

Australia and Technology Transfer to Developing Countries (TTDC)*

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1. Scope of the study

This study probes the rationale for the Transfer of Technology to Developing Countries (TTDC) from Australia, itself highly dependent on foreign technology. It is argued that TTDC would have to be appropriate not only from the perspective of macro-economic and strategic goals of the donor but also from the basic needs attainment and self-reliance objectives of the recipient Developing Countries (DCs). The latter implies the nurturing of an indigenous technological capability.

Several mechanisms engaged in the Australian TTDC are critically reviewed. The Australian aid program and international technical co-operation in Science and Technology (S&T) are overtly non-commercial TTDC mechanisms. In contrast, off-shore investment and consultancy by Australian Transnational Corporations (TNCs) and trade in manufactures are commercial in orientation.

Australia as a benign donor has responded sympathetically to the needs of DCs for technology. However, despite recent attempts at streamlining, Australian TTDC remains fragmented and ad hoc. The implementation of an effective and optimal policy package on TTDC requires a fuller comprehension of the trade-offs between the various transfer mechanisms outlined in this study. This study focuses on above issues which would enable the formulation of more effective policies and institutional co-ordination for fruitful TTDC — a positive-sum game.

2. Rationale of technology transfer by a dependency

Australia, according to many descriptions and quantitative indicators, could be classified as a technological dependency. The overwhelming dependence of Australia on imported technology has been one of the main concerns of the current debate on the impact of technological change on Australia's macro-economy (BIE, 1981; Stubbs, 1980; Myers, 1980;

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Treasury, 1979; Badger, 1979). The magnitude of foreign domination of Australia's technology is demonstrated by three indices: over half of the national industrial Research and Development (R&D) expenditure, 90% of payments by firms for technical know-how, and 93% of the patents granted in recent years were of foreign origin. (See Table 1)

Table 1. Indices of Foreign Technological Domination of Australia

Index	Unit	Total Expenditure	Foreign domination as (%) of total	Year
Industrial R&D	\$A million	157	50	1976-77
Firms' payments for know-how	\$A million	130	90	1978-79
Patents granted	Numbers	8425	93	1980

Source: Ganicott, op. cit. Tables 1, 2, 4.

Therefore, a moot question is whether a technological dependency has the capacity to engage in worthwhile TTDC. Although Australia is technologically dependent, it has established the 'critical minimum' human and institutional infrastructures necessary to adapt and absorb technology transferred to Australia from overseas. The national debate on the impact of technological change is narrowly focused on the adequacy of present capabilities to meet national needs. But, from the perspective of developing countries Australia as an intermediate economy has a very constructive role to play in the process of TTDC.

Australia has favourable access to the technologies of advanced countries. Transnational corporations (TNCs) operating through local subsidiaries adapt technology to suit the scale and market conditions of the Australian economy. These modifications to process and product technologies make them more appropriate to the resource endowments and development objectives of DCs (Parry, 1981). Thus through a two-stage transfer model: first, from advanced to the intermediate Australian economy and then, after modification to DCs, Australia can play a mid-wifery role in the much coveted transfer of appropriate technology to the DCs.

The transfer of technology to DCs has positive implications for trade and the balance of payments. By TTDC Australia can stimulate trade with her neighbours and further-innovation generating R&D activity at home. However, in the current technology debate in Australia, the positive sum game in TTDC is ignored. This may be due to the tacit belief that TTDC is a political hot-potato in an economy in reverse gear. The Australian economy is currently plagued by double digit inflation and an unemployment rate moving towards an unprecedented 10%. The deficit on the current account of the balance of payments

exceeds 1 billion dollars. TTDC at a glance may seem to have the potential of worsening Australia's economic headaches. Although the outlook for the Australian economy is bleak in the 1980s (ISAR, 1982), despondency is no basis to ignore TTDC. An effective TTDC policy would help Australia to soften the harsh economic effects of the recession.

The lack of an effective policy on TTDC could also tarnish Australia's long-standing track record in the eyes of the world as a benign donor. The flagging support for the commitments by advanced countries on TTDC at the 1979 United Nations Conference on Science and Technology for Development (UNCSTD) in Vienna has been noted by DCs. High-powered missions from DCs have recently been lobbying donors for a more generous and effective approach to break the constraints on smoother TTDC. Australia could take the lead in this respect and reap benefits, not only in goodwill but also in terms of trade in S&T hardware and software. Tardiness will result in losing stature and commerce to astute competitors.

3. Issues in technology transfer and appropriate technology

Technology exhibits some of the peculiar characteristics of public goods: indivisibility; inappropriability; uncertainty; factor embodiment, and price indeterminacy (Streeten, 1982). The price of technology is determined more in the framework of a duopoly model and therefore the outcome is related to the bargaining strengths of the donor and the recipient. The lack of 'information about information' (Vaitsos, 1970) could make recipient DCs the victim of extortion through exorbitant economic rents in the technology transfer process. Australian TTDC can help to strengthen the negotiating hand of DCs in bargaining for TTDC on fair and equitable terms. In the long-term this would necessitate the up-grading of the human infrastructure in DCs.

However, TTDC should not be regarded as a black-box whereby the supply of hardware and software would remove the brakes on development imposed by the absence of a fair-priced technology. It is now widely recognised that, besides the supply-side, the demand-side of the equation of technology transfer needs to be tackled simultaneously. The demand for technology is inextricably linked to the widening and deepening of the productive base of the recipient's economy. Transferring technology without integrating it to the production base of the economy can only have temporary benefits and in the long-run can prove to be dysfunctional. It is pertinent therefore to assert that TTDC should be geared to the recipient economy's industrialisation and overall development strategy. The industrialisation process in DCs would create effective demand for technology. Moreover, the TTDC to be appropriate should be consistent with a DC's economic development goals. In other words TTDC must meet the specifications of a basic needs strategy (BNS) or-synonymously-the dictates of poverty-oriented and employment-generating policies (Bhalla, 1979:30).

The emphasis on TTDC should not mislead policy-maker to construe that the supply of technology will be the magic lever trigger off Say's law, and demand will look after

itself. On the contrary, there is ample evidence that transfer of technology can be counter-productive and inappropriate unless it is directed to the central issue of creating *pari passu* an indigenous technological capability. This means, the establishments of human and institutional infrastructures to adopt and modify imported technology for self-reliant development by the use of local engineering and design capabilities.

A through-going realignment of domestic policies prevailing in many DCs is imperative to implement the concept of appropriate technology in DCs. Many DCs pursue factor pricing policies that do not reflect the true opportunity costs of the country's resource endowments. Capital is overpriced due to tax-holidays, exchange rates are overvalued and interest rates, are kept low whilst labour is under-priced as a consequence of minimum wage laws (Robinson: 1979:27). Appropriate technology implies getting the prices right so as to reflect the true scarcity values of resource endowments and to achieve the development goals articulated in redistributionist development strategies.

Advanced countries can also contribute to the appropriate TTDC by diverting a larger fraction of their R&D expenditure to research relating to DC problems. In this regard it is noteworthy that only a mere 2% of the world's R&D is developed to DC issues. Over 50% of R&D is spent on defence and harmful activities.

4. Mechanisms of Technology Transfer to Developing Countries (TTDC)

In a broad sense we could identify at least four major mechanisms that facilitate TTDC from Australia. They could be categorised into non-commercial transfer and commercial transfer mechanisms. Under the rubric of non-commercial transfers are the Australian overseas aid operation administered by the Australian Development Assistance Bureau (ADAB), and the International Co-operation in Science and Technology.

There are two major commercial transfer mechanisms operating in the Australian TTDC. They are private foreign investment and consultancy by Australian TNCs in CDs, and trade in S&T-related goods and services with DCs. In a global context the quantitative importance of commercial transfer of TTDC far outweighs non-commercial transfers. But Australia being a technological dependency declares that her aid program is the major vehicle of TTDC. Bilateral aid, nearly one-third of which is procurement-tied accounts for 80% of the total overseas aid and the balance is multilateral. Aid-tying indicates the hidden commercial motives of an overtly non-commercial Australian aid program to DCs.

Australian TNCs engage in commercial TTDC. They use at least four main channels: wholly -or partly-owned subsidiaries; joint ventures with DC entrepreneurs or governments; licensing agreements and turn-key projects. The characteristic of all TNC operations is that they control a magic package of production, marketing and managerial know-how. By spatially dispersing the package TNCs reap monopolistic rents. It is also alleged that TNCs transfer inappropriate technology to the DCs — the costs of leakages caused by that technology far outweigh the benefits from linkages.

In the subsequent sections an in-depth critical review of the various major Australian non-commercial and commercial TTDC mechanisms identified above will be attempted.

5. Technology transfer and the Australian aid program

The Australian aid program aims to serve simultaneously a multiplicity of goals: humanitarian, strategic, commercial, political, and TTDC. The last objective emanates from the recent ADAB perception, that technology transfers have an instrumental role to play in the promotion of self-reliant development in recipient DCs. The magnitude of Australia's aid program for 1980-81 is given by its value which was \$A 558 million. This accounts for about 0.48% of GNP. If we consider the Science and Technology (S&T) component of aid as a surrogate for TTDC, nearly 28% of the total aid could be attributed to TTDC. But when the budgetary grant for Papua New Guinea which accounts for over 40% of Australia's total aid is excluded the TTDC component rises to 50%.

It should be noted that multilateral aid scores twice over bilateral aid. The TTDC component of multilateral aid is 50% compared with the 23% of bilateral aid (See Table 2).

Table 2. TTDC Component of Australian Aid (1980-81)

Aid	Total Aid \$A million	TTDC proxy \$A million	TTDC as % of total aid
Bilateral	457	107	23
Multilateral	101	51	50
TOTAL	558	158	28

Source: ASTEC (1982) op. cit. Table 8.1;
Budget Paper No. 8, 1981-82.

Nearly \$A13.4 million, or just over 2% of the total aid budget in 1980-81, was committed to the strengthening of national research or what is tantamount to the building of an indigenous technological capability DCs. In the aid program the over-emphasis on agricultural and livestock projects and the bias towards rich country regional projects were clearly evident. Over 30% of the total research expenditure was in agriculture and 25% was undertaken for the most advanced DCs: e.g. in ASEAN. The international S&T program also received strong support with the allocation of 25% of the total TTDC funds (See Table 3).

The rich country bias in Australian aid surfaces in the geographical distribution of funds for S&T projects with an overt training or technical assistance program. Out of \$A55.5 million allocated for the above purpose ASEAN countries received 64% of the total while the more populous and poorer South Asian countries received only 19%. The same bias was observed in the geographical distribution of S&T assistance projects providing goods

Table 3. Aid for building national technological or research capability (1980-81)

Project	Percentage of total Expenditure (%)
Agriculture & livestock	30
ASEAN Australia regional co-operation	25
International S&T program	25
Australian Universities International Development Program	9
Regional Research & Training Centre	6
Others	5
TOTAL (\$A13.4 million)	100

Source: ADAB Statistical Summaries 1979-80.

and services of a technological nature: ASEAN accounted for 41% of the total; Oceania 26%, whilst South Asia received only 13%. However, almost 98% of the cash grants totalling \$A5.7 million were allocated to Oceania for the purchase of professional and technical goods and services (ASTEC, 1982: 36-38). The imbalance in Australian TTDC due to the over-emphasis of the allocations to agriculture and livestock appears misplaced in the face of DCs, priorities for the harnessing of the radiant dynamics of industrialisation. These imbalances need to be rectified. Further, the rich country bias which arises due to the larger potential of trade in technology from DCs at a higher level of economic development needs to be redressed on equity grounds.

The sectoral composition of Australia's bilateral aid reveals that much of this aid flows into capital-intensive sectors in DCs. Australia, of course, has a comparative advantage in capital-intensive or labour saving technologies, but their appropriateness to DCs is questionable. Road building, water supply, irrigation and such public utilities account for a high 38% of the total bilateral aid budget. Agriculture and education receive the next largest allocation (See Table 4). An efficiency audit on Australia's overseas aid revealed several deficiencies in some large public sector projects (ADAB, 1981). Overall the sectoral allocation of Australian aid shows a bias in favour of capital-intensive public sector projects. Whether such projects are consistent with poverty-eradication and employment-creation goals in DCs is debatable. The Australian aid program's TTDC therefore, needs re-examination in the light of DC development aspirations.

6. Spin-offs to TTDC from Australia's international co-operation in S&T

Australia leans heavily on international S&T exchange for the bulk of her technology requirements. The transfer process is carried out by informal means involving personal contact, research publication and conferences.

Table 4. Sectoral Composition of Australian bilateral aid (1980)

Sector	Percent of total
Public utilities	28
Agriculture	21
Education	18
Multisector	7
Social infrastructure	5
Miscellaneous	11
TOTAL	100

Source: ADAB Statistical Summaries, 1979-80.

Some 15,000 S&T personnel in government, tertiary and commercial institutions are engaged in this international S&T co-operation effort in Australia. Being non-commercial just like aid, it has a significant potential for the transfer of appropriate technology and the building of indigenous capability, at little cost to the recipient DCs.

Nearly 80% of the multilateral technical co-operation funding of \$A19 million, has been channelled to UN related agencies. The balance was spread equally between OECD and Commonwealth agencies (See Table 5).

Table 5. Australian Funding of International S&T (1980-81)

Organisation	Total \$A million	S&T component % of total
UN	15	80
OECD	2	10
Commonwealth	2	10
TOTAL	19	100

Source: ASTEC, op. cit., Table 5.1

The multilateral program of S&T transfer is primarily designed for Australia's own benefit. However discussion of these transfers to Australia in internal for a provide useful opportunities for interaction with DCs, S&T requirements for TTDC.

The Commonwealth and the State Governments also operate programs to share S&T research in certain areas with DCs. The Commonwealth Scientific Industrial Research Organisation (CSIRO) carries out research related to Australia's primary and secondary industries. In 1980 the Center for International Research Co-operation (CIRC), an arm of CSIRO, handled projects in over 40 countries. They were valued at nearly \$A4 million. CSIRO's computer-based information bank is used by many scientists in DCs.

In collaboration with the Department of National Development and Energy, a national

network of information on renewable energy is being developed to serve national and DC interests as well. (Commonwealth Record, March 1981:248).

Tertiary institutions play a critical role in the general process of technology transfer. The recent curtailment of study-leave entitlements to academics in this context has been viewed with concern by the Australian Science and Technology Council (ASTEC). A number of professional bodies such as the Australian Academy of Sciences also have programs that pass on some of their benefits to DCs.

Australian policy-makers have been aware for some time, of the spin-offs national R&D and S&T programs based on international co-operation can have for TTDC. In fact, the National Paper presented at UNCSTD in 1979 recognised that: "Australia's experience in applying science and technology for its own development can be of considerable assistance to developing countries" (Australian National Paper, 1979:85). The chief spokesman for Australia at UNCSTD acknowledged that there were spin-offs from Australia's own international co-operation for TTDC. However, they were unco-ordinated and marred by ad-hocery. He announced that the Australian government proposed the establishment of an umbrella organisation – the Australian Science Technology Co-operation (AUSTREC) program (Farrands, 1980:25) to administer effectively the spin-offs to TTDC from Australia's international co-operation in S&T. In 1981 the government also established the Advisory Council of the Australian Centre for Agricultural Research (ACIAR). Besides, the Consultative Committee for Research and Development (CCRD) was streamlined to provide quality advice to ADAB in its efforts to program TTDC effectively. "Since the 1970s, changes in the policy machinery of the government have infused a breadth of pragmatism into R&D, and have lead to the integration S&T policy in Australia" (Middleton, 1983). But from the point of view of TTDC, much still remains to be achieved. The government continues to dominate R&D as in many technologically dependent economies accounting for 76% of R&D. The overseas component of GERD is a paltry 1%. (See Table 6). In view of the

Table 6. Percentage Distribution of Gross Expenditure on R&D
(GERD in Australia 1978-79)

Source	% of GERD
Commonwealth Government	66
State Government	13
Business enterprise	21
Higher education	—
Private non-profit	2
Overseas	1
TOTAL	100

Source: Middleton, op. cit., Table 1. p. 287

fact that R&D as a percentage of GDP is less than 1% (and even decreasing) in Australia, it is clear that Australian performance on TTDC cannot be substantial.

Despite some improvement the TTDC strategy of Australia remains fragmented and unco-ordinated. The complex nature of the trade-offs between various commercial and non-commercial TTDC mechanisms have not been properly analysed and interpreted. Such information provides decision-makers with insights into the Australian TTDC and the efficacy of Australia's international co-operation in S&T.

7. Australian Transnationals and technology transfer

The off shore investments by Australian transnational corporations (TNCs) is an important commercial mechanism of TTDC. The value of TNC investment in DCs in 1979-80 was \$A333 million. This was equivalent to about 60% of the value of total Australian aid to DCs that year. As we mentioned earlier, the activities of TNCs in DCs have negative as well as positive effects. In this section, avoiding polemics, a feel for the nature and structure of TTDC by Australian TNCs will be given using aggregate proxies.

The sectoral composition of TNC investment according to data from a recent Bureau of Industry Economics (BIE) Survey is concentrated equally in manufacturing and services. These sectors are prone to technology transfers although quantification of the technology magnitudes are at this stage unknown. The manufacturing and service sectors accounted for 49% and 45% respectively of the total Australian private investment in DCs in 1979-80. At a disaggregated level manufacturing comprised mainly chemical, metal fabrication and machinery firms. These branches of manufacturing have a high degree of engineering design and skilled manpower requirements. Presumably, there was substantial TTDC by Australian TNCs through the above manufacturing activities. The service activities at a finer level of disaggregation encompassed the wholesale and retail distribution of Australian products, property and financial management etcetera (Bennett et al, 1981). The regional distribution of Australian TNC investment in DCs reveals that Asia and Pacific were favoured locations. Together, DCs in Asia and the Pacific accounted for nearly 45% of the total Australian private investment flows to DCs (See Table 7).

The TNC investment in DCs according to the BIE survey were not primarily motivated by TTDC. The main motive of Australian private investment was to capitalise on the growth prospects offered by host country markets. But economic rents, patenting and licensing technology in host DCs undoubtedly were attractions for the TNCs. The survey identified lower unit costs, safeguarding export markets, entry into adjacent markets, profiting from incentives and tax-holidays as other lures of Australian TNC investment in DCs. These diverse motives for TNC investment in DC make it clear that TTDC was regarded as a secondary spill-over of TNC activities.

There is no neat theoretical explanation of TNC motives for investment in DCs. Perhaps the eclectic synthesis of trade, capital and growth of firm theories all offer plausible expla-

Table 7. Australia's TNC investment abroad (1979-80)
Composition (Percentage)

Sectoral	%	Regional	%
Primary	3	Pacific	15
Manufacturing	49	Asia	30
Services	45	Other Developing	1
Others	3	Developed	54
Total (\$A333 million)	100	Total	100

Source: Bureau of Industry Economics Survey quoted in Bennett et al. (1982) op. cit. Table 2, p. 4.

nations for TNC investment behaviour (Denning, 1979). The eclectic explanation argues that TNCs move to DCs to internalise the monopolistic advantage they exert on the magic package and exact as much economic rent as possible from the host country market.

The restrictive business practices of TNCs of advanced countries prompted DCs to demand a mandatory code to regulate their activities. However countries such as Australia have been reticent to support the mandatory code and perhaps opted to support the OECD voluntary code to control TNCs. DCs are overtly concerned about the adverse effects of TNC activity but that TNCs are a very powerful vehicles for the transfer of technology cannot be gain said.

Australian investment overseas has been increasing at over 16% per annum during the past decade. TNCs in donor nations, such as Australia, have been chastised for exporting jobs and capital. The arguments are lopsided as the evaluation of net effects of TNCs on DCs should reckon the impact of TNCs on the balance of payments and job creation in the export sector. These overall effects can be assessed only by considering many other facets, such as trade.

Consultancy services figure prominently in TNC-TTDC. In 1981 over \$A100 million was added to export earnings of Australia through consultancy contracts. The government offers a variety of incentives to promote consultancy contracts: The Australian Overseas Project Corporation (AOPC) helps TNCs to win overseas contracts; a Consultancy Services Feasibility Study Fund (CSFSF) is operated by the Department of Trade. Also, income tax-exemptions are offered to Australians working on overseas consultancy contracts (Overseas Trading, 1982: 691). Consulting services no doubt transfer to recipient DCs the much needed know-how as a side effect. Locals collaborating with foreign experts benefit from 'learning by doing' and this eventually enhances the domestic technological capabilities of DCs.

8. Trade as an engine of technology transfer

Australia's trade with developing economies transfers product and process technology and acts as an engine of growth in the recipient DCs. Australia's total trade with DCs has been growing at an annual average rate 60% over the past two decades. Imports have continued to grow only at about 30% per annum. Australian exports to DCs comprise mainly rural, mining, processed resource-based and manufactured products. The shares of Australia's total trade show that DCs account for about 20% of Australia's imports and over 40% of Australia's exports. Industrialising DCs account for an important slice of the total trade of Australia's DC trade (See Table 8).

Table 8. Australia's Share of Trade with Developing Countries
As Percentage of Total (1979-80)

Group	Imports (%)	Exports (%)
ASEAN	5	7
NIC	8	7
Low income DCs	4	11
Mid-income DCs	5	7
Total DCs	20	42

Source: Industries Assistance Commission quoted in Warr & Lloyd, op. cit., Table 1. p. 5

Due to problems of netting out TTDC components, trade in manufactures is assumed to provide a crude proxy of the size and direction of Australia's TTDC. However, it is appreciated that trade in manufactures may not reflect DC needs and may be affected by Australian sales promotion, brand names and aid-typing. But this is the best available proxy at this stage, and manufactured imports and exports from developing economies of Asia, which account for over 50% of all DC manufactures, are analysed (See Table 9). These figures indicate that manufacturing exports to DCs account for only about 15% of total Australian exports. They are projected by the Industries Assistance Commission (IAC, 1981) to grow at over 10% in 1980s. Due to the importance of manufactured trade in terms of TTDC and in value terms a further examination of the situation in Australia – DC manufacturing trade is attempted next.

The economies of developing Asia have been industrialising at a spectacular rate, generating pressures on Australia's standard technology industries, such as clothing, footwear and textiles. Industrialisation in DCs offered Australia with opportunities for the sale of technology and specialised skills according to Australia's comparative advantage in resource based and high technology industries (BIE, 1978). Manufactured exports are anticipated to grow at roughly 10% per annum in the 1980s. So far manufactured exports have accounted for about half the share of Australia's total exports to DCs in the Asian region. Due to the

Table 9. Regional Share of Australia's Trade in Manufactures with Developing Asia. (% of Total exports and imports)

Region	Imports		Exports	
	1968-69	1977-78	1968-69	1977-78
Asia	1	4	10	8
Other East Asia	4	8	5	7
Total Developing Asia	5	12	15	10
Total	100	100	100	100

BIE (1981) Source: *The Structure of Australian Industry – past developments and future trends.*

Bureau of Industry Economics, Tables 3.2, 3.7.

failure to adjust positively, Australian manufacturing doles out huge amounts of assistance to inefficient industries to withstand competitive pressures. These neo-protectionists measures in turn impinge on Australian manufacturing exports and TTDC. The resources boom and the balance of payments surpluses generated by it have further eroded the competitiveness of Australian manufacturing exports in the world economy.

Australia can play a dynamic role in TTDC if it recognises the comparative disadvantage in clinging to certain labour intensive manufactures which could be relocated in DCs through TNC-TTDC mechanisms discussed in the previous section.

The import pressures on standard technology manufactures have created small job losses of about 0.1% of the work-force (Johns and Metcalfe, 1981). But in the long-run net employment creation by exports to DCs is bound to create positive net employment and income effects if proper measures of structural change are implemented.

Clear-cut policy actions are required to benefit from overseas investment and trade in the face of Australia's changing comparative advantage due to rapid DC industrialisation. The debate on Australian protectionism is clouded with confusion. Leading decision makers argue that Australian trade figures "make nonsense of the image of Australia as a country dug behind protectionist ramparts and indifferent to the needs of its Third World neighbours" (Fraser, 1981). Others contend that labour-intensive manufacturing in Australia is highly protected and effective adjustments "offer the most direct means by which government can give effect to its rhetoric on the importance of liberalising the trading environment faced by the poorer nations of the world" (Warr & Lloyd, 1982: 36). The debate on the political economy of neo-protectionism in Australia clearly indicates that there is much confusion about the exact impact of the high levels of prevailing assistance or effective rates of protection to the Australian manufacturing sector and its impact on DCs. The TTDC, which is an important part of the trade-engine of growth, remains a neglected issue in the

trade-protectionism debate of Australia. If the issues are not clearly identified and tackled, Australia will continue to lose opportunities for TTDC and benefits of trade with the dynamic markets of developing neighbours.

9. Conclusions and Recommendations

Australian policy on TTDC is institutionally diffused, fragmented in intent, and ad hoc in implementation. Although policy-makers are becoming increasingly sensitised to the need for the transfer of appropriate technology to promote economic development in DCs, Australian TTDC, despite recent attempts at streamlining by such measures as the establishment of CGIAR and CCRD to advise ADAB, is largely unco-ordinated and ineffective.

The conflicts and trade-offs that are inherent in the various commercial and non-commercial technology transfer mechanisms identified in this study are not fully reckoned in Australia's TTDC policy measures. A harsh critique of Australian policies conclude that "Australia can no longer afford the widespread scepticism and criticism aroused by aid policies which are, at best, cynically self interested and, at worst, a positive barrier" to the development of DCs (Hayden, 1981: 822). The time is opportune to formulate creative policies. Optimal policy-mixes and institutional back-up for implementation cannot be formulated without analysing and reconciling the conflicts that are inherent in the pursuit of diverse commercial and developmental goals. Some economists befuddled by the complexity of the issues involved in TTDC maintain an aloofness, and others rush to prescribe that donor countries would be wise to down-play TTDC. For example, it has been cogently argued that increasing the elasticity of supply of technology by fairer and freer transfers would undermine the capacity of DCs to build an indigenous technological capability (Leff, 1979). But this type of mumbo-jumbo typically is designed to condemn DCs to languish in their underdevelopment and is certainly of no value for a country such as Australia, committed to third-world development.

Besides, Australia's own development in the field of technological innovation may benefit more by collaboration with DCs than suggested at first blush. A recent exhaustive study on the Australian patent system argues that the benefit-costs ratio of the patent system for Australia may be negative – a point belaboured by UNCTAD on behalf of DCs for many years – and there is ample justification to take measures to reduce the costs inflicted by the system (Mandeville et al., 1982: 214). Australian aid is one-third procurement-tied. Off-shore investment stimulates the phasing out of inefficient local technology and the undertaking of high technology ventures consistent with Australia's revealed comparative advantage. Further, trade in technology with DCs will have favourable net effects on Australia's balance of payments, employment, and long-term growth prospects. TTDC is not just chaity to DCs but a positive sum game. To play it in a manner that is mutually beneficial requires the formulation of an optimal policy-mix for effective TTDC taking full cognisance of the mechanisms and goals of both Australia and DCs into consideration.

Such measures have to be formulated in the spirit of joint programming of projects of technical assistance as recommended by the Development Assistance Committee of OECD, recently (OECD, 1981). It should be, in other words, by collaboration between donor and recipients rather than by a top-down approach of donor-donor collaboration as in the past.

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