last point should not, of course, be generalised to encompass the whole set of manufacturing enterprises under local ownership. The sample used was almost certainly drawn from larger Thai-owned companies far more locked to IC production patterns than their smaller-scale counterparts.

Evidence on possible outflows connected with employment of expatriate staff is less clear-cut but still quite strong. For Hong Kong firms, we have the following observation: "In 1977, according to the estimates of Hong Kong firms, a Chinese engineer stationed in another Southeast Asian country could cost up to $ 14,000 a year plus bonus, depending on

the company's performance. An engineer from an advanced country employed by a multinational would cost several times this."[1] Indonesian figures do suggest that the average expatriate employment per project is higher for DC investor firms than for TNCs, and that sometimes by a factor of 2 or 3,[2] but this is scarcely enough to make up for the salary differentials. The actual propensity to repatriate is not known with any degree of precision though all the odds indicate that it will be much higher for the TNC employees, simply because they are nationals of ICs in almost all cases and their interest in accumulation is tied to their IC country of origin.

Taken together, then, the financial evidence points strongly to DC investors performing relatively better vis-à-vis both TNCs and local firms.

The third advantage concerns more appropriate products. Direct evidence on this point is currently difficult to establish in that we do not have data on consumption patterns of lower-income groups, still less on from whom these groups buy items (roughly basic-needs satisfiers). Since brand-name items seem to be less appropriate, then the chances are that the DC investors are producing far fewer of these. So, referring to Indian experience with joint ventures abroad, Balakrishnan says "India's chance to succeed in consumer product lines with a heavy marketing orientation is limited as we have not built up strength in that area. Even within India, such products are manufactured and marketed by or in association with multinationals."[3/] At a more detailed industry level, he notes "other than Parrys Confectionery, with its unit in Malaysia, no other Indian manufacturer of consumer goods has even come up with a proposal to set up a joint venture abroad. Parrys, anyway, had an international brand image especially in the Commonwealth countries. Even in the oils, drugs and chemical industry, Indian units concentrated on non-brand products. The efforts of Tata Oil Mills, with their excellent experience in marketing, to enter branded products like soaps and vanaspathi are facing market resistance, even when they succeed in palm oil extraction."[4/]

In the Hong Kong case, we have the explicit statement that "Hong Kong firms have not gone abroad to use consumer marketing skills developed for the home market. In fact, few Hong Kong firms have developed well-known trade names. Most have relied instead on undercutting the prices of potential competitors."[5/] In the Indonesian market, there is some evidence on product differentiation and origin of investors, as set out in the following table:

1/ Wells, Columbia Journal of World Business, op.cit., p. 44.

2/ Wells, Appropriate Technology from Neighbours, op.cit., table 7.

3/ Balakrishnan, op.cit., p. M.48.

4/ Ibid., p. M.45.

5/ Wells, Columbia Journal of World Business, op.cit., p. 42.

Table 1 (7): Product differentiation and origin of investors in Indonesia (realised projects)

% of sales of industry spent on advertising (US)	Number of Industries (3 digit SIC) in which DC firms are proportionally more important	Number of Industries (3 digit SIC) in which IC firms are proportionally more important
Low advertising (less than 1%)	7	9
Medium advertising (1% or more, but less than 2%)	1*	3
High advertising (2% or more)	1*	7

* Industries with only one investor from a developing country.

Source: Wells, Indonesia, table 1.

The TNC/DC/local groupings in Thailand provide some information on advertising and selling expenses as % of sales, with the numbers being 8/3/3. These are probably reflective of a relative concentration by TNC enterprises on brand-name items and again point to production of relatively more appropriate items by DC investors.

As far as possible external effects are concerned, we have, as yet, no evidence. In principle the kinds of issues to be considered include training of local personnel, degrees of linkages with other parts of the local economy through subcontracting, impacts on market structure (either to increase or decrease the degree of market power within and across markets), impacts on supply prices for local raw materials and so on. No purpose is served by expatiating on these matters in the absence of evidence so we turn to the obstacles to DC DFI.

1.9.3 Obstacles to DFI

What are the barriers to entry for potential DC foreign investors? The major barrier to entry, and, indeed, the major obstacle to all efforts at DC co-operation, is the structure of the international business system itself. The moulding pressures exerted by that system do not need to be repeated here, save to emphasise one aspect, the communications structure. The ability to generate, collect, process and distribute information is a crucial element of market power. The existing structure has been so organised that the prospects for DC investors to engage in any and all of these activities are far less than for other international capitalist groups, among them the TNCs. To shift that structure requires a seachange, on which work is just beginning. If and when that structural shift is realised, the new vistas will be for DC investors - but also for other DC groups who are currently not in the transnational struggle at all.

Within the prevailing structure there are four kinds of entry barriers: legal, economic, political and cultural. The legal barriers impinge on the investment process both in countries of origin and of destination. For the countries or origin, we have noted already the impediments to capital export, particularly in the form of cash. In

destination countries, the very impacts of, and measures against, the TNC kind of investment may lead in practice to a perverse discrimination against precisely those types of foreign investment that could be more favourable. It is worth citing at length Díaz-Alejandro's perceptive remarks on the Latin American situation: "Barriers arising not from company laws but from economic legislation are another matter. A turbulent and not always profitable history of dealings with foreign investors, as well as a history of balance-of-payments crises, has been reflected in most Latin American countries in regulations that complicate capital movements in general and DFI in particular whether incoming or outgoing. The traditional targets of such rules have been the exploitative non-LA, foreign investor and the local entrepreneur seeking to take his capital abroad. Such a defensive attitude is reflected in a hundred ways throughout the economic legislation of most Latin American countries and now, somewhat ironically, creates a barrier to Latin American joint ventures and intra-Latin American DFI. Indeed, the twists and turns of restrictions, exemptions, and incentives in some Latin American countries may have the net effect of favouring DFI from outside Latin America relative to that from other countries in the area. A given Latin American country, for example, may have a smoothly working treaty with the United States to avoid double taxation of foreign investment but none with neighbouring countries. Countries within the Andean group have shown a special preoccupation with existing differences in the treatment given to national and other Andean firms in such matters as access to domestic credit and taxation, especially in public enterprises.

Neutrality between home and foreign investment, regardless of its geographical destination, and nondiscrimination among sources of inflowing DFI will be rejected in Latin America as undesirable policy guidelines for a mixture of economic and non-economic reasons that have also defeated those guidelines de facto, if not always de jure, in industrialised countries. It is easy to imagine a treatment hierarchy developing. Thus, some Andean countries could end up discriminating among purely national, Andean, other-LA, other LDC, and several other types of investments from industrialised countries. Because discrimination can arise in the formal and informal handling of the many incentive schemes that Latin American governments have to achieve regional, export, and other goals, discussions regarding LA DFI can lead to a reexamination of the effectiveness and rationality of many of these rules, and not just from the viewpoint of encouraging socially beneficial intra-LA DFI. One may hope that as many Latin American countries become both home and host countries for DFI, the people charged with overseeing the flow will enrich and deepen their knowledge of both costs and benefits of the process."[1/]

The economic barriers stem from both the relative absence of contacts among DCs, and hence the inadequate information on market possibilities, and the morphology of existing markets within would-be countries of destination. On the former, Sharma noted that an analysis of the reasons for the abandonment of 105 of the DFI projects approved by the Indian government revealed that "finding the right local partner is the main handicap".[2/]

1/ Díaz-Alejandro, op.cit., pp. 181-182.

2/ Sharma, op.cit., p. XXIII.

On the latter, a good deal depends on what are the sources of competition in the particular product markets which DC investors enter. In a recent survey Lall offers insight into the issues involved regarding existing TNC presence when he notes: "The general upshot of the work seems to confirm a priori expectations that TNCs are a significant and growing force in the manufacturing sectors of most LDCs, that they are present in industries with high degrees of concentration, and that they are generally larger than domestic private firms. We are, however, unable to say confidently from the evidence whether or not TNCs cause higher levels of concentration. TNCs certainly flourish in sectors that are marked by high levels of oligopoly, but the causes of oligopolisation may well lie elsewhere, in scale economies of production, R + D, marketing, finance, or some such factor: to the extent that several modern industries are inherently oligopolistic, the presence of TNCs may not as such cause higher concentration. However, it is quite plausible that in LDCs their entry does speed up the natural process of concentration, and that weakness of local competitors (with the exception of enterprises fostered by the state) enables them to achieve a much higher degree of market dominance, in sectors in which they are active, than would be the case in developed economies."[1/] Using this summary as a basis we could say that barriers to entry may be stronger in industries:

(i) where the nature of the production process requires the concentration of a large amount of capital in a single entity, since DC investors are likely to be in a weaker position to achieve this than either TNCs or domestic enterprises benefiting from state support;

(ii) where TNCs have moved in first, thereby tilting the balance in their favour and (on the assumption that TNCs are better organised than local firms would be) giving the DC investors greater competition; and that they may be weaker in sectors where the technological and/or consumption frontiers are not advancing much so that competition is dictated by price considerations.

These observations certainly mesh with data on events so far; as a prediction about future events, they suggest that most DC DFI will remain confined to a limited number of sectors except insofar as corporations in some DCs manage to achieve:

(a) technological levels close to those of IC actors, and

(b) the form of organisation which will permit them to manipulate abroad large quantities of capital closely tied to the country of origin.

In summary, then, economic barriers are informational, historical (history of the market), technological and organisational. They have obvious implications for the future of DFI from different kinds of DCs and in distinct sectors.

1/ Lall, Transnationals, Domestic Enterprises..., op.cit., p. 227.

The third type of barrier is political, including both intrinsic geo-political considerations and internal attempts to strengthen or protect the position of specific groups. Balakrishnan illustrates the former regarding Indian DFI: "We seem to be suffering from political hang-ups in collaborating with contiguous countries in South Asia. ... In most cases the ambivalent attitude of the host country seems to have been the major impediment. These countries are keen on acquiring technical know-how and domestic manufacturing capabilities and are politically also on good terms with India. However, the fears of the small neighbouring countries about possible political domination through business and economic domination need to be alleviated. It is this fear which also seems to have prompted the Indian government to prevent Indian entrepreneurs from investing in Bangladesh immediately on its gaining independence."[1/] Díaz-Alejandro describes possible internal resistances, even to public sector operations, when he says: "Joint ventures involving public LA enterprises, even when highly desirable on economic grounds, could be hampered by obstacles more powerful than those facing private joint ventures. The armed forces are influential in many public enterprises, and they may fancy that national security is threatened by joint ventures. ... In other cases, the non-military bureaucracies running other national public enterprises may be more interested in maintaining existing profitable links with extra-regional TNCs, which may or may not be socially profitable, than in exploring new links and forming a common front with other LA public enterprises."[2/]

The cultural barrier to entry is, of course, the product of the structural grip held by the ICs. The "OECD culture" dominates attitudes in destination countries and deters the investment behaviour of DC entrepreneurs. For destination countries, in turn, the "anti" attitude can be manifested in government and/or private decisions. In his examination of the reasons for the relative lack of success of Indian joint venture attempts in the Middle East, Balakrishnan remarks that the countries of the region "are not psychologically prepared to accept advice (technical or managerial) from a country like India which in their eyes is still a very underdeveloped one. We have no image for our products or know-how."[3/] More generally, consumers are often much more impressed by what is sometimes literally written as a "Made in Foreign" label than by items which contain reference to production at home. Entrepreneurial perception of this factor can lead them to take a less sanguine view of the risks and returns linked with DFI and thereby entice them to maintain contacts just through exports or to tie up with representatives of the OECD culture so as to increase the acceptability of their investment and output. The latter approach is forcefully illustrated by the case of one Hong Kong firm: "One paint manufacturer, for example, joined with an American firm in a Southeast Asian country in order to gain its trade name. The Hong Kong firm had already proved its technical ability in a third country where it had made paint without international help (and sold it successfully in that market, which was protected from competitors with international trade names)."[4/] Later in the same paper we find: "Impressionistic evidence suggests that firms

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1/ Balakrishnan, op.cit., p. M.43.

2/ Díaz-Alejandro, op.cit., pp. 183-184.

3/ Balakrishnon, op.cit., p. M.39.

4/ Wells, Columbia Journal of World Business, op.cit., p. 45.

from other developing countries share Hong Kong firms' weaknesses in marketing. There are, of course, a few well-known exceptions, such as Incacola from Peru (with plants in Puerto Rico and Ecuador), F and N from Singapore (with plants in Indonesia and Malaysia), San Miguel beer from the Philippines (with plants in Spain, Indonesia and Hong Kong). But the majority of the firms from developing countries appear to depend on special production abilities that enable them to compete on price."1/

1.9.4 Implications of DFI

The evidence presented so far suggests that we may be moving into a fifth phase of the evolution of the international claimant system, and that the phases may be distinguished by reference to the trade/foreign investment relation on the one hand and the labour/capital relation on the other. Prior to the colonial expansion, there was a certain amount of trade between dispersed regions (at that time it made no sense to talk of international) but virtually no investment, portfolio or otherwise. With the colonial era, and in ever more complex ways until towards the end of the 19th century, an international economy began to be formed pivoted on trade but with production of primary materials in peripheral countries kept under the total control of, and organised for the benefit of, the colonial powers. Investment in fixed stock still played but a minor role. Seen from the perspective of the emerging capitalist nation states, this was the phase of internal accumulation in which technical and managerial advances contributed to a tightening grip of capital over labour as industrial activity via the factory system grew in importance relative to international primary production. The third phase, beginning in the latter part of the last century and continuing during the first half of this century, was one where trade and foreign investment were still weakly related in the manufacturing field while the capital/labour struggle in the ICs became sharper only to be sublimated by the internecine conflict of 1939-1945 which resulted in a relative strengthening of the position of capital. The past quarter century has been par excellence, that of the internationalisation of production through DFI with that DFI, in turn, organised and managed by the supreme corporate agent, the TNC. It is in this phase that international trade has been finally subordinated to international investment and both have been internalised in the TNC, thereby simultaneously:

(i) giving the corporate giants greater control over their environment;

(ii) encouraging solidarity among, at the same time as they divide, segments of the labour force located in different countries;

(iii) driving much of the trade of DC enterprises into residual markets where the risks of volatile prices are much higher while the prospects of greater returns are small.

1/ Wells, Columbia Journal of World Business, op.cit., pp. 47-48.

In this phase, therefore, the international economy has not been (if indeed,ever was) characterised by competition but by growing oligopolisation of markets and rapid increase in the concentration of power across markets. These changes have not been confined to manufacturing: extractive industries, and finally agriculture itself, have been pulled into the network such that no aspect of economic activity is now free from transnationalisation.

In the early 1970s, some nasty shocks shook the scaffolding of the preceding 25 years. The transnationalisation of US business (in particular) had been accompanied by the transnationalisation of the US government. While the expansionism of politico-military dominance could be made compatible with economic dominance, the US government and the US transnationals could work essentially in harmony, the former providing the latter with the protection and predictability they desired. But the collapse in Vietnam showed US business (and corporations and governments elsewhere) that Washington was not omnipotent and showed DC groups that they were not impotent. Both factors suddenly focussed on the fact that TNCs would need much more sophisticated insurance policies, including new methods of exercising control which would be much less tied to equity ownership, or DFI as such. Economically, the Vietnam defeat roughly coincided with the end of the Bretton Woods era and the rise in oil prices via the first major institutional force created by a group of DCs, namely the Organisation of Petroleum Exporting Countries (OPEC). So, in a very short space of time, effective global hegemony was broken and the current phase of "the onset of oligopoly" began. Seen through the economic prism, this phase has two key dimensions: (i) for the major economic actors in ICs, the TNCs, it is one of enormous restructuring as (according to their sector) they shape a new set of instruments for control in face of what the corporations would regard as the "inappropriateness" of the state apparatus (even the EEC included) everywhere, especially in the DCs; (ii) for DC investors now in a stage to begin internationalising production, the current period provides opportunities which, however, are essentially conditioned by the power of the major actors. Before we can interpret these developments, and thereby draw some implications, a few brief comments on theoretical accompaniments to the historical dynamics are necessary.

In the first, long phase, trade (i) tended to be in luxury items, (ii) was conducted by individuals (sometimes by guilds), (iii) was between quite dispersed regions, and (iv) for most of the time was relatively free from institutional controls. The principal centre was the Mediterranean and the leading writers are all more or less closely connected with that world. During the second phase, lasting from the Renaissance in Europe until the last part of the 19th century and including various sub-periods, we had what might be called the "expeditionary force" approach to trade. The colonial powers supported all sorts of "voyages of exploration" whose initial purpose was to obtain greater supplies of species and raw materials. As the state grew in strength, so trade was developed under state monopoly, with the creation of joint stock corporations as the institutional vehicles for carrying out the trading. Now the central contributions to thinking came from the new loci of power. Pamphleteers in Elizabethan England, Quesnay and the physiocrats in France, some of the propagandists of Castile lauded the role of the state as monopolist over trade

and trading. But other crucial changes were occurring which, during the century from Adam Smith to Marx, introduced different perspectives on the nature of trade and investment, on the one hand, and their relation to the expansion of productive forces, on the other. Smith and Marx, in particular, focussed on the productive process, asking why industrialisation was taking place and what would be its effects. Investment in the industrialising nations was taking the form of fixed capital with the growth in the industrial work force necessitating an increase in the supply of food - international trade was composed more and more of staples although joined gradually by manufactured items. As state monopolies in trade gave way to an effective monopoly of the entities from one nation, England, so in that country Ricardo expounded his theory of comparative advantage from international trade and thereby laid the basis for subsequent disciples to talk of "free trade". This phrase was interpreted to mean an absence of state control or support of trade, though of course it does not eliminate the possibility of state enterprises being traders. The significant obstacles which the resulting schema could present for countries hoping to industrialise, i.e. create a comparative advantage rather than just live with the one bequeathed them by recent history, were fully appreciated by List. He saw that to acquiesce in that framework would be to accept a lower order role in the emerging international division of labour and argued that the only way for the nation state to resist that tendency would be through developing its instruments of control via the generation of a well-formulated protective policy. In effect, there would be a close correspondence between the interests of the new industrialists (as a class) and the behaviour and interests of the state (spread of the German empire).

From the later years of the 19th century until around the middle of the 1900s, one capital flow (above all in the pre-1914 period) remained mainly of the portfolio type with the DFI concentrated chiefly in extractive industries. By and large, there were no great changes in either the composition of trade or the international division of labour. There were, however, significant developments both regarding the capital/labour relation and the role of the state as control organ in international trade. Rationalisation and concentration of domestic industrial power in the strongest nations served to sharpen the lines of conflict between capital and labour, a pattern underlined during the major depression of the 1930s. At the same time, the intense Soviet industrialisation debate resulted in the pursuit of industrialisation in one country at root divorced from international channels of trade and investment. By now the split was becoming wider between those locked to the trade and investment paradigm and those focussing on relations in the production sphere. Within the former category, important analytic and policy contributions served to reveal further the nature of the approach and some of its problems. This was the era of Heckscher and Ohlin, theorists of the diffusion of advantages through trade, and of those other Scandinavians Nurkse and Hilgerdt (operating through the secretariat of the League of Nations). Nurkse explicitly took a position on "trade as the engine of growth", thereby implying that to engage in the trade game would encourage internal expansion and raising no questions about the distribution of the gains from trade and investment (an issue to be tackled head-on at the end of the period by Singer and Prebisch). At the policy level, a critical choice had to be made, involving an implicit position on the gains from trade issue.

Faced with severe depression, governments increased their control over trade as a defence mechanism for domestic economic interests who supported these moves. Now it was not a matter of state monopolies as traders, or of "structural monopoly" but rather of a centralisation of policy instruments in state hands to be used in "the national interest". When the critical period was over, the prevailing view among those belonging to the trade/investment school was that these instruments should be gradually released.

In the 1940s the institutional superstructure for the next 25 years began to be laid. In finance and trade, especially, major organisations were set up whose purpose was to provide a setting in which a steady shift towards relatively freer flows of commodities and capital could take place (most intensely among the OECD countries but also North/South). Most important, however, was the fact that by now the evolution in the corporate institutional structure was such that the internationalisation of manufacturing production, and thus a still greater hierarchising of labour, could take place. Earlier an international system had laboriously been constructed in which the role of one state (England) had been central. From now on, the dominant entity was to be the TNC, which would mould a transnational economy. Until the early part of the present decade, a considerable degree of responsibility could be delegated to the governments of the leading OECD countries and to the international agencies under their purview since they were, despite all the complaints from TNCs, performing their functions. The collapse of US hegemony on the global scale, announced by the Vietnam defeat, signalled the end of corporate trust in IC governments as reliable managers. Their role now has to be curtailed, in relative if not absolute terms, and the TNCs themselves are ceasing to delegate so much power to agencies no longer capable, in the words of the Trilateral Commission, of successfully "governing democracy". Increasingly, the instruments of trade and investment, not to mention control over production by direct and indirect means, are being internalised by the TNC in ways ostensibly beyond the effective control of all governments, ICs or DCs.

But it is in the quarter century from the end of the 1939-45 war to the beginning of the present decade that a still greater fractioning of analytic and policy perspectives on the trade/investment/production issues has taken place. Roughly, we have a set of views held by those still placing considerable faith in the trade prospects. These range from the pure theorists who apparently believe that "free trade", once existed, can and should be made to exist again (Samuelson, Johnson) to the exponents of "second-best" handling of trade policies (Meade, Bhagwati) to those attempting to generate an apparently "dynamic" vision of comparative advantage and tying it to investment (Vernon). Then come those emphasising various structural questions and thus placing market phenomena in a much broader setting. We have:

(i) writers who criticise the "malfunctioning" or even "dysfunctioning" of existing institutions on the implicit assumption that these institutions are neutral and can therefore be "bent" to good purposes - examples of the view would be Myrdal, Prebisch and Singer, all of whom countenance policies of the redistribution of market power through existing institutions;

(ii) those who explicitly argue that institutions are loci of power and, in the international arena, seek to discover who wields power, where that power is to be found, for whose benefit it is used, and how it is used. Their policy prescriptions are in essence directed at the creation of countervailing power through countervailing institutions, generally identified as the state, state agencies and inter-(DC) state groupings. It is usually stressed that the struggles in which the new institutions will be involved are only partly against IC states. In the main, they are fierce negotiations with the motors of the current world system, the TNCs. There are two variants of this approach: the predominantly economic (Sunkel, Vaitsos) and those extending their structural vision to other domains (Galtung). All of the preceding approaches define their "limits of the possible". For the theorists of second-best, the border line is given by the international terms of trade; for the institutional reformists, by existing organisations; for the loci of power groups, by the national state setting in which new institutions can be created. This leaves one more approach, those who see the roots of the contradictions in the labour/capital antagonism and the state as the product of those contradictions. For them, institution-building, in the sense of organisms embracing nation states, has no logic. The central problem is to identify the forces of resistance within all parts of the globe, DCs and ICs, and to work with them to build a totally new set of social relationships of a non-exploitative kind. Writers in this vein would be Baran and Hymer.

The preceding observations allow us to show the historical specificity of the various writers on problems of trade, investment and the internationalisation of production. In particular, the modern theorists, of whom Hymer and Vernon are perhaps the clearest examples, appear to be dealing with phenomena seen essentially from the perspective of the ICs in general, and the US in particular. Both Vernon's income differential approach, and Hymer's remarks about a "special asset", are strongly coloured by the idea that the only possibility is simply to copy what is happening in the ICs. Neither of them seems to give much weight to the chance that DCs might build up parallel structures in production and investment. The evidence presented earlier and our views on probable future developments lead us to think that a considerable amount of production and investment can take place among DCs especially in two kinds of activity: capital goods production and undifferentiated consumer goods. The former will tend to be through public sector corporations; joint venture arrangements will reflect an effort to reach the global technological frontier for these industries. The creation of pools of highly skilled manpower is intended to lead to command over the technology and it is possible that in the longer run enough can be done to obtain a place on that frontier.[1/] However, these investments are extremely costly and the state, despite its fiscal power, probably does not have, in the large majority of DCs, enough leverage to mobilise the requisite financial resources on its own. It is primarily because of the need to finance such capital goods ventures, that both joint ventures are initiated (cost-sharing) and considerable borrowing takes place on the

1/ A rich source of data and ideas on intra-DC movements of skilled personnel, and thus on the possibilities for the creation of pools of highly skilled manpower, is the study by the UNCTAD Secretariat: Co-operative Exchange of Skills among Developing Countries: Policies for Collective Self-Reliance in Skilled Manpower, TD/B/C.6/AC.4/8, 8 February 1978.

international money markets. For the capital goods area, then, the long-run hold of IC institutions will be in the financial realm where we would expect the consolidated strength of the big bank consortia to be enough to maintain command. For DCs to escape from this would imply a very substantial capacity to generate savings via both current account surpluses on the balance of payments and high domestic savings rates, all this linked of course to an internalised ability to manage the technology.

In the sphere of consumer goods, the inroads do not come through mobilisation via the state but rather because of the possession of certain abilities in production which, as we argued earlier, IC enterprises do not wish to and/or cannot replicate. What is the nature and essence of these production abilities? Their main characteristic is the fact that production is problem-oriented rather than system-oriented. Given that numerous DCs have been adopting rather similar patterns of industrialisation (at least in consumer goods industries), there is a strong probability that the same sorts of problems are being, or will be, faced by domestic producers in these sectors. From the perspective of ICs, no significant returns accrue to solving such "second-order" matters while for DC producers their resolution is critical. So the experience can only be conveyed from one DC plant to another, not from one IC plant to a DC one. The result is that incentives exist for contact between producers in two or more DCs with the tendency being for the provision of services and/or investment to be from the country with a longer industrial experience and/or larger industrial sector to the country with a less strong background. Naturally, this does not explain why DFI should be the chosen form of contact and indeed, as will be seen later in these notes, straight supply of technical services is growing among DCs. But oftentimes the desire of the recipient country is to have a fairly solid tie with its DC counterpart so that the latter can be sufficiently "locked in" to the success of the enterprise. Seen from the perspective of the investor, the linkage can be a way of obtaining entry to markets that would otherwise be vulnerable to tariff interference (c/f our earlier remarks on avoiding protective devices). It is also one way of expanding returns on skills developed on the job and which may not be easily saleable through the supply of technological services.

At one level, we could argue that this kind of DFI is taking place in residual markets, i.e. in countries and sectors where the TNCs have no particular chance to collect sizeable returns from their systemic approach to marketing, distribution, production and technology generation. By the same token, it is also the area where the market power barriers to entry are smallest for DC enterprises. How far this kind of DFI can proceed, therefore, depends on a complex mix of the following factors:

(i) the range of products and processes which IC corporations are prepared to vacate;

(ii) the speed at which they are prepared to do this;

(iii) the extent of local technological generation and modification successfully realised by DC corporations;

(iv) the degree to which the improvements made can best be switched to one place from another by means of DFI rather than other methods;

(v) the pattern of government incentives and controls in both the countries of origin and those of destination.

The sketch offered above of the various perspectives on trade/investment, production should suffice to show that existing arguments provide rather little insight into how this mix of factors may operate and that more detailed evidence and analysis are required of both the shifting strategies of IC firms in the industrial sphere and the content of local technological activity in DCs. Some material on the latter is contained in the third section of this paper; on the former, we have as yet only very partial facts.

It is but a short step from the theory of DFI to its geopolitics. In his observations on this matter, Díaz-Alejandro says: "Even more familiar are the preoccupations of Bolivian and Honduran officials who may wonder whether it is a good idea to have so many Brazilians and Mexicans in their country and whether they are trading a first-rate imperial power for a second-rate one. Such preoccupations could lead Ecuador to treat FDI from Germany more kindly than that from Peru."[1/] Hence the problematic is:

(a) so far, DFI among DCs is nowhere near the size of, nor comparable in form to, the DFI from ICs;

(b) it is, however, growing and could become a powerful force in the next decade;

(c) the DFI is concentrated in a few countries of origin and probably will remain so for at least the next few years;

(d) the resulting stratification of DCs (observable in many other dimensions too), leading to a greater "stretching" of the international hierarchy, leads to the following key question: What alliances will the stronger and more influential DCs aim for?

A quick scan of the current international scene suggests that the possibilities for the weightier DCs (above all, Brazil, India, Republic of Korea and perhaps Saudi Arabia) are:

(i) Try to become full members of the Western power structure.[2/]

(ii) Associate status in the Western power structure, whereby the associate is confirmed in his position of pseudo-hegemony in his region but is implicitly excluded from global operations. Under this arrangement the associate would almost certainly not be

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1/ Díaz-Alejandro, op.cit., p. 179.

2/ Korea, for example, stands out as a potential candidate for membership in one of the most important institutions, the OECD: "By 1985, the world will look on South Korea as the country which went from ... abject poverty to OECD membership in a single generation." See The Economist, March 3, 1979, A Survey on South Korea, p. 3.

allowed, for example, access to key military information and to this extent would be worse off than under the full membership schema; on the other hand, an associate might prefer not to join fully at first, for conjunctural reasons or otherwise, and could also preserve more liberty of manoeuvre during a period which would enable him to bargain for full entry later from a stronger base.

(iii) Seek to form an independent coalition through which, de jure as well as de facto, they would establish themselves as the DC leaders and attempt to cut out a path differing significantly from what might be pursued by other groups in the world. To some extent this would mean trying to consolidate "Third Worldism' as a doctrine.

(iv) Operate, singly or together, to link with non-DMECs such as China or the USSR, so as to create a fresh set of alliances outside the occidental axis.

(v) A "go-it-alone" bid by each of the big DC countries where each one tried to establish his own sphere of influence and steer clear of close ties with anybody.

Any sketch of possibilities is misleading to the degree that it paints the world as divided into blocks which are too rigid. Two major sources of over-simplification in the preceding design are:

(a) An assumption that the structure of influence in the grouping of Western states will remain unaltered. Thus far the grand alliance pivots around US, Federal Republic of Germany and Japan, with a variety of other OECD members coopted to make things appear smoother and stress the new image of a world of many partners instead of a single leader. But it is possible that several of the lesser entities who have been coopted could be discouraged by the concentration of power and themselves try to push for new formations - an example in this vein would be the so-called "like-minded countries".[1/] More critically, perhaps one of the big three could be lured away. Overwhelmingly the spotlight plays on Japan, the one non-occidental country which has forced its way to the top of a Eurocentric world and which might be tempted to conclude favourable ties with non-members.

(b) That no fresh "leaders" will emerge to challenge the handful mentioned earlier within the DCs. This has two aspects, namely the chance that, say, Nigeria would struggle for entry into the DC leaders club (the direct challenge), and the evidence that several DCs of notable weight would simply refuse to accept such hegemony. Argentina, Cuba, Zaire, Pakistan, Iran and others could readily fall into this camp; given the strongly capitalist bent of few current leaders, it is also more than likely that countries seeking a socialist path would resist hegemonism in its new forms, just as it has been, and will continue to be, resisted in its old forms.

1/ See the work being carried out by the RIO Foundation.

What can be gleaned from delineating all these possibilities? In essence, the main lesson is that any co-operative schemes drawing on the DFI potential of certain DCs should try to build in protective devices such that the schemes can proceed (thus continuing to chip away at the principal citadels of power organised through the TNCs) while simultaneously the likelihood of domination by a few DCs is decreased. How can that be done in a practical way? The question in effect can be itemised: Which groups should be involved? What should be the scope of the schemes? Through what institutional mechanisms should they function? A first answer would be along these lines: Try to mix countries from different parts of the Third World and at distinct levels of industrial development so as to reduce the tendency towards regional "looking in", which certainly has occurred under previous co-operative schemes. Try to package two sorts of things, viz. the investment, technology, skills bundle on one side, and the intermediate and final goods supply/distribution network on the other. Why this? Because this type of marriage greatly increases the range of countries that can become involved and tends to equalise their participation in the sense that each will be using these items in which it has a clear edge. Until now the DFI has involved either just one group of countries taking the initiative or several coming together when substitutability rather than complementarity of contributions was the norm. Neither situation augurs well for distribution of benefits and stability of the relationship. Set up an international institution combining the technical wherewithal to generate projects and put interested parties into contact and with the financial force to ensure that these projects not only can be initiated but also that they can remain in operation despite hurdles from time to time.

Theoretically the IBRD ought to be capable of an activity of this sort: but practical experience has shown it to be ill-suited to the task. At no stage has the Bank sought to encourage DC co-operation in this way. Its political stance, not to mention the devices through which information is centralised in Washington, amount to massive obstacles which eliminate it from serious consideration for a task of this type.

With this we conclude this brief first look at the DC DFI phenomenon. At many phases of the discussion, its relation to technological development in DCs has been manifest, so the next section summarises what we have discovered about the subject.

CHAPTER 2: EXPORTS OF TECHNOLOGY BY DEVELOPING COUNTRIES

Available data indicate that some DCs are now exporting technology in various forms and to a significant extent. In this section we summarise the information, classifying it by exporting country, and then examine implications of this new phenomenon.

2.1 Argentina

Probably the best-known way in which technology is exported is through turnkey projects. Table 7 lists 34 examples of such exports (including a few cases of less complex engineering works) made by firms located in Argentina during the quinquennium 1973-1977. A glance at the table is enough to show that the total value of these exports, at almost $ 341 million, was equal to nearly 10% of the total value of all Argentinian manufactured exports over the same period and to 2% of exports of all kinds. With one exception, all the contracts were with other Latin American countries suggesting that Argentinian firms are finding it easier to export within the region, at least in this early phase of operations. Many of the contracts cover quite complex technological fields, including integrated communications systems, a water treatment plant for industrial uses, a plant to produce glycerine. Thus the range of technologies is in no sense limited to simple items which implies that domestic technological progress in the industrial area has been considerable.

Katz and Ablin[1/] have provided data which clarify some further aspects of the exports. From table 7 we know that the 34 contracts have been won by 25 enterprises; supplementary information reveals that 20 of these firms, which obtained 28 of the contracts, were national enterprises while five affiliates of TNCs obtained the remaining six contracts. In value terms, however slightly more than 50% of total export receipts accrued to the five TNC affiliates. Admittedly a large part of this figure can be attributed to a single contract (that of Techint in Peru) but even when that is omitted, that average size of contract for the TNC affiliates is still double the size for the national firms. Hence, a sizeable part of the exports of technology from Argentina are carried out by TNC affiliates, in just the same way as other TNC affiliates are major exporters of manufactured products from Argentina (in an earlier study the same authors showed that 16 of the leading 20 exporters of manufactures in 1969 were foreign affiliates[2/]). On a sectoral basis, the largest numbers of contracts were obtained in food industries (15) and chemicals (5), both areas where Argentinian industry has long been engaged in domestic production and where we may expect accumulated expertise to be fairly important.

1/ See Katz, J. and Ablin, E., De la Industria Incipiente a la Exportación de Tecnología: La Experiencia Argentina en la Venta Internacional de Plantas Industriales y Obras de Ingenieria, Monografia de Trabajo no. 14 del Programa BID/CEPAL de Investigaciones en Ciencia y Tecnología, Buenos Aires, Abril de 1978.

2/ Katz, J. and Ablin, E., Tecnología y Exportaciones Industriales: Un Analisis Microeconomico de la Experiencia Argentina Reciente, Desarrollo Economico, Vol. 17, no. 65, Buenos Aires, Abril - Junio 1977.

Table 2 (1): Argentina's exports of turnkey plants: 1973-1977

Year	Company	Type of plant	'000 $	Destination
1973	De Smet	Vegetable oil factory	5,525.0	Bolivia
	Nisalco	Cooked meat and extracts	200.0	Brazil
	Standard Elec.	Automatic central telephone station and external communications plant	573.9	Ecuador
	Sicom	Integral communications system	2,329.4	Chile
1974	SEL Engineering	Slaughter-house and cold storage plant	12,500.0	Cuba
	Phoenicia	Integral baking plant	2,900.0	Cuba
	Nisalco	Glycerine-producing plant	90.0	Mexico
	Emepa	15 sheds for port storage	6,775.0	Cuba
	Emepa	Structure sheds, metallic coverings and silos for fowl farms	15,940.5	Cuba
	Adabor	Metallic silos with integrated conveyors	2,329.1	Cuba
	Lix Klett	Air conditioning, ventilation and heating for a bank building	90.0	Paraguay
1975	Meitar	Processing of citrus fruit	6,200.0	Cuba
	Dosicente	Two honey-making plants	1,490.0	Cuba
	Eximparg	Plants for extraction of vegetable oil from cotton seed	4,000.0	Bolivia
	Lito Gonella	Supply, distribution and pumping terminals for liquefied gas	1,993.3	Ecuador
	Techint	Oil pipeline and pumping stations	120,000.0	Peru
	Bago Laboratory	Antibiotics-producing plant	220.0	Bolivia
	Benito Roggio	Airport	52,000.0	Paraguay
	Nisalco	Plant for processing of water for industrial use	47.3	Uruguay
1976	Meitar	Processing of citrus fruit, pineapple and manioc	8,310.0	Bolivia
	Gale Estab.	Plant for processing and bottling of spices	1,441.0	Cuba
	De Smet	Plant for extraction of oil for solvent and for treatment of sunfloverseed and soyabean seed	746.4	Uruguay
	Harial	Plant to produce lead oxide	146.8	Venezuela
	Harial	Plant for melting and recovery of lead	105.7	Venezuela
	Cemati	Ironworks for electric installations	146.5	Bolivia
	Phoenicia	Integral bread-making plant	115.0	Chile
	Caissutti	Slaughtering and processing of fowl	183.5	Paraguay
	Giuliani	Powdered balanced food factory	239.2	Bolivia
	Industrial Gases	Plant for refining fats	285.2	Chile
	Iradi	Plant for processing and storing grain	480.2	Uruguay
	Bago Laboratory	Plant for the extraction of active elements	450.0	Honduras
1977	SEL Engineering	Plant to produce sodium casein, calcium and powdered milk serum	253.3	Uruguay
	Tecnimontsade	Pesticide-manufacturing plant	45,000.0	Bolivia
	Latinoconsult	Hospital	46.000.0	Ivory Coast
		TOTAL	340,742.4	

Source: Katz, J. and Ablin, E., op.cit., 1978.

Information[1/] on some of the enterprises selling the turnkey plants throws more light on the technical activities undertaken. Benito Roggio e Hijos has been employing Paraguayan manpower in the construction of the airport terminal guilding in Asunción. The

1/ See Economic Information on Argentina, October 1978, pp. 27-29.

Argentinian firm is conducting training courses to prepare personnel capable of handling the technical department of the airport. Techint won a competitive tender from 30 international companies to build the two pumping stations in the North Peruvian oil pipeline (subsequent news indicates that this firm has obtained a $ 100 million contract from Saudi Arabia for the construction of a liquefied natural gas pipeline). Laboratories Bagó was established in 1974 for the purpose of exporting plants in the pharmaceutical and pharmochemical fields. The Honduras contract listed in table 2 (1) is for a pilot plant; if that is remunerative, the plant cost is expected to increase to $ 5 million. Besides the Bolivia contract also mentioned in the table, the firm does business in Uruguay, Paraguay and Peru, where it secured a $ 40 million contract to build an antibiotics plant in competition with 30 international firms. Fo. all contracts the company takes charge of the training of technicians and specialised workers. Gases Industriales, whose Chile contract is shown in table 2 (1), exhibited a special plant for the recovery of carbonic gas originating during fermentation processes at the Munich "Interbrau 77 international fair. The interest shown in this locally developed technology was considerable. Subsequently, the Philippines bought a $ 600,000 plant for the recovery of carbonic acid during the fermentation of molasses, and similar plants were sold to Paraguay, Uruguay and US. In every case, should the purchasing country so request, the company takes charge of the training of personnel over a period of 60 days and Argentinian experts are sent to control the operation of the equipment during a period of approximately 90 days.

The turnkey sales are thus following the pattern familiar from similar sales by IC corporations. The evidence suggests that, notwithstanding the relative absence of government support, several Argentinian-based companies are becoming quite competitive internationally. But the issue of the institutional context, private and public, in which these exports are taking place merits further comment since it reveals some of the difficulties confronting actual and potential exporters of turnkey plants.

Though the label "turnkey" indicates that the enterprise is selling the whole plant (and so in this sense the buyer is dealing with just one seller of technology) this by no means implies that the seller can operate alone. Three complementary agents are essential:

(i) consulting engineering firms;

(ii) international trading companies;

(iii) financing and insurance groups capable not only of supplying credit but also of providing guarantees and covering risks.

The first group in practice is called upon to fulfil a wide range of functions, ranging from diverse aspects of engineering to arranging for the supply of certain kinds of capital goods and ensuring their compatibility with each other and with the basic process being sold. When the turnkey seller is a large corporation, these functions might well be internalised, either as a division of the company or even as a separately incorporated affiliate. Yet for a small or medium-size supplier, particularly one with limited experience as a seller

of turnkey plants, the assistance of a consulting engineering enterprise will be indispensable. In a vital sense, these firms can function as the intermediate agents on the technical side; their very knowledge of the capital equipment suppliers makes it quite likely that they can be catalysts for the sale of domestic capital goods in projects unrelated to the one for which they have been contracted.

A similar role, this time in the areas of marketing, transportation and legal arrangements, can be played by international trading companies. To begin with, they are frequently the initiators of the transaction, i.e. they bring potential buyers and sellers together. Again, there is no need to underline the value of this catalyst activity to small and medium-size national firms with scant knowledge of international market opportunities. To carry through the sale, however, requires detailed knowledge of legal matters (e.g. conditions governing the use of any patents or trademarks associated with parts of the plant), negotiation of the manifold dimensions of the project, organisation of transport of equipment and personnel, and perhaps mechanisms for continued contacts among interested parties after the contract is completed and the plant is functioning satisfactorily. International trading companies realise economies of scale with all these aspects of a turnkey arrangement and their services are indispensable to the effective initiation and operation of turnkey arrangements among smaller enterprises. For Korea, discussed below, "integrated trading companies account for over 80 per cent of recent turnkey plant exports."[1/]

A fundamental element of the market for turnkey sales is the availability of adequate risk coverage. It is well known that international tenders must be supported by letters of credit establishing the financial capacity of the supplier to carry out the operation for which he is tendering, and that, if the tender is successful, the supplier must provide a further credit guarantee when signing the contract. Both serve to cover the buyer in that he can be sure of the financial situation of the supplier - but it is the latter who must obtain these credits. Yet the seller himself is exposed to risks including:

1/ Rhee and Westphal, op.cit., p. 13. The significance of these firms may be seen from the following report: "On February 11, the Ministry of Commerce and Industry named 13 exporters including Sam Sung Co. Ltd., as the general trading firms of this year.

Of the 13 trading firms, two companies - Hyundai Corporation and Yulsah Industries Co. Ltd. - were newcomers, while 11 others were redesignated. In order to be designated as a general trading firm, a company has to meet the conditions, among others, of exporting the equivalent of at least 2 per cent of the nation's total merchandise exports, maintaining at least 20 overseas offices, and exporting at least five items worth $ 1 million each. General trading firms are given a variety of advantages including easy access to export finance and the retainment of foreign exchange to a certain level by their overseas offices.

The 13 general trading firms have 313 overseas offices accounting for 23 per cent of all traders' overseas offices. And the exports by these firms during 1977 reached $ 3,255 million or 31.1 per cent of the total. These general trading firms plan to export $ 5,406 million worth of goods this year or 43 per cent of the overall $ 12.5 billion target set for this year.

The designated general trading firms are as follows: Sam Sung Co. Ltd., Daewoo Ind. Ltd., ICC Corp., Bando Sangsa Co., Sunkyong Ltd., Samwha Co., Kumho + Co., Hyundai Corp., Hyosung Corp., Ssangyong Trading Co., Hanil Synthetic Fiber Ind. Co., Yulsan Ind. Co. Ltd. and Korea Trading International Inc."

Export-Import Bank of Korea, Quarterly Bulletin, March 1978, p. 7.

(a) any failures by firms to whom he subcontracts to meet their obligations;

(b) delays in payment by the buyer;

(c) political risks, arising from governmental measures in the buyer country which might interfere with payments arrangements.

In a well-functioning market it would be possible to insure against these eventualities; but in most DCs this is not easy to do in practice. A major help to exporters would therefore be the establishment of state assistance schemes, which would thereby recognise the need to give sufficient export incentives to sales of technology as well as sales of manufactured goods.

In Argentina, it seems, recent legislation has failed to provide adequate encouragement along the lines just described. Two sets of problems can be detected. On the one hand, administrative actions fail to capture the essentially inter-related nature of exports of industrial plants, exports of engineering services and other related skills, and exports of capital goods. To stimulate the first will have positive linkage effects on exports of the other two; conversely, each time a domestic enterprise fails to obtain a contract, or even to tender, because of inadequate backup on the risk dimensions, so it is quite likely that exports of engineering services and capital goods will also be foregone. On the other hand, any useful measures should embrace both an acceptable definition of which activities qualify for support and sufficiently strong instruments of support, i.e. the ones which really make a difference to the functioning of the market. Thus far, as Katz and Ablin show, the financial reimbursements (in effect, tax refunds) and lines of credit offered are inadequate.

Limited information is available concerning proprietary rights in technological discoveries among countries of the Latin American region. One index on this matter is patent applications among countries of the region, though of course it is only a rough indicator given that there is no guarantee that the patents are actually used for domestic production in the filing country, there is no information on the likely value of the patent, and we also do not know whether the enterprise filing the patent is genuinely an Argentinian firm or is simply a TNC affiliate. Subject to these caveats, 1973 data show that of 11,853 patent applications filed in Latin American countries excluding Argentina, only 93 of these were filed by enterprises based in Argentina i.e. less than 1% of the total filings.[1/] For proprietary technology, then, rather little is used elsewhere in the continent.

1/ See UNCTAD' Industrial Property in Latin America and its Role in Development and Economic Integration, TD/B/C.6/16, tables 1 and 2.

2.2 India

An emphasis on "inward-looking" industrialisation has played a part in propelling the country to becoming the world's tenth largest industrial producer. Three aspects of Indian industrialisation policy have been central to the accumulation of stocks of technology and technical expertise. First, sustained application of tariff barriers on final imports have stimulated tariff-jumping production by TNCs. Second, pressure on foreign investors producing for the local market to employ local equity and personnel have made TNC operations resemble joint venutres rather than stay as wholly-owned subsidiaries. This local participation has had spinoffs in the R+D area, among other aspects of corporate activity. It is not unreasonable to suggest that in terms of the acquisition of skills and know-how, India has been able to derive great benefits from TNCs relative to those obtained by other DCs. Third, active participation by the state in defence and civilian R+D and by state-owned enterprises in technology-intensive productive activity have enabled otherwise private learning costs to be absorbed substantially by the public sector. State support for public sector enterprises attempting to assimilate or replicate advanced technologies has not been unequivocal or free from inconsistencies or reversals.[1/] However, even the skeptical observer would agree that the stocks would not have existed had private entities been left to carry the burden. Table 8 summarises data on exports of engineering goods from India. The figures are derived from data in current Rupee terms, which overstate the growth rates due to fluctuations in the exchange rate and (more important) inflationary trends in the domestic and international economies, during the period 1972-1975. We have compensated for the former by converting rupee figures at current dollar exchange rates, but it is impossible to compensate for the latter in the absence of an appropriate price index for this sector.

Table 2 (2): Exports of engineering goods from India

F/Yr.	Current Values Rs. ('000,000)	% Change	$ 1 = Rs.	$ (mill.)	% Change	% Share of Total Exports
70/71	1,166.3	-	7.50	155.51	-	7.5
71/72	1,252.7	7.20	7.45	168.15	8.12	7.8
72/73	1,410.8	12.60	7.73	182.51	8.53	7.2
73/74	2,012.9	14.30	7.86	256.09	40.31	8.0
74/75	3,528.0	75.27	7.98	422.11	72.63	10.2

Source: Nayyar, D., India's Export Performance in the 1970s, Economic and Political Weekly, May 15, 1976.

1/ Economic and Political Weekly has carried many articles on this subject. As examples see B.M., Vendetta against Indigenous Technology, April 5, 1975, and Subrahmanian, K.K., Approach to Foreign Collaboration, April 8, 1978.

Engineering exports for F/year 1977-78 are estimated by one source to have reached $ 781.25 million and the same source expects the figure to cross the $ 1,000 million mark by the turn of this decade.[1/]

The sharp rise after 1973/74 may have been caused by three factors. First, a slump in domestic demand stimulated enterprises to mount a greater export drive. Second, the re-distribution of international income flows to OPEC countries increased their demand for technology-intensive products. As a consequence, there has been a recomposition in Indian exports towards the Middle East. As shown in table 2 (4) between 1970/71 and 1974/75 India's engineering exports increased their share of total trade with the Middle East by 10%. Third, the demands generated by the newly-emerging Bangladesh economy were directed towards Indian producers by public (tied aid) and private efforts. The latter two are of direct importance to the present context since they indicate greater South/South flows. The indications from this trend are that in the Middle East market, especially, Indian exports are becoming increasingly competitive with equivalent output from other countries, including the industrialised countries.

An indication of the range and sophistication of technological exports can be derived from a recent paper by Wadhva and Kulkarni.[2/] The authors conducted a questionnaire survey of 221 corporations broken down as follows:

"giant" private sector companies:	101
"mini-giant" private sector companies:	100
large public sector enterprises:	21

The objective was to ascertain the composition of exports and export plans of these companies in the light of their past performance. Fiftyfive companies responded to the (mailed) questionnaire and of these respondents, only 36 were exporters or had export plans. Thus these 36 companies formed the effective sample. Fifteen of them were manufacturers and exporters of engineering goods. In addition, two trading companies participated in the export of engineering goods. Although the latter are affiliates of non-Indian trading houses, their importance lies in the fact that they export items manufactured in India.

1/ Figures appearing in an advertisement entitled "Indian Engineering At Home, Around the World", issued by the Engineering Export Promotion Council and placed in the Financial Times Supplement on Indian Industry, op.cit. To substantiate its title, the article says: "Indian engineering has today emerged as a major task force the world over. From being an importer of engineering goods in the 1960s, India has become, in less than a decade, one of the largest exporters of engineering products to international markets. Today, a wide range of engineering equipment and accessories leave our shores for highly developed countries like the USA, Canada and others in the East European and Far Eastern regions - ample proof of our international quality standards. ... Turnkey projects have become another area of specialisation for Indian technologists today. Developing countries in the Middle East, South East Asia, Africa and South America have reaped the benefits of a total range of technical consultancy services from India. From feasibility studies, preliminary surveys and project reports to planning, designing, erection and commissioning. For steel, sugar, cement and paper complexes and in other areas like port and civic development."

2/ Wadhva, C.D. and Kulkarni, G.R., Exports and Future Export Plans of Large Indian Companies, 1970-75, Economic and Political Weekly, Review of Management, May 1977.

Table 2 (3): Comparison of India's engineering exports to the Middle East 1971/72 and 1974/75

Year	Engineering Exports (Rs.million)	As a % of total M.E. exports	M.E. engineering exports as a percentage of world engineering exports	M.E. total exports as a percentage of total world exports
1970/71	253.5	21.73	41.78	4.0
1974/75	1,100.7	31.20	42.94	7.6

Source: Derived from Nayyar, op.cit.

The term "engineering goods" covers 48 items, ranging from steel materials and transmission towers to flashlights and components.

The sample of 36 companies may be a random one. We do not know how these companies rank in relation to the rest of Indian manufacturers and other business units. Thus aggregative analysis is severely constrained by the absence of an appropriate reference background against which to judge the companies. Within the sample, 29 companies registered average export growth rates which were equal to or greater than 10% (table 2 (4)). In this subset, 10 companies were exporters and/or manufacturers of engineering goods.

A cross comparison of total values of the exports of the ten companies (table 2 (5)) with the total values of engineering exports supplied by the Nayyar paper (table 2 (2)) indicates a moderate level of concentration among Indian engineering goods exporters. The export market share of these companies ranges from 8.5% to 13.75%. This calculation is very rough since, in making the comparison, we have assumed that the accounting years of the companies are identical to the fiscal year; further, there has been no downward adjustment of table 2 (5) figures to compensate for the Union Carbide items (v) to (viii) which are not engineering goods. The relevance of this computation rests on the (safe) assumption that these firms are relatively large in the Indian engineering industry.

Table 2 (4): Average annual growth rates of engineering exporters in India

Company	% Annual Growth of Exports				Average Annual Growth Rate
	1971/72	1972/73	1973/74	1974/75	1971/72 to 1974/75
Bharat Heavy Electricals	31.7	51.02	127.10	6.47	53.97
Hindustan Brown-Boveri		-28.95	577.76	212.12	253.64
India Aluminum Corporation	-76.76	-56.03	376.31	66.81	77.61
Lakshmi Machine Works	-21.97	19.00	460.68	179.52	164.31
Larsen and Toubro	-49.09	377.83	109.27	-0.09	109.48
Lucas TVS	-56.06	73.86	70.60	126.92	53.83
Metal Box of India	24.07	-10.45	18.33	63.38	23.83
Shri Ambica Mills	38.95	9.06	22.48	59.96	32.61
Union Carbide	28.44	10.74	38.79	162.07	60.01
Voltas	55.56	30.95	160.00	52.45	74.74
	Unweighted average of firms:				90.40

Source: Derived from sample of 29 Indian companies with an average annual growth rate higher than 10 per cent.

Table 2 (5): Commodity composition of exports of responding companies

(Rs. '000,000)

Company	Products	1970-71		1971-72		1972-73		1973-74		1974-75	
		Value	Per Cent	Value	Per Cent	Value	Per Cent	Value	Per Cent	Value	Per Cent
Bharat Heavy Electricals	Transformers					11.63	8.37	17.10	5.42	69.39	20.66
	Switchgear	1.89	2.70	10.02	10.89	6.99	5.03	4.50	1.43	13.20	3.93
	Motors + controls			4.77	5.19	7.47	5.38	14.12	4.48	3.41	1.02
	Boiler components	65.97	94.15	76.59	83.27	15.92	75.60	278.94	88.42	249.28	74.21
	Valves	1.41	2.01								
	Capacitors	0.35	0.50					0.19	0.06		
	Heat exchangers					7.30	5.62				
	Miscellaneous	0.45	0.64	0.60	0.65			0.62	0.20	0.61	0.18
	TOTAL	70.07		91.98		49.31		315.47		335.89	
Heavy Engineering Corporation, Hindustan Brown Boveri	Machine ped plates									68.00	100.00
	Switchgear products					11.04	89.61	45.72	54.75	95.64	36.70
	Electric furnaces			18.97	69.39			0.01	0.02	1.16	0.48
	Electric motors			8.37	30.61	1.28	10.39	4.80	5.75	12.19	4.68
	Powerline carrier equipment							32.97	39.48	151.53	58.14
	TOTAL			27.34		12.32		83.50		328.52	
Siemens India	Electric motors	6	5.66	4	2.25	16	8.84	24	8.79	16	2.84
	Switchgear/boards	21	19.81	4	2.25	14	7.73	33	12.08	37	6.58
	Transformers					2	1.10	1	0 37	4	0.71
	Cables/wires	72	67.92	167	93.82	139	76.79	171	62.64	400	71.17
	X-ray					1	0.55	29	10.62	32	5.69
	Others	7	6.60	3	1.68	9	4.97	14	5.13	73	12.98
	TOTAL	106		178		181		272	562		
Tata Iron and Steel	Steel materials	5.98	100.00	3.19	100.00	1.92	100.00	0.67	33.30	0.42	27.45
	Other materials (ferro-manganese, sil manganese, chrome, ore, botton plate srap, agrico-tools, flanges + trans-mission line lowers)							1.33	66.67	1.11	72.55
	TOTAL	5.98		3.19		1.92		2.00		1.53	

Table 2 (5) continued

Company	Products	1970-71 Value	1970-71 Per Cent	1971-72 Value	1971-72 Per Cent	1972-73 Value	1972-73 Per Cent	1973-74 Value	1973-74 Per Cent	1974-75 Value	1974-75 Per Cent
Union Carbide[a/]	Dry batteries, battery raw materials, components, flash-light components, cinema arcs carbons, photo-engraver plates, plastics/chemicals, marine products, pesticides	115.57	100.00	148.93	100.00	164.80	100.00	228.70	100.00	304.09	100.00
	TOTAL	115.57		148.93		164.80		228.70		304.09	
Voltas	Engineering products, incl. turnkey projects	24.31	90.30	15.18	36.10	51.91	94.31	71.96	50.49	176.42	80.91
	Crude and ground barytes	2.61	9.70					70.56	49.51	41.63	19.09
	Consumer products			26.86	63.90	3.13	5.69				
	TOTAL	26.92		42.04		55.04		142.52		218.05	
Metal Box Company[b/]	Tinplate containers	11	20.37	13	19.40	8	13.30	15	21.13	16	13.79
	Aluminium tubes	11	20.37	9	13.45	21	35.00	24	33.80	23	19.83
	Caps + closures	13	24.07	12	17.91	10	16.66	7	9.86	12	10.34
	Paper + plastic products	1	1.85	1	1.49	1	1.66	4	5.63	5	4.31
	Machinery	8	14.81	21	31.34	14	23.33	10	14.08	46	39.65
	Other products	10	18.52	11	16.42	6	10.00	11	15.49	8	6.90
	Products of other manuf.									6	5.17
	TOTAL	54		67		60		71		116	
Lakshmi Machine Works	Textile machinery	30.22	100.00	23.58	100.00	28.06	100.00	162.94	100.00	455.45	100.00
	TOTAL	30.22		23.58		28.06		162.94		455.45	

a/ Not disaggregated. Bias upward in totals.

b/ TNC affiliate.

Table 2 (5) continued

Company	Products	1970-71 Value	1970-71 Per Cent	1971-72 Value	1971-72 Per Cent	1972-73 Value	1972-73 Per Cent	1973-74 Value	1973-74 Per Cent	1974-75 Value	1974-75 Per Cent
Larsen and Toubro	Petrolpumps	18.79	33.81	0.25	0.91	71.88	73.75	39.16	19.28	22.46	11.11
	Garage equipment	18.09	32.62	0.09	-	6.80	6.98	64.97	31.99	46.51	23.00
	Switchgear	1.92	3.46	2.65	9.62	6.99	7.17	37.60	18.51	102.49	50.69
	Welding electrodes	1.98	3.57	1.81	5.84	2.95	3.03	1.42	0.70	5.84	2.89
	Drills + drilling equipment	0.71	1.28	15.38	55.81	-	-	1.42	0.70	0.54	2.67
	Bottle closures	4.99	9.00	7.02	2.55	6.78	6.96	8.38	4.13	13.17	6.51
	Sugar diffusers							48.67	23.96	8.57	3.25
	Storagetanks									0.71	0.35
	Moulding machines	3.78	6.82							0.88	0.44
	Tools					1.07	1.10	1.50	0.74		
	Johnston pumps					0.27	0.28				
	Rollcharts	0.17	0.31	0.24	0.87	0.65	0.67				
	Emilite units					0.08	...				
	Emergency light units			0.12	0.44						
	Dairy equipment	0.04	...								
	Cement machinery	5.02	9.06								
Lucas TVs	Automobile electrical equipment	25.51	100.00	11.21	100.00	19.49	100.00	33.25	100.00	75.45	100.00
	TOTAL	80.96		38.77		116.96		236.37		1176.62	
Macnell + Magor[a/]	JPI tubes + castings					107.56	5.96	138.20	7.54	251.52	16.43
	FMG reduction gears					0.02	...	0 08	...	0.35	0.02
	Materials handling equipment					0.01	...	0.47	0.03		
	Elec engg. starters + switchgears					0.51	0.03	1.09	0.06	2.30	0.15
	Reprographic drwg. office equipment					0.52	0.03	0.17	...	0.27	0.02
	Tarpenlins					0.64	0.04	2.66	0.15	1.25	0.08
	Chem engg. equipment					0.58	0.03	0.25	0.01		
	Flow control valves					4.25	0.24	18.33	1.00	24.20	1.58
	Precision diamond tools					8.79	0.49	1.42	0.08	2.38	0.16

a/ Trading House.

Table 2 (5) continued

Company	Products	1970-71 Value	1970-71 Per Cent	1971-72 Value	1971-72 Per Cent	1972-73 Value	1972-73 Per Cent	1973-74 Value	1973-74 Per Cent	1974-75 Value	1974-75 Per Cent
Macnell + Magor	Graded castings Polywood products					13.61	0.75	21.80	1.19	24.00	1.57
	Tea machinery + spares, chems, etc.					4.93	0.27	12.45	0.68	0.43	0.03
	TOTAL					141.52		196.74		306.70	
Kaman/Engg. Corps.	Transmission line + substation structure	349	37.69	218	29.50	386	45.63	389	31.99	443	55.51
	Phase and ground conductor, insulators + access.	469	50.65	398	53.85	362	42.79	589	48.44	230.	28.82
	Construction for turnkey projects in Sudan, Libya, Thailand + Iran	108	11.67	123	16.64	98	11.58	242	19.90	117	14.66
	TOTAL	926		739		846		1220		790	
	GRAND TOTAL OF FIRMS	1415.72		1469.93		1656.94		2768.30		4594.05	
	Approx. % of total engineering exports	12		8.5		11.7		13.75		13.02	

With regard to turnkey exports Lall has noted that "Indian exports of plant in relatively simple industries like textiles, sugar processing and cement have been common for some time now. Recent years have, however, witnessed the export of complete plants in sophisticated activities like large-scale electrical generation: complete automatic telephone exchanges; electrical transmission equipment: pharmaceutical plants; fertilizer plants; oil transmission, blending and electronic control systems: steel plants (some of these were subcontracted to India by Russia); machine tool factories; assembly of light two-wheelers; and several other types of manufacturing plant. Both public and private sector firms are active, but the former seem to predominate in the 'heavy' end of the business."1/

As the discussion on Argentina showed, the export of turnkey plants is closely linked to growth in, and international projection of, domestic consultant engineering. In his study, Lall drew attention to this: "Consultancy firms from India active abroad include large private companies like Dastur and Co. (exporting consultancy for iron and steel to several developing and industrialised countries), Dalals (chemical technology), Industrial Development Consultants (general consulting), and Tata Consulting Engineers (thermal power technology), as well as several public sector consulting and manufacturing enterprises: HMT in machine tools; ITI in telecommunications; National Industrial Development Corporation, NIDC, in chemicals, diesel engine plants, machine tools, pumps, food processing, mining machinery, textiles, paper and industrial planning and forecasting, selling to developed as well as developing countries; Engineers India Ltd., EIL, in fertilizer, petroleum and chemical industries, singly and in collaboration with TNCs (like Kellogg of the US and Progetti of Italy) from developed countries; Rail India Technical and Economic Services Limited, RITES, in railway technology; Metallurgical and Engineering Consultants Ltd., MECON, in metallurgical technology, which is providing services to several foreign enterprises, including Altos Hornos de Mexico, itself a technology exporter. Apart from manufacturing, Indian consulting firms are also exporting services in hotel management, civil works, construction of dams, townships and airports, and in feasibility studies and project designs of all sorts."2/

In a private communication to us, EIL notes that it has adopted a four-pronged approach to securing overseas business. First, co-operating with international contracting organisations either by making joint bids or through seeking sub-contracts from such organisations. Second, associating with other Indian organisations in the public and private sectors with a view to making joint bids abroad. Third, nominating experts through technical service agreements entered into with various organisations. Fourth, seeking assignments as a consultant to foreign project execution authorities. Thus far, the bulk of EIL's supply of services has been in the first of these categories, and within that has veered towards seeking subcontracts rather than joint bidding. The subcontract approach has functioned through EIL supplying its quotations for specific portions of the work to

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1/ Lall, S., Third World Technology Transfer... , op.cit., p. 5.

2/ Ibid, pp. 7-8.

foreign contractors when they bid as well as seeking a portion of contracts already awarded. In either case, EIL's lower engineering costs are its strong point. More generally, a regular arrangement is maintained with several international contracting companies for the purpose of obtaining subcontracts from them - it also appears that an understanding exists with certain foreign companies for jointly exploring business in third countries. Obviously, the last of the four categories listed is the one which requires the maximum scope and depth of input by EIL and apparently it is now beginning to turn its attention more in this direction.

The pattern of Indian development in this area is one heavily influenced by assimilation of foreign technology, perhaps some modification, and an export drive subsequent to the establishment of manufacturing expertise. Their link is reflected in the fact that in the W. and K. sample, 19 companies out of the 35 manufacturer-exporters had foreign (presumably OECD) collaboration. The authors do not mention how many of the engineering exporters have foreign collaboration, and what form this collaboration takes place. However, "six companies (including public and private sector companies) have admitted that their foreign collaboration agreements restrict the scope of their exports wholly or partially."1/ Again, no further details are given, so we cannot find out much about whether this restriction imposed by foreign participation applies to the engineering goods exporters and/or how it influences them. There seems a clear intention on the part of all the companies to increase their export markets, but the problem of realisation of these plans, via well-defined marketing strategies, is either not perceived or not attacked systematically. If one were to attach weight to the W. and K. questionnaire's findings, we would conclude that the major impediment all exporters found to their growth prospects was either inadequate fiscal incentives to exporters, or the absence of market information. Thus they perceived the state as either neglecting their interests or acting at cross-purposes to them.

India is engaged, through private and public institutions, in the training of personnel in other DCs. "One of two training centres in Singapore is run by Tata's, a private enterprise. The government-owned Central Machine Tools has helped to set up a metal working research institute in Iran as well as providing training facilities for Iranian engineers in India. The National Industrial Development Corporation is setting up industrial estates in Guyana; it is equipping a Technical Training Institute in Malaysia, and it has helped Iran to set up Technolog, an engineering consulting enterprise. Hindustan Machine Tools is establishing an advanced training centre in Iraq and planning an industrial estate to service a machine tool factory in Iran. Besides this, there is a constant exchange of personnel between enterprises and technology institutions of India and other developing countries."2/

1/ Wadhva and Kulkarni, op.cit., p. M.55.

2/ Lall, S., Third World Technology Transfer ..., op.cit., p. 13.

The foregoing suggests that, even if progress differs significantly among sectors and among types of technology export, India is now well into the field. It is at present ahead of several of the smaller OECD countries and its large industrial base, long experience, plentiful supply of skilled manpower and considerable investments in scientific endeavours (notwithstanding the many deficiencies associated with these investments) suggest that it is likely, during the next decade, to become a major exporter of technology in global terms. All this does not mean, of course, that there is no scope for policies which can further encourage this progress; they are taken up later in this paper.

2.3 Taiwan

In their study referred to earlier, Rhee and Westphal's note that local production by foreign firms, whether for local sale or exports, is of relatively little weight in the economy (save for electronics) so that the observed expansion of mechanical engineering exports is already one indicator that domestic firms have mastered conventional production technology. Between 1965 and 1975 the share of such exports in total exports rose from 6.4% to 10.9% and this at a time when the aggregate was itself growing extremely quickly (23.7% per annum from 1960-1970 and 16.2% from 1970-1976).[1/]

More directly, data for 1976 presented in table 2 (6) show that 58 turnkey projects were exported in that year for a total value of $ 16 million. All the exports were to other DCs except for a single project in Japan; nearly all of them were within the South-east Asian region though there were three in Africa and one to Latin America. In their survey, Rhee and Westphal draw attention to some characteristics of these exports and the context in which they take place which are worth summarising:

(i) Practically all exports are of small plants - of the 58 projects only three were for a value in excess of $ 1 million.

(ii) Interviews showed that "the technology embodied in the exports had most often been acquired through licensing agreements with Japanese and European firms, though in many cases there was no longer active technical co-operation."[2/]

(iii) Exporting firms had received very little help from the government. The exports were at the initiative of the firms themselves, i.e., they had to seek out markets and promote themselves. In addition, and more seriously, the financing arrangements for sales were gravely deficient. "In only some cases were the interviewed exporters able to finance their exports through credit given to the purchaser under a government-sponsored programme of medium term export credits. Moreover, the exporters themselves typically had to guarantee repayment when securing financing for the purchaser. These firms indicated that it was expensive to obtain the credit information needed to make guarantee decisions, and that they faced a modest degree of risk of delayed payment or default. One of the firms visited faced the imminent prospect of default on the sale of a plant to Indonesia."[3/]

1/ Rhee and Westphal, op.cit., data from p. 5.

2/ Ibid, p. 10.

3/ Ibid.

(iv) The current exports make little use of subcontracting and also embody technologies which have not been significantly adopted or upgraded in relation to the original Taiwanese imports from ICs.

(v) Most of the marketing is done through contacts with overseas Chinese (31 of the 58 projects were in Indonesia, Malaysia and Hong Kong where the Chinese business communities are strong).

These findings suggest that, for turnkey sales, the Taiwanese enterprises are cost-competitive but that substantial shifts both in government and enterprise policy will be required if the exports are to expand substantially.

Table 2 (6): Taiwan: Turnkey plant exports in 1976

Type of Industry	no. of sets	Destination	Value US $ '000
Sugar Refining	1	Liberia	5,400
Cement	1	Hong Kong	1,250
Paper	7	Indonesia	3,081
	3	Malaysia	786
	1	Thailand	395
Wire and Chain	2	Indonesia	150
	3	Malaysia	350
	2	Thailand	300
Can Manufacture	1	Japan	213
	2	Indonesia	364
	3	Thailand	468
	1	Ivory Coast	151
Soap	2	Indonesia	221
Rolling Mill	1	Nigeria	820
Salt Refining	1	Thailand	110
	1	Indonesia	121
Plastic Injection Molding	3	Thailand	213
	3	Indonesia	146
	1	Philippines	113
	1	Malaysia	112
PE Woven Bag	1	Thailand	80
	1	Philippines	78
Water Treatment Plant	4	Indonesia	80
	3	Philippines	42
Non-Woven Fabric	1	Philippines	68
Dry Battery	1	Paraguay	87
	1	Philippines	68
Air-Pollution Control Equipment	1	Thailand	15
	1	Indonesia	14
Galvanized Sheet	1	Indonesia	167
Steel Pipe	1	Malaysia	209
	2	Philippines	451
TOTAL	58		16,257

Source: Rhee and Westphal, op.cit., table 2.

?.4 Republic of Korea

As with Taiwan, exports of metal products and machinery from Korea have risen substantially in recent years, with their share of total non-food manufactured exports increasing from 5.5% to 9.2% over the decade 1965-1975 at the same time as total exports were rising at a growth rate of 35.7% per annum during the 1960s and of 31.7% per annum from 1970-1976.[1/] Some evidence indicates that Korea is strengthening its position relative to that of Taiwan in most of these items.

Thus far the numbers of turnkey plant exports are much smaller than in Taiwan, but their average value is considerably larger and it seems as if a huge increase in numbers will also soon be registered (see table 2 (7)). "As of mid-1978, Korean firms had been awarded 13 additional plant export contracts worth US $ 434.4 million in total value, and were in the process of negotiating contracts worth between US $ 5 and 9 billion, with an average contract value well in excess of US $ 100 million."[2/] A glance at the main features of Korea's exports reveals some notable differences as compared to the Taiwanese situation:

(i) The exporting enterprises are the giants of Korean industry and include some of the famous integrated trading companies.

(ii) Local know-how is an integral part of these exports, though in the larger projects it is mixed with foreign suppliers through subcontracting or joint ventures.

(iii) Construction works, where Korean success is legendary, have provided a basis for some of the turnkey sales, above all the huge $ 235 million project for a cement plant in Saudi Arabia. It appears that the Korean command of this field is complete. Thus construction know-how "necessarily includes the ability to organise and manage a construction undertaking as well as the skills of construction engineers, technicians, and workers. These aspects of modern construction technology were learned by Korean firms through their involvement in US military construction projects in Korea and in various Southeast Asian countries (most importantly Vietnam), which predates their venture into the Middle East. But it equally appears that Korean construction firms have a technological advantage that permits them to complete a project in far less than the time considered to be normal or average (precise information is lacking, but anecdotes abound). Moreover, 'marketing' is done by the Korean firms, acting without foreign agents. This is one area where Korean know-how relating to transactions is second to none."[3/]

(iv) Government support seems to have been substantial, both through the general encouragement offered to large enterprises and the decentralisation of export incentives and export marketing.

1/ World Bank Development Report, August 1978, Annex table 6.

2/ Rhee and Westphal, op.cit., pp. 11 and 13.

3/ Ibid, p. 17.

Table 2 (7): Korea's turnkey plant exports as of the end of 1977

Exporting Company	Year of Completion	Industry, Product or Process Classification	Contract Value ($ '000)	Receiving Country	Type of Company Exporting
Sung-Lee Machinery	1973	Synthetic and silk textile weaving mill	1,000	Afghanistan	Leading textile machinery producer
Seoul Miwon	1973	Glutamine-soda factory	3,800	Indonesia	Leading food-processing company
Korea Engineering	1976	Synthetic resin plant	6,000	Saudi Arabia	Engineering consulting company
Hanil Cement	1976	Rolling mill	1,580	Indonesia	Leading cement manufacturer
Dae-Han Heavy Machinery	1977	Watergate of hydraulic power plant	1,200	Taiwan	Leading engineering company
Yoohan-Kimbery	1977	Paper plant	1,000	Columbia	Leading paper products manufacturer
	TOTAL completed	6 plants	14,580		
Hankook-Inshuro	Construction in progress at end of 1977	Glass fibre plant	650	Saudi Arabia	Subsidiary of glass fibre company
Daewoo	"	Polyprophylene plant	490	Kenya	Integrated trading company
Daewoo	"	Tire factory	60,000	Sudan	Integrated trading company
Daewoo	"	Galvanised sheet plant	1,000	Sudan	Integrated trading company
Hyun Dai	"	Cement	235,000	Saudi Arabia	Integrated trading company
Won-Hyo	"	Roofing nail plant	1,030	Nigeria	Engineering company
Sun-Kyung	"	Pipe fitting plant	450	Kenya	Integrated trading company
Whasin Industrial	"	Zinc smeltery	72,000	Thailand	Leading engineering company
Kang-won Industrial	"	Turbine plant	2,000	Sweden	Leading engineering company
Yoohan-Kimbery	"	Paper plant	1,500	El Salvador	Leading paper products manufacturer
	TOTAL in progress	10 plants	374,040		
	AGGREGATE	16 plants	388,620		

Source: Chung-Ang Daily Newspaper, February 24, 1978, as reproduced in Rhee and Westphal, op.cit., table 3.

The build-up of domestic technologies' skills as a basis for exports has now spread to the armaments industry, as demonstrated by a recent report in The Economist. "By 1983 South Korea could be among the big exporters of home-made military weapons, especially tanks and missiles. Until recently, virtually all the country's arms were made under license from American companies, or imported from the United States and modified. Seoul needed the approval of Washington before exporting (or re-exporting modified) arms. But as South Korea soaks up American know-how and puts together possible imitations, it plans progressively to scrap the licensing agreements.

"Last spring an upgraded version of the American M-48 tank was unveiled in South Korea. Foreign buyers have shown great interest, but President Park has not yet sought Washington's permission to export it. One reason may be that a home-grown 40-ton tank is on the drawing board and could be in production by the early 1980s.

Before then, South Korea will be selling abroad its long-range missiles, medium-range surface-to-surface guided missiles and a truck-mounted multi-tube rocket launcher. These projects no doubt benefited from know-how gained under licence from the American Nike-Hercules, Hawk and Honest John missiles (as well as the French Exocet). But they are proof that South Korea can now build sophisticated weaponry from scratch. ...

Washington recently gave Seoul permission to export 81 mm mortars. South Korea has also begun exports of M-16 rifles (this time without a formal nod from Washington). Since 1970 the M-16 had been built under licence from Colt Industries of America. Seoul says that enough changes have been made to the original M-16 to call it home-made - so it is no longer subject to the licence restrictions on exports. ...

South Korea is already exporting a modified American high-speed patrol boat (again without formal consent from Washington). Several have been sold to the Indonesian navy. So far, America has turned a blind eye to these technical infringements. ...

America seems less willing to give South Korea's military aircraft business a helping hand. Licence agreements here are limited to Hughes Aircraft's 500-MD helicopter, of which South Korea builds 50 a year. American diplomats have indicated that Washington may smile on requests for licensed production of the F-5 fighter plane but draw the line at weapons which might be 'destabilising' i.e. high-performance aircraft like the F-15 fighter. Or, of course, nuclear weapons."1/

The preceding remarks show that Korea is exporting technology embodied in skill-intensive manufactured goods of various kinds and provides a significant and rapidly growing export of turnkey plants. The sale of technical services now appears to be starting although information is still scant.

"In one case, a leading Korean synthetic fibre producer is negotiating licensing the use of its technology for nylon tire-cord production to two companies in Thailand and one in Taiwan. The know-how that would be exported has been learned, and perhaps slightly modified, from Japan and the US over the past ten years. In turn, a Korean public corporation active in rural development has for some time exported technical services, with past exports to Vietnam, Nepal, Bangladesh and Indonesia. It is currently considering further exports to Iran, Saudi Arabia, Sudan and Nigeria. In many cases the know-how being exported concerns irrigation; in others, rural programme management. Finally, Korean firms in developed countries. For example, a Korean engineering firm was reported to be negotiating a joint venture with a leading US engineering consulting firm in order to participate in the construction of Nigeria's new capital city."2/

1/ The Economist, December 2, 1978, p. 85.

2/ Rhee and Westphal, op.cit., pp. 21-22.

The overall picture is, therefore, one of a country where the rapid growth of the manufacturing sector, based on an export-oriented economic policy in which power has been progressively concentrated on a small number of conglomerates actively supported by government and government institutions, has now led to the threshold of a major expansion of technology exports (in diverse forms) to accompany the spread of DFI. That expansion so far is focussed on other DCs and is likely to make the Republic of Korea into one of the most successful of the DCs in this field, if not the most successful. Whether that experience is replicable by other DCs is of course another matter.1/

1/ The following remarks are important in this context:

"Economic growth has largely been accompanied by stagnation, growing inequality and even absolute impoverishment in the rural areas. The exceptions to this trend are few and far between. They are believed to lie in a few socialist developing countries and in a few developing market economies which have combined very rapid growth rates with stability around a distribution of income that is more egalitarian than that of most other developing countries. The latter set of countries are exemplified by Japan, Taiwan and South Korea, sometimes referred to collectively as the 'East Asian' model of development.

The fascination that the East Asian model exerts for liberal development studies is easy to understand. They are seen as the vindication of the viability of the neo-classical route to development, that the free market can generate rapid growth without floundering in the impasse of growing inequality and mass poverty. Furthermore, given the natural propensity to believe that what is possible must be replicable, these models have been dissected to see 'what made them tick' in order what the secrets of success might be more widely diffused in the rest of the developing world.

The aim of this paper is to look at the South Korean experience from the perspective of the rural sector. Much of the previous work on South Korea has concentrated on the industrial sector and its extraordinary growth through a strategy oc concentrating on export-oriented, labour-intensive industries. Yet the rural sector offers several interesting issues for analysis. The available data seem to indicate that the performance of the rural sector has also been exceptional in comparison to the rest of the developing world. Output and productivity growth has been steady while there has been no trend of increasing inequality or landlessness, as has been the case elsewhere. This performance has occurred from a base of a thorough land reform between 1945 and 1957 and the resultant agrarian structure, being relatively egalitarian and homogeneous, has been a principle factor in explaining the widely diffused growth in the rural economy."

Lee, E., Egalitarian Peasant Farming and Rural Development: The Case of South Korea, International Labour Organisation, World Employment Programme Research, Working Paper 16, April 1978, pp. 1 and 2.

CHAPTER 3: PROPOSALS FOR INTERNATIONAL CO-OPERATION

3.1 Technology Imports, Technology Policy and Technological Progress

The preceding discussion has shown that in most cases exports of technology have complemented exports of manufactured goods in the more industrialised developing countries. However, there is a sequence of relationships involved which can be sketched as follows:

(i) For consumer goods where technology is relatively simple, the observed pattern is of DFI among developing countries; in this sense the exports of technology contained in the investment package substitute for exports of manufactured goods.

(ii) Improvement of technology, however, may lead in a more advanced stage to promotion of the sales of producer goods. In other words, suppliers of turnkey projects may very well buy their capital goods from home country producers.

(iii) Where, in the most advanced cases, a developing country generated the capacity to supply technical expertise on a broad scale, the relation between technology and exports of capital goods may become very weak or even negative. Put another way, if the supplier of technology decides to source his purchases of capital goods on an international basis, this may well displace existing exports from his country of the same products.

The idea of a sequence is fundamental in understanding buth the process by which some developing countries have become exporters of capital and technology, as well as the reasons for international co-operation in this field.

The exports of technology so far observed from developing countries have, in almost all cases, originated from initial inputs of technology from the ICs. Policies towards technology inputs have varied substantially and there seems to be a strong relationship between the nature of those policies and the ability to export technology at a later stage. Thus we have:

(a) Countries where original imports of technology have taken place through DFI and where limited efforts only have been made to unpackage the investment-technology bundle.

(b) Countries where the imports have been primarily via licensing and other disembodied forms; in there cases the domestic enterprises have had much moser opportunity to internalise and increase their technological capability.

(c) Countries where imports have been fully disaggregated at the earliest possible stage in order to move the country rapidly into a phase where it has substantial technological independence.

The three phases represent progressively more profound policies of technological protection. The critical question for DCs is therefore: how to strike the best balance between initial inputs of technology from abroad and subsequent domestic development? The balance is affected by three main considerations:

(a) The nature of the foreign technology purchased.

(b) The conditions under which it is purchased, particularly

(i) The training of domestic staff provided under the import arrangement;

(ii) The permitted scope for domestic adaptation of the technology and the size and type of incentives to do so;

(iii) The opportunities to use and diffuse the adapted technology.

(c) The linkage impacts of the technology import both across industries and with regard to the kinds of technological activities undertaken.

These three conditions pertain, in turn, to the setting of a development strategy, the specific procedures used to obtain foreign assistance, and the structure of the domestic economy in which these policies are implemented. The inter-relationship of these three factors will become clearer as we proceed.

To understand the mechanisms at work, we must focus on the nature of technological change as it occurs in DCs. The process can be broken down into three phases:

3.1.1 Productivity Changes Within a Given Technology

These cover improvements on the shop floor due to repetition of tasks and amendment of products. (They embrace, in other words, the activities described by Arrow as "learning-by-doing".) Certain characteristics of these improvements can be identified. First, they are hardly likely to be affected (for good or bad) by the ownership of the firm or by other factors connected with the control of its operations. Second, they probably cannot be transferred to other enterprises very easily. Third, they may well reach physical or natural limits quite quickly. Fourth, they may or may not imply much directed activity, i.e. there may or may not be much need to make heavy investment specifically aimed at generating these productivity improvements.[1/] Fifth, it is most unlikely that they will have any direct implications for other entities in the economy either public or private.

1/ What is essential to note is that, even at this initial stage, a firm might have to make investments in learning and to begin formulating an explicit technological strategy. See Katz, J., Gulkowski, M., Rodrigues, M. and Goity, G., Productividad, Tecnología y Esfuerzos Locales de Investigación y Desarrollo. Monografía de Trabajo no. 13 del Programa BID/CEPAL sobre Investigaciones en Temas de Ciencia y Tecnología, Buenos Aires, Marzo de 1978.
See also Galea, A., The Effects of Learning by Doing on the Performance of a Clothing Firm in Malta, University of Malta, June 1978.

3.1.2 Design Efforts

These cover the ability to replicate or ameliorate a technology. To acquire the knowledge necessary for replication means that both trained people (e.g. design engineers) and capital goods production must be available in the economy. Hence the ability to replicate not only affects the skill profile at a factory but also may lead to the establishment of new factories specialising in the production of capital goods. The knowledge for amelioration may lead to fresh organisations not only within the innovating factory (e.g. establishment of an R + D department) but also to new groups supplying a whole industry. In terms of skills, the amelioration may require inputs from scientists - to sustain this over the longer term obviously means that the educational system will have to be adapted.[1/] Amelioration of the technology can include, of course, more intensive use of local raw materials as well as greater employment of domestic creative and technical skills. In this sense, the second phase places much heavier demands on the mobilisation, utilisation and organisation of domestic resources.

3.1.3 Construction Efforts

These cover the building of production plants and the building of products and processes. An economy possessing these capabilities will draw on a wider range of skills and activities than in the preceding phases. The former activity (production plants) is likely to require the growth of engineering consultancy services as well as to call upon marketing skills and the provision of financial support in ways hitherto unnecessary in the economy. The latter (new products and processes) may require investments in basic R + D which bring with them fresh institutional structures and quite possibly the development of new scientific and technological skills. A DC which has reached this phase in any sector or group of sectors can genuinely be described as autonomous in technology. To be autonomous does not necessarily mean that:

(i) the economy is at the world frontier for all branches of the industry; it may still be importing technology in various areas but at least it has the capacity to absorb and modify;

(ii) the economy is exporting technology - whether it does or does not do so depends on factors additional to technical and organisational prowess;

(iii) the economy is itself ready to take global leadership in any branch of the industry; whether or not this occurs is likewise a function of conditions going beyond the technological.

1/ This point is discussed in the Latin American context by Katz, J., Cambio Tecnológico, Desarrollo Económico y las Relaciones Intra y Extra Regionales de la America Latina, Monografía de Trabajo no. 30 del Programa BID/CEPAL sobre Investigaciones en Temas de Ciencia y Tecnología, Buenos Aires, Agosto de 1978, especially sub-section II.2, pp. 11-14.

Movement from phase (i) through to phase (iii) should not be treated as in any way a mechanistic, automatic or non-reversible shift. Qualitative changes are involved which pose significant choices that a country may or may not be prepared to take. Costs and risks are likely to rise, relatively and absolutely, when an economy attempts to strengthen its technological capabilities and attain autonomy; and the issues concerning who bears the costs and risks, and who reaps the benefits of successful investments are at root political. Certainly the accumulation of experience can serve to reduce some of the hazards, but it cannot eliminate them entirely. Other countries too will not be static, so even a carefully planned policy is no guarantee that the investments of time, money and creative effort will yield high rewards. Technological "forced marches" may give the impression that some of the phases we have described can be jumped through concentrating resources in time and space, yet the net results (assuming success) must be to create the capacity to raise productivity, design plant and equipment, and construct and innovate new products and processes. The matrix of productive activities in a technologically autonomous economy is, therefore, bound to be quite dense and to exhibit strong intersectoral linkages. The first of these features means the existence of sufficient production range to meet requirements at home; and the second is another way of saying that, to be effective, the new activities must be organically tied to the old. Where this is not so, the resources expended on them would be a drain on the economy rather than a fountain of creative endeavour.

3.2 Technology Exports by DCs and International Co-operation

What determines the possibilities for technological exports by DCs and the forms these might take? The possibilities for export depend on three conditions:

(i) Knowledge of market opportunities, on the part of DC buyers as well as sellers;

(ii) Possession of some edge which gives the DC seller a competitive advantage. This could be through supply of a technology not available from other sources, through the offer of similar services at lower cost, or because the supplier, the buyer or both are given preferential encouragement to deal with each other rather than third parties;

(iii) Availability of the requisite support facilities for international transactions in technology.

These facilities, in turn, are of three different sorts. First, appropriate legal procedures in buyer and seller countries which can allow intra-DC transactions to take place in ways and under terms not inferior to those at the disposal of DC exporters. Second, the active help of agents in financing, transport and product marketing. Third, domestic market structures such that potential technology suppliers can treat export opportunities as adding to their total sales range rather than being made to choose between expanding exports and maintaining domestic market shares.

The form that DC technology exports will take (i.e. through DFI, turnkey sales, provision of consultancy services, licensing, or training of local staff) will depend on:

(i) What the technology is that is being exported and the nature of the edge which the exporter believes he possesses;

(ii) The reason for the export, that is, what the buyer and seller are trying to achieve;

(iii) What the seller is.

There is no need to belabour the point that, through national policies, DC governments can promote technology export.[1/] But what would be the domain for multilateral action? What purpose would it seem to achieve? Which DCs would be interested and why? What mechanisms could it employ?

The evidence presented in this paper shows that, at present, DFI and technology exports are taking place through private enterprises and through the establishment of multinational enterprises where DC governments are the driving force. The least which international, and above all intra-DC, co-operation could aim for would be to improve the conditions for these private and public transactions. Yet it is possible to go further on both the technical and legal fronts. As long as DCs view their technological development as a matter for each country separately, their prospects for pooling resources will not be great. But there are three areas where resources could profitably be pooled. First, in some kinds of R + D where few, if any, DCs have yet entered the trading arena in a noticeable way. Second, in the

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1/ A fascinating example of what has been achieved by a small IC through energetic government policy is provided by New Zealand: "For more than 100 years New Zealand's vital export earnings have come mostly from its agricultural products, butter, cheese, lamb and wool, but now great efforts are being made to promote a new type of export-expertise.

An organisation called ENEX, formed exactly 10 years ago, has put millions of dollars onto New Zealand's overseas earnings by pooling the country's resources of skill and technical knowledge into a unique talent organisation.

It competes for contracts to design, plan and supervise any large-scale operation in Southeast Asia which calls for sophisticated expertise. Many are multi-million dollar operations and would be well beyond the resources of one individual company.

Electricity planning projects, fish storage operations, hydroelectric schemes, roads and bridges through difficult terrain, cement plants, flour and feed mills. All have been planned and designed by New Zealanders as a result of contracts won through ENEX.

It has a full-time staff continuously travelling through Asia seeking out opportunities where New Zealand can utilise its talent. Membership of ENEX includes consultants who investigate, design, plan and supervise a project, technicians who can provide technical advice, contractors who can built it, and manufacturers who can supply equipment.

ENEX gives smaller companies an opportunity to participate in overseas contracts and obtain experience working overseas which they would normally have no chance of getting. A variety of contracts have been carried out in 17 countries. These range from Korea and Thailand through Nepal, Malaysia, a number of Pacific Island countries to Afghanistan and Libya."

See "New Zealand Expertise Selling Well Abroad", Financial Times, 12 December 1978.

marketing of technology to ICs. Third, in monitoring the technological changes occurring in ICs.[1] From the legal perspective, in turn, three aspects of co-operation appear promising. First, harmonisation of legislation so as to encourage South/South trade in technology as a positive-sum game. Second, adoption of a common position aimed at augmenting the possibilities for exports of technology from DCs to ICs. Third, elaboration of a new institutional form which would extend beyond multinational corporations and become a Third World Corporation (TWC) whose function would be to meet certain of the technology requirements of all DCs. To see these options more clearly, let us look at the objectives of DC co-operation for each of the domains identified.

Where the purpose is to promote DFI and technology exports through private enterprise transactions, co-operative action should be directed at the following objectives: First, the dissemination of information on the availability, quality and price of DC technology, on the one hand, and on the interest and requirements of prospective buyers on the other. Second, elaboration of appropriate legal and institutional structures to ease the flow. A financing organisation aimed at supplying credits for buyers and sellers, and offering adequate insurance guarantees to cover DC tender bids in competition with ICs for turnkey contracts, is an essential part of the "appropriate institutional structures". While many of the legal changes should be directed at conditions governing DFI, the finance support is critical if the technology exports are to receive meaningful encouragement. Third, assistance in negotiation to ensure that DC technology deals do not replicate the unfavourable features observed in IC - DC sales and to seek maximum internalisation and diffusion of the technology in the recipient country.

To achieve these aims implies possession and use of technical knowledge, market structure knowledge, financing knowledge, and legal knowledge. Part of the co-operation would be achieved by performing catalytic cum brokerage functions, and part by establishing support activities. Evidently the help is best given through a multilateral agency, on a regional or multi-regional basis. Major initiatives along just these lines were taken at end-1978 in Latin America.[2]

1/ For a brief reference to this possibility, see UNCTAD, Technological Transformation of the Third World: Issues for Action in the 1980s, Document TT/9, April 1978.

2/ "The Instituto para la Integración de America Latina (INTAL), the Inter-American Development bank's economic integration agency headquartered in Buenos Aires, is launching a new advisory service for Latin-American-owned companies seeking to enter joint ventures or technology transfer agreements with other firms in the region. The programme, which is geared towards small and medium-sized firms, is an ambitious attempt to provide locally-owned firms with the basic economic, legal and business information they need to undertake a successful cross-border venture. While majority foreign-owned companies may not avail themselves of the programme, their minority-held affiliates, licensees and distributors may - thus opening an interesting new avenue of information and consultation that could expand their business horizons.

The new scheme, called the Servicio Latinoamericano de Cooperación Empresarial (SEC), has been set up to act as a sort of marriage broker for firms in one Latin American country seeking to collaborate with firms in another country. The collaboration could take the form of a joint ventures, transfer of technology agreement, export-import agreement, joint distribution agreement, R + D programmes, joint development of designs or trademarks, industrial complementation or joint investment planning. The SEC programme will also aid firms that wish to make direct investments in other Latin American nations.

It is possible to conceive of initiatives being taken in other parts of the developing world and then gradually bringing the various organisations together to facilitate cross-regional contacts. Latin America has a long history of efforts at regional integration repeatedly thwarted by external forces, today in the shape of the TNCs, linked to domestic oligarchic groups, and that history provides a base on which initiatives of this type can build. Elsewhere in the developing world the terrain is as yet not so fertile and it may well be that all that can realistically be sought at present is to begin the linkage process among sub-regional sets (e.g. ASEAN) and perhaps spread from there. In principle, however, any such scheme ought to qualify for backing through the UN system both for provision of finance and technical expertise. The organisation should be on a nonprofit-making basis.

SEC offers services on several levels, depending on the degree of interest of the inquiring firm. The ground level is an information service under which subscribing companies may obtain - through personal consultation or by written, telephoned or telexed inquiry - a rundown on companies in the region, economic data or investment legislation. Typical inquiries might include the names and addresses of firms in a particular industry, their financial standing, information on prices or buyers, general economic background on a specific country, copies of laws or regulations, and interpretations of such laws and their application.

Companies that subscribe to this basic service receive three specialised publications, in Spanish, that are also available by separate subscription:

- Boletín sobre Inversiones y Empresas Latinoamericanas (BIEL), a monthly bulletin of economic news and commentary regarding foreign investment, transfer of technology and joint ventures in Latin America.
- Boletín de Información Legal (BILE), a monthly bulletin containing summaries and news of economic legislation in the region.
- Colección Textos Legales, a loose-leaf publication that includes legal texts and administrative rulings, updated semiannually. One volume of the series deals with foreign investment regulations and the other with transfer of technology.

For firms that wish to go a step further, SEC will draw up reports on co-operation possibilities in various Latin American countries. The information, gathered by SEC's network of correspondents throughout the region, would include a review of the leading firms in the sector, principal markets, industry innovations, a preliminary market study and the legal climate for joint ventures in the selected countries. SEC will tailor the information to the requirements of the client.

In addition, SEC will circulate requests from companies that need capital or technology and will publicise offers from firms that have capital to invest or are in a position to supply technology to groups in other Latin countries.

While the newly created SEC has not yet taken on its first joint venture, INTAL has been informally involved for some time in the kind of activities SEC seeks to promote. For example, INTAL was instrumental in organising the joint Argentina-Bolivian pesticides project (BL '78, p. 170) and aided a Mexican firm seeking joint-venture prospects in Ancom.

SEC does not wish to compete with private consultants but wants to provide a service for companies that do not have ready access to other sources of information on international investment. Because it is a nonprofit organisation, its fees are set to cover only its actual costs, making it accessible to smaller firms. In this respect, it is similar to the EEC's Business Co-operation Center, which matches requests and offers for co-operation among small and medium-sized European concerns to help them take advantage of the Common Market. SEC's scope is broader, however, because it also provides legal and economic information.

If the programme is successful, it could have a positive effect on the region's climate for international investment over the long term. One of SEC's prime goals is to help locally-owned firms break out of the confines of their domestic market - in a sense, encouraging them to Latinamericanise their business perspective. The partici-

The rationale for intra-DC co-operation in the creation of multinational enterprises is clear. The organisations seek simultaneously to:

(i) pool resources, including investment capital and technological knowledge;

(ii) capture part of the benefits available through operating in certain markets as a concentrated rather than fragmented force;

(iii) distribute those benefits through the mechanisms of the enterprise rather than via fiscal and commercial policies;

(iv) influence industrial location directly.

Here, too, Latin American experience is richer than that of other parts of the developing world and several examples of these enterprises are to be found in the continent.1/ This type of co-operation differs from the other in that public and not private capital is involved; there is a specific attempt to create entities which will impinge on market structure in several countries; and the investment-technology complementarity is worked into the fabric of the new corporation. Relatively little can be done here other than providing various sorts of technical assistance to smooth the process.

Co-operative work on technological development, which could lead to substantial exchange of technology among DCs though perhaps along corporate channels different from those so far employed, ought to be directed at two ends. First, industrial technologies relevant to the needs and resource availabilities of the DCs. Second, monitoring of technological progress in the ICs which might affect the future industrialisation prospects of DCs. The former aim would be to provide technologies unavailable either from ICs or from within the private sector of DC themselves, thus creating original additions to the stock of technological assets at the disposal of DCs. The latter is potentially of enormous importance since it could yield data on:

(i) advances in IC technology likely to alter drastically the international division of labour and market structure in future;

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pation of more Latin American firms in this transnational movement would help remove the barriers multinational companies face when doing business across borders and perhaps even produce a more equitable treatment of investment throughout the region."

Business Latin America, 20 December 1978, p. 407.

Also, an information office, Red de Información Tecnológica Latinamericana (Ritla) has been recently set up by CELA aiming at identifying, evaluating, selecting, adopting and systematising technologies in accordance primarily with the requirements of the countries of Latin America. See Comercio Exterior, Vol. 28, no. 9, September 1978 and Notas Sobre la Economía y el Desarrollo de América Latina, nos. 293/294, May 1979.

1/ This should not be taken to mean that no major initiatives have been taken elsewhere. A summary of the situation as of mid-1975 is to be found in three excellent studies prepared for UNCTAD and published in October of that year. They are: Okigbo, P.N.C., Joint Ventures Among African Countries, TD/B/AC.19/R.3; Shihata, I.F.I., Joint Ventures Among Arab Countries, TD/B/AC.19/R.5; and Dr. Agrawal, R.G., Joint Ventures Among Developing Asian Countries, TD/B/AC.19/R.7.

(ii) new ways in which ICs might want to utilise mineral and other natural resources of DCs or of the planet and its atmosphere as a whole;

(iii) possible changes in the economic, and thus political, significance of different DCs to the stretegic aims of ICs.

Both aims, if realised, should be in the nature of public goods to the DCs as a whole: to ensure their optimal provision, the most appropriate legal cum institutional setting might be the creation of a Third World Corporation for Advances in Technology which would treat the technological information generated in the course of its activities as a Common Property Resources for all DCs. Some notion of what is involved can be found in the proposals for establishing a similar corporation to harness the resources of the sea and the sea-bed, repeatedly voiced in the various conferences during the past decade on the Law of the Sea. Those proposals have met fierce opposition steeming mainly from the delegations of the most powerful ICs, whose corporations (particularly the mining ones) see a new entity of this type as a potential threat to the strenglehold they hope to tighten around marine resources. If solidarity among DCs in the technological field is to be anything more than an expression of verbal piety, similar resistance should not come from the more advanced of the DCs who would, for some time, have to contribute more to the common pool.

The objectives of co-operation in the legal setting would again be twofold, viz., the fashioning of instruments, including preferential arrangements, relevant to the situation which the flows of intra-DC DFI and technology are in, and compatible across countries; and the elaboration of common positions designed to make the international setting as a whole more responsive to DC needs. Such efforts follow the lines of many discussions during the 1970s and do not call for further comment.

3.3 Conclusions

We have identified the possible domains and objectives of co-operation among DCs aimed at promoting DFI and exports of technology. But adequate identification is no guarantee of adequate implementation. The fact that certain sorts of co-operation offer a strong *a priori* case of advantages for all does not mean that all will in fact be prepared to co-operate. Our empirical evidence shows that the number of DCs currently involved in significant DFI and/or exports of technology is still relatively small, that they are all located in Latin America or Asia, that they are all in the set of DCs having the highest ratios of industry to GDP and of manufactured exports to total merchandise exports, that they vary enormously along such axes as population and GNP per capita, and that their policies towards the industrial sector and its involvement in export trade differ substantially.[1/] The politico-economic perspectives and objectives of this dominant set cover a wide range,

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1/ Of the countries considered in these notes we find that the industry/GDP ratio in 1976 varied from 23% for India to 41% for Argentina, the proportion of manufactured exports to total exports went from 17% in the Philippines to 97% for Hong Kong (1975 data) while GNP per capita in Argentina was at least 10 times the Indian figure.

from Taiwan and Hong Kong whose political status in the next decade is closely bound up with the future policies of the People's Republic of China, to India and Brazil who may see their roles in terms of a regional context, to the Republic of Korea, the fastest grower of all with a well integrated and concentrated state/big industry power complex but whose geopolitical objectives are not easy to discern. What are the prospects that such a group would be prepared to co-operate among themselves rather than follow their own paths? What are the prospects that they would be prepared to share their knowledge with other DCs?

The variety of co-operation possibilities already signalled (the "domains" of the preceding paragraphs) suggest that co-operation might be easier in those areas where the emphasis is on private flows rather than public contributions. In other words, permissive changes brought about through co-operative action (e.g. legislative amendments) might be quite feasible since they could create opportunities which the enterprises involved would be free to use or not according to their circumstances. Competition among the firms might very well increase (though we have as yet no evidence the likelihood is that competition among DC exporters in this field is not intense) but at the same time the total set of opportunities would also expand. By the same token, establishment of an institution through which information on all aspects of private transactions could be handled would also facilitate equitable arrangements as far as importing firms are concerned. Put another way, DCs with fewer technological resources would benefit from the presence of an international institution assisting them to find appropriate technology and import it under reasonable conditions.

Where co-operation involves public resources (financial and otherwise), the risk of a more reticent reaction by the larger DCs is enhanced. There are two dimensions to the problem: one is that they may prefer to compete with each other, or link with the leading ICs, rather than share complementary skills; the other is that, even if they did share, they might not be ready to offer the results to less advanced DCs. Until now the leading Latin American countries have demonstrated a mixture of co-operation and competition among themselves, with responses changing according to countries and issues. Though there is little evidence on other parts of the developing world we might expect that, there too, a pragmatic, case-by-case approach would predominate. Some sharing to weaker countries is found in the Latin American experience and assistance to similar countries elsewhere ought to be possibl .

The keynote of technology policies among DCs has to be promotion and protection. What has been said in this paper shows that there is now enough of a base on which to build. For the technologies already available within the developing world we need institutional mechanisms which handle:

(i) the provision of technical information, classified by item, supplier, quality and possible cost;

(ii) identification of potential users and the essential brokerage between sellers and buyers;

(iii) establishment of the vital support activities covering consulting engineering, international trading companies and financial assistance, the last including credit arrangements for buyers and sellers plus provision of insurances and financial guarantees;

(iv) purchasing behaviour of international organisations and governments which can offer valuable markets to suppliers, particularly when the latter are medium and small firms;

(v) the negotiation and elaboration of new legal arrangements capable of adapting concepts and practice to the requirements of DC exporting possibilities;

(vi) formulation of preferential systems designed to give DC exporters genuine opportunities in IC markets and, most importantly, to stimulate the growth of intra-DC trade in technology;

(vii) co-operative efforts by DCs to harness their technological resources towards the joint production and maximum use of technologies appropriate to their needs and resources and to monitor the technological developments in the ICs.

The institutions which might accomplish these tasks are the following. First, an International Technology Brokerage Organisation which should be set up and be responsible for functions (i), (ii), (v) and (vi). Second, an Agency for Technology Financing, Insurance and Trading which would be directly responsible for item (iii) above and would conduct negotiations with relevant international agencies, such as the United National Development Programme (UNDP) and IBRD, who make substantial use of technology suppliers of various kinds, and would seek to encourage and direct government purchasing behaviour towards DC suppliers. Third, a Third World Corporation for Advances in Technology which would be responsible for function (vii), would be financed, staffed and controlled by DCs and their nationals, and would have special legal status in all countries where it operates. It would, therefore, be a genuine transnational corporation established and operated by and for the DCs.

The specific financial and legal details of the establishment and operation of these new organisations are the proper subject of international negotiations. A successful outcome to such deliberations during UNIDO's Third General Conference in New Delhi would represent a decisive contribution to the technological advance of the DCs in the coming decade.

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THIRD WORLD TECHNOLOGY TRANSFER AND THIRD WORLD TRANSNATIONAL COMPANIES

by

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TABLE OF CONTENTS

I. Introduction

This paper presents a preliminary attempt to describe and assess the emergence of domestic enterprises in the Third World as exporters of capital and technology. The evidence, while scattered and incomplete, points to a clear trend: the more industrialized of the developing countries have experienced a considerable measure of technological progress in recent years, and have now developed the capability to generate and transfer a large range of industrial technologies. This has important implications for policies concerning technological development and transfer in developing countries. It also has major implications for conventional theories dealing with the role of developing countries in the international division of innovative effort and industrial skills and their subsequent long-term comparative advantage in trade and production.

The copious literature on the economics of technological innovation and diffusions[1] and on technology transfers to, and its absorption by developing countries [2] has ignored the generation of technology by indigenous enterprises in poorer countries; the few exceptions will be noted later. The literature has, therefore, failed to recognize a number of significant changes which have occurred in recent years and which may be summarised as follows:

(i) A significant amount of technological change is taking place in the modern industrial sectors of developing countries, particularly in those with relatively long experience of manufacturing and with broad-based capital-goods sectors. Such 'change' is defined broadly. It encompasses increases in productivity and efficiency from simple learning by doing (which is entirely expected), advances in the capability to completely appraise, design, construct and manage complex and advanced industrial processes (which is less so), and a manifestation of the ability to adapt, change, improve and extend these technologies (which is unexpected). Developing countries are, in other words, increasingly able to assimilate, imitate and innovate in areas of medium to high technology.

(ii) The nature of technological change in developing countries is very different from that in industrialized countries. The skills and needs on which it is based guide and constrict its progress: but it <u>is</u> progress, and it calls for skills and resources which are not normally attributed to developing countries. The nature of this progress is discussed below.

(iii) Such progress has enabled a number of countries to emerge as exporters of technology in several forms and to diverse areas. This 'revealed comparative advantage' of developing countries calls for a rethinking of some modern trade theories which assign

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1/ Recent summaries and discussions of the literature may be found in David (1975), Freeman (1974), Johnson (1975), Mansfield (1968), Parker (1974), and Rosenberg (1976).

2/ See, for instance, articles by Cooper and Stewart in Cooper (1973), Baranson (1969), various studies by UNCTAD under the general title of "Transfer of technology to developing countries", and surveys by Morawetz (1974) and Lall (1978).

an importer's role to them in skill and technology-intensive industries. It is not general requirements of skills and technology which increasingly determine comparative advantage between industrialized and developing countries, but particular forms of skill and technology, based on speficic investments in R + D, organization and marketing, within industries (regardless of whether they are 'high' or 'low' technology in conventional terms) that decide such advantage.

(iv) The basis of comparative advantage in technology exports by developing countries is threefold: the low cost of highly skilled manpower; the suitability of the technology to conditions in developing countries; and the 'unpackaged' nature of technology sales.

(v) Technological progress occurs within both indigenous and foreign firms in developing countries (this paper is concerned only with the former), but it is likely that the nature and strength of links with firms abroad negatively affects the speed, depth, and external benefits of such progress in indigenous enterprises. TNCs may be very effective agents of transmitting modern technology to developing countries, but strong ties with them (in the form of ownership and control) or a total technological dependence on them (in the form of continuous and passive licensing) can reduce the capability of indigenous enterprises to assimilate, improve and export certain forms of technology. It follows from this reasoning that developing countries should exercise greater selectivity and restriction in buying foreign technology than most of them do. This prescription, for partially 'delinking' domestic from foreign technology, especially in capital goods manufacture, is based on the need to protect investments in new inherently risky and costly activities in information creation.

II. The Evidence

Technology can be transmitted across countries through a large variety of channels, ranging from official technical aid, migration, scientific communication and exports of equipment to licensing, direct investment, turnkey projects, training and consultancy services. This paper is concerned with technology exports by indigenous enterprises in response to market forces, and with technology in the sense of adding directly to the industrial capabilities of the host economy [1]. It concentrates on the following five forms of technology exports: setting up of entire production systems (turnkey projects); engineering consultancy for manufacturing industry; licensing of know-how and managerial/technical services; direct investment; and training schemes. Exports of capital equipment, though growing in significance and sophistication, are excluded from this discussion, as are government ventures undertaken on a cooperative or technical assistance basis with other governments, outside the market framework.

1/ Technology exports are also growing in the field of civil engineering, banking, tourism, but these are not considered here.

The bulk of information used in this paper is on India, and it comes from periodicals rather than from academic studies. The main sources are the official weekly news bulletin of the government on trade, Economic and Commercial News (New Delhi) and the official periodicals on the public sector, Lok Udyog; these are not referred to in detail because of the frequence with which they have been used. Jha (forthcoming) provided invaluable background on Indian technological development in the public sector. For other countries, sources are published articles and newspaper reports, references to which are given individually.

a) Turnkey Projects: The sale of turnkey projects by local enterprises in developing countries has grown impressively in recent years. The main exporters of complete industrial plants seem to be India, Argentina, Brazil and Mexico. Their relative importance is impossible to gauge with precision because of the lack of data, but the evidence at hand suggests that India is the most important, with Argentina some way, and the others much further, behind in terms of the number, range and sophistication of exports involved.

Indian exports of plants in relatively simple industries like textiles, sugar processing and cement have been common for some time now. Recent years have, however, witnessed the export of complete plants in sophisticated activities like large-scale electrical generation [1]; complete automatic telephone exchanges [2]; electrical transmission equipment; pharmaceutical plants; fertilizer plants; oil transmission, blending and electronic control systems; steel plants (some of these were subcontracted to India by the USSR); machine tool factories; assembly of light two-wheelers; and several other types of manufacturing plants. Both public and private sector firms are active, but the former seem to predominate in the 'heavy' end of the business.

The development of turnkey activity by Indian firms has been the next logical step from the export of individual items of capital equipment in those industries where the complexity of new manufacturing facilities makes it more economical and rational to order the entire plant from one supplier than to buy bits and pieces and put them together. The supplier then designs, makes and starts up the entire plant - clearly, the skill and technology required are far more advanced than the manufacture and export of individual items of equipment. [3]

1/ Bharat Heavy Electricals Limited (BHEL), a public sector undertaking, is setting up generating capacity of 544 MW in New Zealand, a 2 x 120 MW thermal station in Libya (for about $150 M., the largest Libyan contract for generation awarded), power generation and distribution facilities worth $74 million in South Arabia, and so on. It has the capability to execute complete hydro, thermal and even nuclear power plants, and all its contracts have been won in open tenders against established TNCs. See Lok Udyog, Oct. 1977 and Raferty (1977).

2/ Indian Telephone Industries (ITI), a public sector firm, has recently won many export orders, including one for two automatic exchanges in Surinam. It is now about to design and manufacture electronic exchanges (PABX + PAX) and sophisticated defense communication equipment.

3/ The export of sophisticated capital goods, based on local design, by indigenous enterprises of developing countries is itself a remarkable phenomenon which requires empirical and theoretical analysis, though this paper cannot discuss it in any detail.

Argentina has been exporting turnkey plant in meat refrigeration, fruit processing, cotton oil extracting, shipyards and baking facilities[1], while Brazil and Mexico have been exporting turnkey plants for steel making[2]. Much of their export has taken place within Latin America, but the Brazilian firm Cia. Vale do Rio Doce is setting up a steel plant as far away as Egypt.

On the evidence available, other developing countries seem to have little or no exports of turnkey plant[3]. Countries like Taiwan, South Korea, Hong Kong and Singapore, which have grown rapidly by exporting labour-intensive products rather than domestically-designed capital goods, do have a comparative advantage in technology in the manufacture of these labour-intensive products. They exploit this advantage mainly by means of direct investment (see below), since they lack the indigenous capital-goods production base on which to build up technology for the design and construction of complete factories (as they develop capital goods production, however, there is little doubt that they will enter this area with the same dynamism that they have exhibited elsewhere).

b) Engineering Consultancy: The growth of the size, complexity and specificity of a large number of industrial processes has made them 'consultancy - intensive': these include steel, non-ferrous metals, power generations, mining and the continuous-process industries like oil, petrochemicals, chemicals, paper, and others.[4] Consultants are essential to the evaluation, design, commissioning and construction of a large number of industries: in a sense they embody the 'pure' technology of setting up modern industry, choosing the technique of production, buying the capital goods and overseeing the construction.

A number of indigenous engineering consultants from developing countries are exporting their services. As the growth of consultancy skills is organically linked to experience of building capital goods and setting up plants, the same countries that export turnkey technology also lead in exporting consultancy technology. India, with over a hundred consultancy enterprises, has the widest range of such services, since it possesses the experience, not only of operating particular industries (which gives rise to consultancy specialized in those technologies), but also of constructing a wide range of investment goods (which gives rise to experience of a family of related technologies). Mexico, Brazil and Argentina follow with a more limited range of services.

1/ Katz and Ablin (1977), p. 10-11. About 20 instances of turnkey sales have been recorded.

2/ Diaz-Alejandro (1977) and information provided privately.

3/ Countries like Spain and Israel undoubtedly do, but are now advanced enough to be counted as industrialized nations. (On Spain, see More (1975). Countries like S. Korea are very active in turnkey jobs in civil contruction: see the Financial Times, 14 March, 1978, p. 20.

4/ This section draws on the excellent paper by Roberts (1973).

Consultancy firms from India active abroad include large private companies like Dastur and Co. (exporting consultancy for iron and steel to several developing and industrialized countries), Dalals (chemical technology), Industrial Development Consultants (general consulting), and Tata Consulting Engineers (thermal power technology)[1/], as well as several public sector consulting and manufacturing enterprises: HMT in machine tools; ITI in telecommunications; National Industrial Development Corporation, NIDC, in chemicals, diesel engine plants, machine tools, pumps, food processing, mining machinery, textiles, paper and industrial planning and forecasting, selling to developed as well as developing countries[2/]; Engineers India Ltd., in fertilizer, petroleum and chemical industries, singly and in collaboration with TNCs (like Kellogg of the U.S. and Progetti of Italy) from developed countries; Rail India Technical and Economic Services Limited, RITES, in railway technology; Metallurgical and Engineering Consultants Ltd., MECON, in metallurgical technology, which is providing services to several foreign enterprises, including Altos Hornos de Mexico, itself a technology exporter. Apart from manufacturing, Indian consulting firms are also exporting services in hotel management, civil works, construction of dams, townships and airports, and in feasibility studies and project designs of all sorts.

Mexico has a well-known independent consulting firm, Bufete Industrial, for general industrial services, as well as a public sector firm, PEMEX, specialising in petroleum technology. The Brazilian state-owned PETROBRAS also sells petroleum technology; its SONDOTECNICA sells general consulting services. There are other consulting organizations of indigenous origin in countries like Argentina exporting manufacturing know-how, but lack of data prevents the citing of specific examples (Diaz-Alejandro (1977) mentions Argentinian consulting firms, along with Mexican and Brazilian ones, as operating abroad in Latin America).

In general, therefore, India seems to lead in the field of exporting engineering-consultancy. Its firms span an enormous range of technologies and serve an impressive collection of countries, including some developed ones like Italy, West Germany, Hungary or the U.K.; they subcontract from established TNCs certain jobs they can perform more cheaply; and they serve as vehicles for exporting know-how and capital goods developed and produced in India.

c) Licensing and Other Services: There is little evidence on the sale of patents and trademarks abroad by developing countries. It is possible that some industrial processes developed by local enterprises in developing countries have been sold as such to other countries in return for fees or royalties, but the incidence of this seems to be rather low. The sale of brand-names must, for obvious reasons, be even more limited.

The reason for this may lie in the nature of developing countries' comparative advantage. The technology that these export is the result not of major innovations in

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1/ ECN, 3 April, 1976, and information supplied privately.

2/ ibid., 19 June, 1976. Roberts (1973) notes that NIDC "offers services to a wide range of industries largely based on the implementation of technologies developed in India". (p. 53).

products or processes, but of imitating, adapting or improving on known technologies: their advantage thus lies in their accumulated experience and the low cost of the people who possess it. It is an advantage which is difficult to embody in a saleable design, patent or blueprint (though this may change as their improvement become more distinct).

As for the export of managerial and technical services (the transfer of disembodied know-how), there is some evidence that this is taking place on a growing scale[1]. Managerial services are exported by hotel chains from India, for instance, while HMT has recently agreed to send 1,500 technicians to Libya to help operate a machine tool factory. Indian Railways has provided technicians to a number of countries in Africa, while Indian steel companies have provided personnel to Iran. It is very likely that similar exports take place within Latin America.

d) Direct Investment: This is one aspect of technology exports by developing countries - "Third World TNCs" - which has attracted some attention in recent work[2]. Some data on direct investments by developing countries - but, especially for Asia, rather incomplete - are presented in the statistical appendix.

Table 1 in the appendix shows Latin American parent companies and affiliates in the region in 1976. Argentina seems to lead the field in Latin America in terms of the number of affiliates abroad (69), though the figures do not differentiate between investments made abroad by indigenous enterprises and by affiliates of TNCs. Colombia, Mexico, Brazil and Peru also have 15 or more foreign affiliates. The main recipient of foreign investment, by number of affiliates, is Ecuador, followed at a considerable distance by Brazil. Appendix Table 2 shows stocks of foreign investment by Latin American TNCs. The main recipients by value of intra-regional investment are Brazil, Colombia and Ecuador. The role of tax havens like Panama and Netherlands Antilles is curious: they seem to export enormous sums of capital, mainly to Brazil, but this is clearly simply a channelling of funds through them by enterprises from developed countries. The Latin American firms that go transnational seem to specialize in consumer products requiring low- to medium-level technology, like electrical products, food products and metal products.

In Asia, (Table 3), Hong Kong seems to be the major investor abroad, and Indonesia the major recipient of Third World capital. The Philippines, Singapore and South Korea also invest in excess of $100 m. each abroad - again, the precise final origin of the investments is not discernible. Part of these may be from TNCs from developed countries, but part of them are clearly from local enterprises: Hong Kong textile firms have, for

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1/ Outside the enterprise framework, of course, such technology is being 'exported' on a massive scale by migration.

2/ See Diaz-Alejandro (1977) on Latin America, Lecraw (1977) on Indian firms in Thailand, and Wells (1977) on the internationalization of firms from developing countries in general. The U.N. Centre on TNCs (1978) has collected some data on direct investment flows between developing countries, which are reproduced in an Appendix to this paper.

instance, gone to other countries to enlarge their access to Europe under the General Scheme of Preferences (which allocates quotas by country). A large number of Singapore firms operate in Malaysia to serve the local Chinese community by making noodles and pickles, as well as operating small engineering works and textile factories. 1/ Some Korean firms have even applied to Portugal for permission to set up an electronics plant there. 2/ As with Latin American firms, these transnationals seem to specialize in small-scale operations using well-diffused technology.

India is not a major direct investor in terms of the value of its capital abroad, though Table 3 understates its activity because it excludes Indian investments in Malaysia, its major host country. India had, by mid-1976, 134 direct investments abroad, of which 64 were already in operation and the rest were under construction. The largest number (36) were in Malaysia; the rest were scattered through Asia, Africa and even some in developed countries (for oil engines, hardboard, asbestos, cement and magnetic wires). There is apparently also a wholly-owned HMT assembly plant for machine tools in Luxembourg, and a number of private Indian enterprises are actively exploring the possibility of investing in the Irish Republic. In general, India restricts its foreign investors to small minority positions, and to contributing their equity in the form of equipment and machinery from India 3/. The former requirement may account for the apparently small value of flows of capital from India.

The industries in which Indian private sector investments are made abroad range from relatively simple ones like textiles, flour mills, soft drinks, foundries and tanneries, to relatively complex ones like integrated palm oil extraction, steel products, paper products, diesel engines, pharmaceuticals, rubber products, light electrical equipment, auto components and so on: the technology used is "mature" and the scale of operations generally small. The public sector firm HMT has also entered into joint venture agreements abroad to produce various types of machine tools abroad; the most recent instance being an agreement with the Kenyan Industrial and Commercial Development Corporation 4/. It will not be at all surprising that other large public firms, now involved in exporting products, technology and personnel, also get involved in equity participation abroad. This would represent the entry of "Third World TNCs" into a distinctly higher level of skills and technology.

The tendency so far has been, as represented by Wells (1977) and Lecraw (1977), to regard Third World TNCs as specialising in 'mature' or 'low' technology, small-scale production and 'low' marketing (i.e. little product-differentation, competition by prices rather than by advertising) activities. While this is true of the majority of cases,

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1/ See Lall (forthcoming)

2/ Information supplied privately.

3/ Large business houses in India are pressing for a relaxation of this restriction, in view of their growing technological capability and the country's large foreign exchange reserves. See Economic and Political Weekly, 'India as Capital Exporter', 17 Dec. 1977, p. 2078-80.

4/ Reported in The Financial Times, 14 July 1978, p. 4.

there is a risk of associating these enterprises too generally with rather low levels of skills, simple products and out-dated technology. The technology used is certainly 'mature' in almost all cases, but the levels of complexity and skill involved in manufacturing operations may be quite high. Furthermore, some Third World TNCs are starting to enter capital goods industries where extremely complex techniques, large scales and the ability to keep pace with innovation, are required. There are limitations to their present capabilities, as will be noted below, but these should be more clearly defined than they are at present, and they will change over time.

e) Training Programmes: The only information available on technology transfers by training schemes comes from India, where a large variety of activities is under way by private and public enterprises to help other developing countries. One of two training centres in Singapore is run by Tata's, a private enterprise. The government-owned Central Machine Tools has helped to set up a metal working research institute in Iran as well as providing training facilities for Iranian engineers in India. The National Industrial Development Corporation is setting up industrial estates in Guyana; it is equipping a Technical Training Institute in Malaysia, and it has helped Iran to set up Technolog, an engineering consulting enterprise. Hindustan Machine Tools is establishing an advanced training centre in Iraq and planning an industrial estate to service a machine tool factory in Iran. Besides this, there is a constant exchange of personnel between enterprises and technology institutions of India and other developing countries.

The export of know-how to set up training centres is the provision of technology to absorb technology: its importance is so obvious as not to require further emphasis. However, it is the ability of developing countries to provide this sort of technology that is worth remarking upon. Until now, such technology has been practically monopolised by the industrialized world.

This concludes the survey of the evidence. To summarise, then, nearly every country which has reached a certain stage of industrial development exports some form of technology. There are, however, noteworthy differences between the exporters. (a) Small economies which have followed liberal trading policies and achieved high growth rates in exports of simple manufactured products (South East Asia) mainly export small-scale, relatively mature technology for the manufacture of consumer goods, mainly in the form of direct investment. (b) Large economies which have followed protectionist import-substitution policies but liberal policies on direct investment by TNCs (the big Latin American countries) export technology by means of direct investment in sectors where local industry flourishes (Argentina being outstanding by virtue of the strength of its indigenous enterprise), but not in those high-skill areas where TNCs are predominant. They export relatively little technology in complex and high-skill industries by turnkey jobs or consultancy - the main exceptions are complex industries where the state has played an active manufacturing role. (c) India, with highly protectionist policies towards imports of goods, technology and foreign investment, combined with a heavy emphasis on the development of local enterprise and domestic science and technology, seems to be in a category of its own. It exports

low to medium technology, for the manufacture of consumer, intermediate and light capital goods, by means of direct investment (though lack of foreign exchange has kept this channel constricted till recently); it also exports technology of much greater complexity and skill, often in direct competition with established TNCs, by means of turnkey projects and consultancy services.

It may be noted that in most cases technology exports have grown to complement exports of manufactured products. For products of relatively simple technology, technology has generally been exported by means of direct investment, often in collaboration with local importers, to forestall threats to established markets [1]. As products move up the skill/technology scale, technology exports occur more to promote sales of producer goods than to protect established markets for consumer goods. In some cases, however, where a great deal of broad industrial expertise has been built up (Dastur's of India), technology sales may be unrelated to sales of products from the home country, and may even displace them if the technology supplier sources its purchases on a world-wide basis (i.e. the experience accumulated through indigenous industrialization may be saleable, even if the final product is not).

Since nearly all technology exports by developing countries have been based on 'minor' or imitative technological activity, the initial input of technology has had to come from the industrialized countries. For foreign-owned or controlled enterprises, this has generally come in the form of direct transfers of designs, capital goods, patents and know-how from their parent companies. For locally-owned or controlled enterprises (including 'joint ventures' with equal participation by foreign and local enterprises) the input has come in the form of licensing (with the technology supplier actively assisting in the initial transfer) or imitation (with the local enterprise 'going it alone')[2]. This section is only concerned with locally-controlled enterprises: and here the role of licensing and foreign technology transfer has, at least till now, been much more significant than that of imitation. Once the initial transfer of licensed technology has taken place, of course, the enterprises have had to devote considerable effort to assimilating, adapting and reproducing it at home and, later, abroad. This process, and the limits on the complexity, novelty and market-orientation of the technology exported, are considered in more detail below. At this point it may only be suggested that two factors seem equally crucial in building up technology exports - the initial transfer from abroad (usually by licensing or joint ventures) and the subsequent assimilation and adaptation. Given these, the competitive edge of developing country enterprises lies in the much lower cost of their skilled manpower which can effect technology transfer to other Third World countries.

1/ See Lecraw (1977) and Wells (1977).

2/ For the process of technology assimilation by Japan in the pre-Second War period, and the interplay between importation, adaptation and (subsequently) innovation see UNCTAD (1978).

However, the more process of importing technology, without the technological base to assimilate it, will not lead to local technological development; and local technological effort, without a measure of foreign input, may be wasteful and unproductive. The correct policy balance will be discussed in the final section.

III. The Nature of Developing Countries' Technological Capabilities

This section provides some tentative explanations of the growth and pattern of technological exports by developing countries. Such a task should ideally be undertaken after a thorough and detailed examination has been made of technological change within the enterprises that develop from being technology importers to being exporters. Clearly, technology exports are only the tip of the iceberg of innovative activity that is taking place in newly industrialising countries. Given the evidence available, however, and the relative paucity of studies of innovation in developing countries [1], we must perforce rely on casual empiricism and ad hoc theorizing.

There are severe problems inherent in the measurement and precise definition of technological change, which have been amply discussed in the literature[2], and which are not relevant to the purpose in hand. Taking the evidence on technology exports as valid proof of a great deal of successful technological activity, what we are concerned with here is: how 'innovative' is this activity? What skills and other inputs does it require? What determines its pace?

Developing countries are clearly imitators and adapters of technology, not major innovators, and even as imitators they have been among the laggards rather than leaders. This does not, however, imply that technical progress does not take place among the laggards. On the contrary, there are, given the initial foreign impetus in the form of new techniques, several types of change that occur, which can be represented by various types of 'learning' processes. These may be grouped into elementary, intermediate and advanced stages, each with two sub-categories.

1. Elementary: a. Simple 'learning by doing', whereby an imported technology is unchanged, but its utilization is made more efficient simply through the experience of workers.

b. 'Learning by adapting', whereby small changes are made within a plant to a given technology by shop-floor technicians, managers and engineers, to raise productivity within a given technology, or to adapt the product to particular needs. Both types of elementary learning may occur, given a certain level of skills, in every sort of industrial activity[3],

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1/ The major exceptions are Jha (forthcoming) and Katz (various).

2/ See Mansfield (1968) and David (1975).

3/ The second sort of 'elementary' learning may also require a great deal of technologically directed activity (as Katz (various) has noted), in contrast to simple 'learning by doing' which occurs almost naturally with the accretion of experience. It is termed 'elementary' only because it takes place within the given context of an imported technology and does not cover the design of the technology itself.

regardless of foreign or local ownership.

2. Intermediate: a. 'Learning by design', whereby imported equipment and processes are replicated, and knowledge is gained by design engineers and capital-equipment manufacturers of industrial processes. A move from elementary to intermediate stages clearly requires the establishment of an indigenous capital goods industry.

b. 'Learning by improved design', the next step in the design of equipment, where productivity raising changes (albeit of a 'minor' nature) are made, or the equipment is scaled down, adapted to use local raw materials or to operate in local conditions and with given operating and maintenance skills. Here design engineers generally need the help of a separate R + D department. This step requires a greater degree of local autonomy and control over the process of basic design of capital goods.

3. Advanced: a. 'Learning by setting up complete production systems', whereby the ability is acquired, not just to produce items of equipment, but to engineer and tailor entire factories or plants to specific needs. At this stage, the industry acquires the capacity to provide consultancy services and undertake turnkey jobs. This stage requires a great deal of accumulated experience in using and reproducing particular technologies or families of technologies, based on manufacturing and designing capital goods.

b. 'Learning by innovation', whereby the R + D department or a separate research institution, extends into basic research and development, and is able to offer new processes or new products, or both. This 'basic' R + D may be of a different order of magnitude from 'basic' R + D done in advanced countries, since it may not be on the frontiers of new technology. However, it may still lead to processes (as has happened, say for chemical products) or new products, which are different from those first imported into the country. This final stage requires not only an advanced and diversified level of manufacturing, but a substantial research effort and high scientific skills.

This three-fold categorisation of 'minor' technological progress helps to illustrate the complex and diverse nature of current technological activity in developing countries. There are different levels of 'innovativeness' involved, rising in skill and manufacturing requirements with each stage. Different developing countries have, according to their strategies and sizes, gone up to different levels: India has gone the whole way, with several enormous independent laboratories scattered through the country engaged in 'basic' R + D, and with an expanding emphasis on in-house design and development facilities in many manufacturing enterprises. Other countries have gone less far, with most stopping at (or even before) the elementary level, and some larger ones going somewhat further in particular industries (note that we are talking of indigenous enterprises only). Some learning is always going on, almost by definition, but the capability to export technology only comes when the enterprise has 'learnt' a particular saleable skill, which others do not possess or which it can offer more cheaply than others.

Different forms of technology exports may require different types and levels of technological 'learning' by the enterprise concerned, and different stages of industrial development in the economy where it originates. For an economy with no local capital goods production in the relevant activity, technology exports may be based upon elementary learning which gives the capability to put together, and efficiently (and cheaply) manage, a 'package' based on imported capital goods and consultancy services. In the main, such exports will take the form of direct investment for the production of standardized consumer goods and 'mature' intermediate goods[1]. In exceptional cases, however, they may also take the form of consultancy services in a particular activity based on long experience of a given industry. For an economy which does possess a capital goods base in the sector concerned, technology exports may require elementary learning by the exporting enterprise where it is, again by direct investment, producing standardized consumer or intermediate goods abroad[2]. They may, however, require intermediate and advanced learning where exports take the form of direct investment for the production of capital goods, or of turnkey jobs, consultancy and other services for the setting up, and running, of diverse or complex production systems. The more diversified and highly skilled the content of technology exports by a country, the more developed are its capital goods sectors, and the longer its experience with different forms of industrial activity, likely to be. Furthermore, the success of technology exports will depend, not only on 'technological learning' narrowly defined, but also on the success of the enterprise in correctly organizing its internal structure and coupling research, managerial, financial and marketing activities [3].

The role of the capital goods sector in generating, diffusing and stimulating technological progress has been emphasesed since the writings of Marx by several scholars, most recently by Rosenberg (1976) and Stewart (1976). Clearly, only local capital goods can <u>embody</u> new techniques generated locally, and only they can <u>transmit</u> new techniques across industries. In their absence, only small adaptations can be made to imported production processes. The skills required for technical learning here are of <u>engineering and design</u> rather than those of science. Minor innovations in machinery making seems to be based on practical engineering experience in designing new equipment. Science-based innovation becomes significant if major innovations - completely new products and processes - are envisaged. This requires more sophisticated and expensive R + D facilities, much larger scale, much more risk-bearing ability and a much longer waiting period, than developing countries can (and should) afford. However, the line between minor and major innovation is hard to draw, and countries like India may well be able to contribute some major innovations in the foreseeable future. [4]

1/ This is illustrated by Lecraw, 1977 and Wells, 1977.

2/ For an analysis of the significant relationship between elementary technological activity (adaptation, 'trouble-shooting', higher process productivity, all within a given technology) and commodity exports in Argentina, see Katz, 1974.

3/ This is discussed for industrialised countries by Freeman, 1974 and for the case of a large selection of Indian public sector enterprises by Jha (forthcoming).

4/ The independent science institutions in India seem to have contributed little by way of useful industrial technology - the bulk of the contributions has come from manufacturing enterprises. Whether this is due to lack of necessary links (Cooper, 1974) between science and production, or simply a longer 'learning' curve is difficult to say. Also see Prahalad, 1977.

In sum, the development of indigenous technological capability is dependent upon the following: the length of experience with industrial activity; the capability of the economy to assimilate technology (which is a function partly of the availability of skilled work force and partly of experience itself); the organizational and managerial capabilities of the firms concerned; the existence of a capital goods sector (which depends largely on the size of the economy and the sort of industrialization strategy pursued); and the technological policy followed by the government. We have already remarked on the first four factors; let us turn now to the last one.

The evidence presented in the previous section seemed to indicate that different policies pursued by developing countries had produced different patterns of comparative advantage in technology exports. Thus, even given large internal markets, relatively developed industrial sectors and reserves of skilled manpower, certain countries had not revealed a competitive ability in exporting indigenous technology as diverse or complex as others. This difference may be traced to the protection and promotion given to the process of learning at different levels by the governments concerned, in particular to the protection and promotion of learning within locally-controlled enterprises vis à vis the import of technology through direct investment by TNCs.

Countries which have permitted a free inflow of technology by means of foreign-controlled affiliates have not exported technology of the diversity and complexity shown by those that have followed a deliberate policy of protecting the learning process in locally-controlled enterprises. India has, for instance, reached a considerably higher level of sophistication in technology exports than Brazil, mainly because the former has fostered the absorption of technology by local firms, forced them to develop their own designs and protected the development of local in-house R + D facilities, while Brazil has done little along these lines in its capital goods industries.[1/] Interestingly enough, in Brazil itself (and in Mexico), where the government has stepped in by setting up state-owned enterprises (as in petroleum) or by providing state assistance (as in steel), local enterprises have developed the capability to sell technology abroad.

The heavy electrical equipment industry provides atother interesting case in point. The performance of Bharat Heavy Electricals Limited (BHEL) has already been noted above: it has become a technology exporter of world class, not able to compete in the largest projects, but certainly a worthy entrant into the next level of competition. In Brazil, on the other hand, where a thriving indigenous sector existed in the 1950s, TNCs have made such enormous inroads into the 'high' technology heavy equipment section of the

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1/ A detailed and perceptive analysis of the Brazilian capital goods industry by Erber (1978) very clearly demonstrates how the lack of protection and promotion on indigenous design led to a decline in Brazilian technological capability, and to a loss of market share to TNCs. It is also likely that permitting local enterprises to maintain a passive dependence on foreign licensed technology will also not develop any local capability: a more forceful policy on developing and using local technology seems to be required. Evidence of this for some small Andean countries is provided by Mytelka (1978). In India, by contrast, Lok Udyog (various) and Jha (forthcoming) show how

industry that domestic enterprises have practically been wiped off the map.[1] Lack of official protection and technological support, and predatory pricing policies and takeovers by TNCs, have combined to limit local technological capability to the elementary level (implementing basic designs supplied from abroad), while in India this capability has developed to the level of providing large turnkey jobs and consultancy in international markets.

It is not difficult to understand the need for official protection and promotion of technological development. Learning at the elementary levels is, given a certain capability, inherent to the production process, regardless of who owns the facilities. Any progress to higher levels, however, requires the fostering of indigenous technological learning activity in capital goods industries which go beyond implementing imported designs, and which require replicating facilities, expertise and skills already in existence abroad. Local design and research activities involve, in other words, considerable learning costs; and they also entail a certain element of risk and delay. Enterprises owned by TNCs or directly dependent on them for skill-intensive basic design and development work in capital goods production are unlikely to undertake these risks, delays and costs: given the availability of established and proven capabilities abroad, the private assessment of investing in further developing indigenous technology is likely to be negative. A similar assessment may also be made by locally-controlled enterprises. Thus, a policy of technological generation must incorporate measures not only for the local production of capital goods, but also for fostering local design, subsidising and cajoling expenditure on design and development, and providing, where necessary, back-up in terms of scientific infrastructure.

Even given all the right conditions for technology generation, however, the pace and limits of successful technological learning will differ from industry to industry. Developing countries' comparative advantage is greatest: where learning involves the design of discrete items rather than of continuous processes. when the techniques involved are not subject to rapid change; when the skills required are based on production/design activity rather than on science-based R + D; when the commercial application of technology does not depend on large-scale marketing and promotion abilities [2] (the acquisition of marketing know-how seems to involve a longer learning process, and even more investment,

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technological capability was built up in various enterprises (and not in some others) by the policy of attracting highly-skilled (often foreign trained) engineers, setting up substantial R + D departments, diversifying the product range, entering export markets and rationalising the organisational structure. Impressionistic evidence shows a marked relationsship between the setting up of R + D activities, in particular, and entry, after a brief lag, into the technology export market.

1/ For a desciption of the Brazilian experience see Epstein and Mirow (1977), and for a more general analysis of TNCs in the electrical equipment industry see Newfarmer (1978).

2/ This is why most exports of high technology by developing countries have taken place on a tender basis, to 'informed' buyers who are not as swayed by brand names as the ordinary customer.

than production technology); when minimum efficient scale does not entail very long production runs or very large orders; and when the technology can be subjected to adaptations, scaling-down, or simplification, to suit the conditions of developing countries. These conditions indicate, very roughly, the areas in which learning is likely to be most successful in the initial stages of entry into world technology markets. In later stages, however, the advantage of developing countries may change and expand: the process is so dynamic, and evidence so limited, that it is difficult to forecast with any pretence to accurancy.

Under present circumstances, nevertheless, these considerations point to an evolving division of technological work between nations whereby the more industrialized of the developing countries, given their cost advantages and experience, increasingly undertake transfers to other developing countries of technologies which are intensive in their types of 'high' skills. These technologies may well be able to meet substantial portions of the needs of these newly industrialising countries. They can also enter developed countries to perform costly skilled jobs where their cheap manpower can provide a massive advantage (e.g. engineering consultancy in certain industries, 'software' components of various technologies, project construction management, detailed design work).

High technology firms in the industrialized countries can participate in the technological progress of developing countries in one or both of two ways - subcontracting certain skill-based activities to Third World technology firms, or establishing affiliates in developing countries to directly exploit their pool of low cost, experienced and skilled manpower. There are signs that both these courses are being adopted,[1/] but they are, as is noted below, likely to follow upon, rather than lead, local technological progress.

IV. Costs and Benefits

A. This section starts by considering the situation for the technology-exporting countries.

The benefits of building up an indigenous technological capability which is internationally competitive are numerous. There is the earning of foreign exchange resulting directly from technology exports, and indirectly from the stimulation of exports of

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1/ Dastur's of India, for instance, has undertaken engineering consultancies in developed countries like W. Germany, as has the NIDC in Italy and the U.K. A few foreign transnationals are establishing research laboratories in the more advanced developing countries like Brazil, Egypt, and India mainly in the food processing and pharmaceutical industries. However, this seem to be more to meet specific local needs that to exploit cheaper scientific manpower. Till now there is little indication that head-office based design and development functions are being relocated in developing countries.

capital goods, services and intermediate products over the longer run.[1] There is establishment of an international reputation and winning of goodwill, and there is the experience gained of foreign operations and skill accumulated by tackling unfamiliar tasks, all of which add cumulatively to export competitiveness. But these are, like the exports themselves, just the tip of the iceberg of the benefits from technological advance internally. The development of an independent capability to assimilate, adapt and improve on technology is such a major step forward in the progress of industrialization that its benefits are difficult to assess quantitatively or even to describe with precision. They range from the building up of a scientific and technical infrastructure capable of rationalising and reducing the cost of technology imports and of producing more 'appropriate' technology [2], the setting up of ancillary and small subcontracting industries [3], the better use of local raw materials and the creation of new skills, to less tangible but equally important benefits resulting from a stronger sense of self-reliance and confidence.

However, the costs of striking out on a serious policy of technology generation should not be underestimated. There are enormous direct expenses involved in setting up a scientific infrastructure, and the Indian experience does not - so far at least - seem to justify the establishment of large laboratories divorced from the production enterprises. A considerable amount of progress can, however, be made by in-house design, research and development expenditures in manufacturing enterprises without resourse to external scientific establishments. The direct costs of promoting technological activity in manufacturing units, especially when the country possesses large number of trained engineers, are unlikely to be high. The indirect costs may, however, be considerable. The essential period of learning - with its inherent costs in terms of lost output, mistakes made, low quality, high prices, delays in reaching efficiency frontiers - before a technological capability is built up in painful. The pangs diminish after a 'technological take-off' occurs, but the first stages inevitably involve inefficiencies of various sorts.

In this context it should be noted that, where a developing country possesses the basic requirements for creating technology locally, the benefits are likely to be greater by localising technological development in indigenous rather than foreign enterprises. Affiliates of TNCs may be able to provide very modern and complex technology much faster and more efficiently than a local imitator can. The very nature of their technological links abroad, however, necessarily reduces the extent of learning locally. An economy

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1/ Such exports enjoy the great advantage that they are not in the category of labour-intensive goods where protectionism is rampant in developed countries, and where import-substitution efforts are likely to come first in other developing countries.

2/ Some evidence on this point is provided for technology exports by means of direct investment by Indian firms in Thailand, by Lecraw (1977).

3/ The promotion of local ancillaries is documented for the Indian case by Subramanian (1976) and by the various special reports on public enterprises published in Lok Udyog. On the Japanese experience see Watanabe (1971) and UNCTAD (1978).

which remains dependent on foreign sources for the bulk of its technological activity remains incapable of generating a certain amount of local technological capability which recent experience proves to be well within its long-term comparative advantage. There is a strong case for confining dependence on foreign technology to activities where local technology is incapable of keeping up with science-based or very rapidly advancing technology abroad.

It is, of course, possible that TNCs themselves can help to reduce the constriction placed by technological dependence, by establishing R + D facilities in developing countries, employing nationals and producing products and processes suitable to their conditions. As noted above, this has already started to happen, but its scope is bound to be fairly limited and it can serve only to complement local efforts, not to replace them.[1/] The broad-based and basic know-how which is needed for technological development in industry as a whole cannot be provided by foreign laboratories - it is experience which only local efforts can generate. Moreover, local enterprise can probably ensure a broader diffusion of innovations, and stronger linkages with domestic manufacturers, than research offshoots of TNCs. The contribution of foreign establishment is, paradoxically, likely to be greater the more advanced is local technological prowess, in the sense that a more experienced indigenous sector is likely to attract the relocation by TNCs of more complex and more basic R + D activities.

The contrast between TNC affiliates and local establishments should not, however, be drawn too sharply. There is a variety of intermediate positions between wholly-owned foreign subsidiaries, on the one hand, and wholly-local enterprises, on the other. Some of these may prove satisfactory, indeed the most affective, vehicles of local technological activity: a locally-controlled joint venture may, for instance, be able to engage in significant indigenous technological activity while drawing upon its foreign partner for assistance in exceptionally difficult problems and for access to technological information from industrialized countries. Others may not be so beneficial: a foreign-controlled joint venture may not, for instance, be willing to shift basic design and development work from its established centres to a developing country, or even a locally-controlled firm may not wish to invest in local R + D. This is an area where generalizations, are extremely difficult, not only because of the anecdotal nature of available information, but also because of the inherently unpredictable individual factor - different entrepreneurs in identical situations wish to retain different degrees of dependence of foreign technology. It seems reasonable to argue, nevertheless, that official policies can successfully be adopted which, on balance, draw forth a greater degree of indigenous technological effort, and these would tend to favour the maximum possible degree of local control compatible with access to foreign technology. [2/]

1/ Foreign R + D can stimulate local innovation by 'fallout' effects; but it may also retard it by attracting the best personnel or picking up promising findings.

2/ This point is made with reference to the Andean Pact countries by Mytelka (1978).

The issue of correct policies will be discussed further below.

B. Let us now turn to the technology-importing countries.

The benefits of importing technology from other developing countries arise from its lower cost, greater appropriateness to local conditions, or both. The cost element is likely to predominate in sophisticated technologies where there is little adaptability but where the input of skilled manpower is very large, as with design and consultancy work. A number of firms from advanced countries (especially the U.K.) have admitted their uncompetitiveness in some fields of standard engineering consultancy by handing over, losing or sub-contracting jobs to Indian firms. The significantly lower cost of Third World consultants fuelled allegations by countries like Saudi Arabia that Western contractors are 'ripping them off' by submitting grossly inflated bids.[1/]

The appropriateness element is likely to be more important in turnkey jobs and direct investments. Facilities provided by developing countries are likely to be of smaller optimum scale, use more labour-intensive techniques, be better suited to supply conditions in developing countries, be more responsive to demands for exporting, for local control and local training, and produce goods more adapted to popular needs, than those provided by the industrialized countries.[2/] The experience gained by developing countries in assimilating foreign technology can provide them with a significant edge in transferring the same technology to another country as compared with the original supplier. Take the well-known example, documented by Baranson (1967), of the Cummins diesel engine plant in India. Baranson's study, conducted in the early stages of assimilating the technology, came to rather pessimistic conclusions about domestic technological and local-supply capabilities. Indeed, his descriptions of the requirements for successful diesel engine manufacture made it sound unlikely that a developing country could ever undertake it efficiently.[3/] Yet within a decade the inefficient technology importer had turned into an efficient exporter: the same Indian firm is now operating affiliates abroad to make diesel

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1/ See "India ready for more Saudi contracts", Financial Times, London, 7 March, 1977.

2/ For an analysis of Indian firms as compared to large TNCs and wholly local firms in Thailand, see Lecraw (1977). He finds that Third World TNCs not only used more appropriate technologies, but also had higher capacity utilization rates, achieved higher profits and reinvested a larger portion of their profits (pp. 455-6).

3/ "For example, in the manufacture of a diesel engine for commercial trucks, there are approximately 750 parts ranging from cylinder blocks to fuel injector pins. In the United States, close to 200 plants supply materials, raw castings, forgings, components, and parts to the diesel engine manufacturers. To produce these parts, as many as 300 different materials are required, each with narrow standards on physical and chemical characteristics and shapes or finishes. Over 10,000 seperate manufacturing steps are required to convert materials and castings into finished parts for a single model .... (To build diesel engines) 8 to 10 volumes (3,000 to 4,000 pages) containing materials standards and manufacturing specifications are required. There are approximately 145 technical specifications, engineering information items, testing methods and engine-rebuild standards; 67 special manufacturing methods; 439 materials standards, 240 process standards; and 25 salvage procedure standards for rejected parts." Baranson (1969) pp. 29-31.

engines. No doubt its accumulated learning has enabled it to transfer the technology at lower cost (to both parties) than had been incurred in the first instance, and than would have been incurred if the original TNC had made the second transfer.

The extra costs of buying technology from a developing country rather than an industrialised one arise precisely from getting small-scale 'appropriate' technology. There may be the out-dated nature of technology, lower quality of output, lower export potential and smaller financial and technological capabilities of the supplier. How important and widespread these costs are cannot be assessed now, but, since developing country exports are not (with a few notable exceptions like offshore assembly of electronic components) in high R + D, rapid-change, export-based products in any case, 1/ these are unlikely to be very high. Existing data, for instance Lecraw (1977), do not indicate that low quality is a problem with technology exported by Third World TNCs.

There are also the potential indirect costs of a new form of technological dependence, of getting pre-digested, adapted technology which can inhibit comparable efforts locally. This is a real problem. The answer to it lies in correct technological policies within each developing country. In so far as a significant element of such policies lies in 'unpackaging' foreign technology and promoting local training, enterprises from other developing countries have shown themselves much more willing to get 'unpackaged', and to provide training and support to local efforts, than the established TNCs. In fact, a number of transactions have started as export sales, and have developed into turnkey projects and into joint ventures at the request of the buyer: the exact opposite of the real TNCs, which have come in with a highly profitable package of technological and other advantages which they have, naturally, been reluctant to dismantle. 2/

This is not to argue that as Third World enterprises gain in size, spread and reputation, they will necessarily remain better 'corporate citizens' than the TNCs of the industrialized countries. It is possible that they may also resort to transfer pricing, market allocation, monopolistic pricing or local technology-inhibiting practices which are feared in the operations of the traditional technology suppliers. Two points should, however, be noted in this context. First, many of the undesirable practices associated with the established TNCs are based precisely upon the possession of a profitable monopolistic 'package' (of capital, organization, brand names, patents, skills, R + D, and the like): since Third World technology suppliers possess mainly specific skills and not

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1/ There are notable exceptions, however, apart from the obvious cases of textile factories set up to take advantage of GSP. Kirloskar's of India have set up a (joint venture) electric motor plant in Malaysia which started exporting to S.E. Asian countries, Australia and New Zealand within 3 years of starting production. Furthermore, some Third World investments in developed countries (especially Europe) are being undertaken precisely in order to export (to the EEC).

2/ For a longer discussion see Lall and Streeten (1977).

a larger 'package', they cannot, by their very position use monopolistic practices to the extent that industrialised country firms can. Second, there may be greater moral and political pressures on Third World technology sellers to be sensitive to needs for local control, local technology creation and increased exports on the part of recipient countries[1/]. A longer-term strategy should aim to reinforce and perpetuate these pressures to ensure that the unfortunate frictions that have arisen from past TNC operation are not experienced again.

In sum, therefore, the purchase of technology from developing countries seems to offer considerable economic benefits. It also offers benefits of a broader sort. In the context of present negotiations on the New International Economic Order, where the building up of a common bargaining position and awareness of interdependence by the developing countries is of prime importance, the growth of intra-Third World trade in technology is of obvious significance. It contributes to greater independence of Third World countries as a group, strengthens their position in buying technology and, most importantly, leads to a more acceptable division of effort (and hopefully more fruitful co-operation) between established and emerging industrialisers.

V. New Mechanisms for International Co-operation

It should be clear that the growth of exports of technology by developing countries, in all its forms, is an emerging phenomenon of great significance for both the Third and the industrialized worlds. This phenomenon should be further investigated and the hypotheses advanced above should be tested and evaluated on the basis of more broadly-based evidence. The evidence at hand, nevertheless, suggests strongly that some developing countries can become major suppliers of technology to other such countries, and can increasingly participate in certain forms of technological activity in the highly industrialised countries. These trends need positive policy mechanisms at the national and international levels to strengthen, direct and spread their benefits.

National measures to strengthen technological capabilities in manufacturing industry cannot be considered at any length here. There are several broad areas of policy making involved, ranging from educational and science structures, the setting up of basic R+D institutions and the promotion of in-house R+D in manufacturing establishments to broad industrial strategy, the control of direct investments and technology imports, and the dynamics of industrial innovation in the industrialized countries. Clearly, some of these depend on social, political and economic factors much broader than the issue of promoting technological progress. Nevertheless, the keen interest shown by several of the more industrialized developing countries in controlling foreign technology inflows, promoting domestic industry and formulating comprehensive technology plans bears witness to the need felt for achieving a measure of technological independence.

1/ See Wells (1977).

It has been argued in this paper that the creation of indigenous technological capability, being inherently a slow and costly learning process based on a specific experience of manufacturing activity, cannot be left to 'free' market forces. Three types of government intervention may be required:

- to provide the establishment of manufacturing capacity locally, incorporating (where feasible) a capital goods sector;

- to provide local control or ownership of manufacturing enterprises, and to limit investments under the control of TNCs from industrialized countries to areas where local technological capability cannot compete; and

- to stimulate local investments in design, adaptation and innovation activity, to promote the use of indigenously developed technology and to reduce, where possible, a passive dependence on foreign technological activity where this can be undertaken locally.

Every type of government intervention entails costs as well as benefits, and the literature is replete with analyses of the inefficiencies created by excessive 'self-reliant' industrialization. A technological development policy must, therefore, try to strike a careful balance between:

- promoting domestic industrialization on a wide front and the risk of setting up unviable industries;

- protecting local enterprises against foreign entry and setting up inefficient, stagnant monopolies;

- promoting local technology and cutting the country off from access to advances abroad, or wasting scarce resources in 'reinventing the wheel'; and

- creating a dynamic technological infrastructure and setting up scientific institutions which are isolated from the production structure, or which produce technology that is incapable of competing internationally.

The best instrument for achieving such balance can only be discovered after further research and trial-and-error. Even if the validity of fostering "infant technological capability" argument is accepted, it may well be that subsidies are more efficient tools than protection against imports and foreign investments. Past experience of Japan, and more recently of India, suggest, that a judicious combination of the two is probably required, but a deeper study of technological failures and successes in these and other countries is needed before a clearer picture emerges. What does seem apparent now is, however, that a number of seemingly inefficient enterprises set up in the heyday of import-substitution policies are now turning out to be highly competitive exporters of modern technology: the lengthy periods of protected production were perhaps only the protracted

costs of 'learning'. These costs need to be reduced, certainly, but the fashionable wholesale condemnation of import substitution needs some rethinking.

Let us turn now to mechanisms for international co-operation, noting again that this paper concentrates on exports of technology which take place in response to market forces. International co-operation to set up multinational enterprises (i.e. jointly owned by different countries) and to engage in co-operative R+D are considered elsewhere.

International co-operation can be considered separately for South-South co-operation and North-South co-operation.

South-South Co-operation: The aims of South-South co-operation promoting technology and capital transfer between developing countries is fourfold:

- first, to maximise the flow of such transfers by providing information and incentive and reducing barriers;

- second, to accord preferential treatment to intra-south technology flows vis à vis North-South flows;

- third, to ensure that the transfer takes place without restrictive, monopolistic or exploitative practices; and

- finally, to ensure that the transfer accompanies indigenous efforts on the recipient's part to develop its own technological capability.

Since the present discussion focusses on market-governed technology flows, the main measures for promoting them must come from national policies. Thus, the exporting countries may set up promotion centres at home as well as in the importing markets to inform both parties of the technologies that are needed and available, of the terms, specifications, costs, and so on involved. The importing countries can implement a more liberal policy on technology and capital inflows from other developing countries, and,more importantly, give special consideration to awarding contracts to Third World suppliers when their terms, quality and deliveries are comparable to those of industrialized country suppliers.

The chief co-operative mechanism that can provide South-South technology flows is an information and advisory centre that actively collects data on technological capabilities, certifies their quality and provides these, with appropriate inducements (like financial assistance), to technology importing countries - a sort of International Technology Brokerage System (ITBS). The need for an ITBS arises from the high costs to national governments in developing countries of doing such information provision and collection individually. The traditional information links on technology have run strongly North to South, and the establishment of an effective horizontal link will be an arduous and complex task, which individual exporting countries will find extremely expensive to undertake for all their potential markets. An ITBS scheme will clearly enjoy enormous economies of scale, especially if it is based on a pool of accumulated experience of needs and capabilities as in UNIDO. The feasibility and benefits of such a scheme may be

illustrated by an example: UNIDO has recently acted as the agent for selling an Indian multi-purpose pharmaceutical plant to Cuba.[1] Normal market channels could never have effected this sale, despite its technical and economic merits, while the information normally collected by UNIDO activities provided an effective means of communication and co-operation. The strengthening and extension of such activities by UNIDO, under a formal ITBS, would clearly be of enormous benefit to developing countries in co-operative ventures, where their differing specializations can be ' ded productively.

As far as safeguards against monopolistic practices by Third World technology exporters are concerned, what is needed is a Code of Conduct along the lines of the code developed by UNCTAD for technology transfers from the industrialized countries. This Code would need to be negotiated and agreed between the group of technology-exporting and -importing countries, and its implementation may be made legally binding, or left to the offices of the ITBS. The establishment of codes raises a host of difficult legal issues that deserve separate consideration, but these cannot be examined in detail here.

North-South Co-operation: There are two issues which arise as far as the development and export of Third World technology is concerned:

- first, the acceptance and co-operation of the North of indigenous technological development policies by developing countries; and

- second, the implementation of measures to facilitate technology imports by the North from the South.

The acceptance and co-operation of the North in the efforts of the South to develop local technology can take several forms, based mainly on national measures: The provision of technical assistance the granting of incentives to TNCs which take minority positions in joint ventures with local enterprises in developing countries, the granting of incentives to the establishment of R+D facilities in developing countries, the training of engineers and scientists in industrial establishments, and so on. There seems little scope for co-operative mechanisms here, except in the broader sphere of scientific exchange.

The facilitation of technology imports by the North from the South does require special co-operative action, for the same reasons that it does in the South: removal of barriers to the operations of Third World technology exporters and provision of information. In the latter case it can take place under the auspices of the ITBS, which can help to establish contacts with technology buyers in industrialized countries, to set up promotion centres in the major industrialized countries, and to promote co-operation among different consultancy organizations from the Third World. As noted earlier, some established TNCs have been sub-contracting parts of their technological work to firms from developing countries. There is no reason why such a division of labour cannot be extended to firms within the Third World in exports to industrialized countries.

1/ Furthermore, several of Dastur's overseas steel consultancies originated in contracts awarded by UNIDO.

Since the success of technological sales often depends crucially on the seller's maintaining close contacts with buyers, developing countries should try to maintain offices or links with the major industrial centres in the industrialized countries. Again, there are enormous economies to developing countries in centralizing these efforts, and the ITBS can serve this function by establishing links with the appropriate firms, ministries and trade associations. Once the viability and economy of many Third World firms is established, this function will become much easier: it is the initial stages of providing information, assessing needs and breaking down barriers and suspicions that will be difficult. The sale of technological services to the industrialized world has already started, however, and these difficulties do not look as great as they may have done a few years ago.

In sum, therefore, the major new mechanism that is needed internationally in this context is an International Technology Brokerage System. The institution which already has relevant experience, and which is best suited to undertake this task, is UNIDO. This agency should set up a data bank on the technological capabilities of developing countries, and should actively promote the sale of their technology to other developing and to industrialized nations.

Table 1: Latin American parent companies and their affiliates in the region, 1976

Country	Location of affiliate		Location of parent company	
	Number	Percentage of total	Number	Percentage of total
Argentina	2	1.2	69	34.0
Bolivia	14	8.2	2	1.0
Brazil	26	15.3	15	7.4
Colombia.....	14	8.2	21	10.3
Costa Rica	5	2.9	3	1.5
Cuba	1	0.6	2	1.0
Chile	3	1.7	12	5.9
Ecuador	55	32.3	4	2.0
El Salvador	1	0.6	2	1.0
Dominican Republic.	2	1.2	1	0.5
Guatemala	1	0.6	2	1.0
Guyana	-	-	1	0.5
Honduras.....	2	2.4	1	0.5
Jamaica	4	2.4	3	1.5
Mexico	3	1.7	19	9.4
Nicaragua	2	1.2	2	1.0
Panama	2	1.2	1	0.5
Paraguay	4	2.4	3	1.4
Peru	7	4.1	16	7.9
Trinidad and Tobago	1	0.6	1	0.5
Uruguay	9	5.3	2	1.0
Venezuela	6	3.5	21	10.3
Binational.....	4	2.4	-	-
Total	170	100.0	203	100.0

Source: United Nations Centre on Transnational Corporations, (1978), p.231.

Table 2: Intra-regional direct investment stock, Latin America, by host country and by country of origin, 1971 and latest available year

(Millions of dollars)

Countries of origin	Host countries										
	Argentina	Brazil		Chile	Colombia		Ecuador		Mexico	Venezuela	
	1974	1971	1976	1974	1971	1975	1971	1976	1974	1970	1974
Argentina	-	7.5	13.3	0.1	0.1	0.9	-	4.5	5.3	...	11.2
Brazil	9.1	-	-	5.2	0.4	2.0	-	4.4	7.2	...	1.6
Chile	-	-	-	-	0.1	0.1	-	-	-	...	0.7
Colombia	0.9	-	-	-	-	-	2.7	7.9	-	...	1.2
Mexico	1.0	2.6	6.9	5.3	1.4	7.5	-	4.0	-	...	4.7
Peru	0.9	..	.	0.8	0.3	0.8	-	1.4	3.6	...	-
Uruguay	2.2	8.3	12.0	-	4.6	4.7	-	-	-	...	2.1
Venezuela	0.1	4.2	9.0	1.7	10.5	19.3	3.4	10.3	1.8	-	-
Latin American Free Trade Area	-	-	1.0	-	0.3	0.3	-	-	3.5	...	-
Sub-total	14.2	22.6	42.2	13.1	17.7	35.6	8.1	32.5	21.4	6.7	21.5
Panama	80.6	80.1	275.0	...	36.4	53.7	...	4.0	119.3	...	...
Bermuda	...	12.2	39.0	...	0.7	1.0	...	-	...	...	...
Netherlands Antilles	...	75.2	192.0	...	13.4	20.2	...	-	...	...	...
Bahamas	...	21.7	66.0	...	13.7	10.0	...	-	...	...	...
Other	...	-	39.0	...	1.2	3.9	...	-	...	...	...
Total	...	211.8	653.2	...	83.1	124.4	...	36.5	...	...	...

Source: United Nations Centre on Transnational Corporations, (1978), p.246.

Table 3: Intra-regional direct investment stock, a/Asia, by host and origin, 1976

Origin	Host country or territory			
	Thailand b/	Indonesia	Philippines	Hong Kong
Malaysia	5.0	42.7	...	...
Hong Kong	10.9	728.3	14.2	...
India	2.4	19.4	...	...
Philippines	0.9	272.1	...	3.4
Singapore	2.2	115.6	...	13.4
Korea, Republic of	...	107.4	...	...
Thailand	...	...	...	29.7
Other Asian developing countries	22.1	102.9	3.1	7.3
Japan	74.5	1,216.6	124.2	56.8

Source: United Nations Centre on Transnational Corporations, (1978), p.247.

a/ The data for Hong Kong, the Philippines and Thailand refer to assets as reported in the sources listed above; the data for Indonesia refer to approved projects as of 1976.

b/ 1975.

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