U.S. Hi-Tech Transfer Policy Towards Third World : A Case Study of Indo-U.S. Super Computer Deal

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CERTIFICATE

This Dissertation entitled "US HI-TECH TRANSFER POLICY TOWARDS THIRD WORLD: A CASE STUDY OF INDO-US SUPERCOMPUTER DEAL" by Mr. JASOBANT NARAYAN for the Degree of MASTER OF PHILOSOPHY is an original work and has not been previously submitted for any other Degree of this or any other University.

We recommend that this Dissertation may be placed before the examiners for evaluation.

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Jasobant Narayan

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PREFACE

The relationship between technology and international relations has been continuous and intimate. From the time of man's most primitive polities, the foreign policy problems and opportunities of states have been influenced by the nature of their technology for transport, communication, warfare, and economic production. But in the twentieth century, especially in post World War II period, the course took a new turn, as technology has started playing a major role in international relations.

Technology has been acknowledged throughout the post-war period as a linchpin of U.S. foreign policy. Indeed, much of U.S. post-war leadership has been based on the supremacy of U.S. military and civilian technology. In modern times, the advent of high technology has become an important factor in the advancement and development of the states, is also playing a major role, in foreign policy making of the modern states. For the United States, control over the transfer of high technology knowledge and goods to other nations as a tangible weapon which is employed openly as well as covertly to influence, the foreign as well as domestic politics of those nations to suit the American perceptions. At the one level the United States has been extremely apprehensive of the implications of the high technology leakage to the then Socialist bloc for its context of Memorandum of Understanding (MOU) on technological cooperation, was with good intention. Nevertheless, in the choice of computer, nature of utilisation the safeguards for technology leakage and its final delivery were subjects of controversy. Hence, this study examines the politics of super-computer deal in detail.

The first chapter aims at providing U.S. technology transfer policy in post-World War II period and the U.S. mechanisms of technology transfer in detail. In the second chapter, the Indo-U.S. super-computer deal is analysed. The third chapter is devoted to understand the politics of super-computer deal. The concluding chapter sums up the main findings of present research.

This research is mainly analytical based on primary and secondary source material available in India.

C H A P T E R - I

U.S. TECHNOLOGY TRANSFER POLICY TOWARDS THIRD WORLD

"In a global economy of physical scarcity", Secretary of State Henry Kissinger said to the Sixth Special Session of the United Nations General Assembly in April 1974, "Science and technology are becoming our most precious resources".[1] He was undoubtedly referring to the particular importance of science and technology to U.S. foreign policy. The International Economic Report of the President submitted to Congress in March 1975 refers to technology as "a valuable and saleable national asset".[2] Indeed, in the more competitive world economic situation today, U.S. technology may be assuming some of the role that U.S. goods and capital played in an earlier U.S. dominated economic world. As Kissinger himself is reported to believe in 1970s" America's ability to contribute money and run the world in the old fashioned way of the 1950s and 1960s is now over. What we can contribute - and what world wants - is our technological capabilities".[3] This statement of Kissinger, seems relevant

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[1] News Release, Bureau of Public Affairs, Dept. of State, April 15, 1974.

[2] Superintendent of Documents, U.S. Govt. Printing Office, (Washington D.C.) p.105.

[3] Nicholas Wade, Kissinger on Science: Making the Linkage With Diplomacy (Cambridge: MIT Press, 1967) p.23.

even in 1990s, of course with some exceptions.

In short, U.S. technology transfer in foreign affairs, **today** is significant not only in terms of its military strategic value but also increasingly in terms of its commercial and social value (that is, its relationship to international economic competitiveness and to national development). Before discussing the U.S. hi-tech transfer policy, let's look at the post-war U.S. technology transfer policy in general.

Post-war U.S. Technology Transfer Policy:

In viewing the post-war U.S. technology transfer policies, there is a need to address to two broad questions:

1. What were the issues and objectives that had guided U.S. policies towards the international transfer of U.S. technology?

2. Related to the first question, what were the mechanisms and institutions by which U.S. technology had been transferred and managed in post-war foreign affairs? And, are there discernible shifts in these mechanisms in current developments, suggesting some redistribution of influence among U.S. groups (actors) in making of technology transfer policy?

In examining these questions, there is a need to take note of the fact that, in the post-war period, the outflow and evaluation of U.S. technology across national boundaries had taken place in three separate and largely unrelated policy contexts.

1. The strategic-military context: emphasising the role of U.S. technology in maintaining a qualitative strategic superiority over communist and other adversaries.

2. In the foreign assistance context: involving the use of U.S. technology to influence domestic and foreign policy conditions in friendly and neutral countries.

3. The private industrial context: reflecting, in large part, the transfer of technology within the integrated organisational structure of the multinational company, but also including significant transfers between independent enterprises (as, for example, industrial relations with Japan).

Policy in these different contexts had not been consistent. Nor has it been formulated by same actors.[4]

In the first context, U.S. policy had been largely restrictive and heavily influenced by high level governmental agencies. In the second context, policy reflects a mix of restrictive (conditional) and liberal (humanitarian) considerations and public and private organizations. And, in the third context, policy has been largely liberal and formulated chiefly in the board rooms of private multi-

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[4] Samreel N. Baw-Zakay, Technology Transfer Model (Rand Publications, California, Santa Monica, n.d) p.509.

national Corporations.

Here it is pertinent to identify the issues (motivations and retionales for technology transfer) and actors(mechanisms) involved in the U.S. technology transfer process.

1. <u>Military-Strategic</u>: Use or value (positive or negative) of technology transfer for the development, manufacture, or deployment of military weaponary and forces. There are two ways in which a technology transfer may contribute to military-strategic capabilities:

(a) directly enhance military capabilities,

(b) improve civilian capabilities and release resources to increase military expenditures, or help to off set adverse civilian effects of existing military expenditures.

2. <u>Foreign Policy/Diplomacy</u>: Use or value of technology transfer for exercising influence in the international arena. From this perspective the transfer of technology not only had an effect on military-strategic capabilities, it may also effect politico-diplomatic intentions. It may also enhance the prestige, leadership, and image of the country initiating the transfer. In short, technology is not just an instrument of power, that is, coercive force, it is also an instrument of influence or psycological force. Frequently, these uses of technology in forein affairs are incompatible. For instance, the

the decision to deny a technology export to a recipient country because of its capability - or power - enhancing potential may also deny to the source country, the diplomatic or influence- enhancing potential of the export. This conflict has been particularly noticeable in U.S. policies towards the export of atomic energy technology. Such exports being restricted, on the one hand, for fear of their power-enhancing effects (that is, proliferation) and promoted, on the other, to enhance U.S. prestige and influence in world affairs (that is, atom for peace).

3. Economic-Commercial : Use or value of technology transfer for profit or commercial gain.

4. Social Environmental: Use or value of technology transfer for "quality of life", that is an evaluation of transfer not just in terms of commercial gains and losses but in broader social and environmental terms.

5. Administrative -institutional : Use or value of technology transfer to affect organisational or bureaucratic interests within the U.S. Just as Technology transfer may be used as an instrument of influence in the international arena, it may also be used as an instrument of influence among agencies within the United States. For example, some elements in Congress may use the technology transfer issue to pursue a power struggle with the executive or, in the case of individual presidential aspirants in Congress , to effect their image and influence in the

political system as a whole.

TABLE 1.1

Motivations of Technology Transfer

Motivation	Definition
Military-strategic	Use or value of technology transfer for the development, manufacture, or deployment of military capabilities, i.e., weaponry and forces: a) directly enhance military capabilities b) improve civilian capabilities and release resources to military outlays or to off-set adverse civilian effects of existing military outlays.
Foreign policy-diplomatic	use or value of technology transfer for influencing intensions (as compared with capabilities) in the international arena.
Economic-commercial	Use or value of tedhnology transfer for profit or commercial gain.
Social-environmental	use or value of technology transfer for improving the "quality of life", i.e., consequences for equity and ecology (as compared with commercial gain).
Administrative-institutional	use or value of technology transfer to advance organisational or bureaucratic interests within U.S. domestic system.

Source: H.R. H.R. Nau, Technology Transfer and U.S. Foreign Policy (Praeger Publishers, New York, 1976), p.12.

Here, the term "national security"as an motivating factor in technology transfer is deliberately avoided. The concept of national security is not irrelevant, but it is a vague, umbrella concept which is used interchangeably by all of the disputants in the technology transfer debate. National security, refers to a composite judgement by a particular group (or individual) of the relative importance of the different purposes or perspectives for evaluating technology transfer.[6]

There are various groups or actors involved in the technology transfer, but here the focus is primarily on U.S. actors. This study is an attempt to assess the technology transfer issues essentialy from the point of view of U.S. interests, which may include foreign interests or the interests of the international system as a whole.

The post-war American experience with technology transfer had been policy sectors of strategic -military, foreign assistance, and private industrial relations.

Technology Transfer and Military- Strategic Policy:

Technology was first recognized as a major national asset in the context of defence policies during world war

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[6] Rutherford M. Poats, Technology for Developing Nations (Washington, D.C., The Brooking institution 1975) p. 19.

II. As Daniel Greenbery has written, "The autility of science and technology in the economic crisis of the early New Deal was never clearcut. But in mid 40's with the radar just beginning to play a critical and dramatic vote in the aerial battles over Britain, there was no difficulty in demonstrating that science and technology were indispensable ingredients of modern warfare.[7] The subsequent mobilisation of science and technology under the office of Science Research and Development (OSRD), confirmed the importance of technology in military -struggle policy. It did not, however, spark an immediate awareness of technology's role in more general diplomatic, commercial, or social areas. After the war, proposals were made for a National Science Foundation, which would direct the application of science and technology to civilian areas, such as national health, creation of new jobs, and betterment of the national standard of living. Despite the efforts, science and technology continued to serve primarily military needs, founded mostly by the Navy and the newly created Atomic Energy Commission (AEC).[8] By contrast, Korean war stimulated another massive increase of funding for weapons development. It is also relevant to note that National Security Council (NSC) 68 of 1950 recommended rearmament programme with deficit financing.

Given the focus on military uses of technology,

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[7]Daniel S. Greenberg, The Politics of Pure Science, (New York: The New American Library, 1967) p.76.

[8]Robert Gilpin, American Scientists and Nuclear Weapons Policy (Princeton, Princeton University Press, 1965) p.128.

attitudes toward the transfer of technology in this period were dominated by the requirement of secrecy. In atomic energy, even wartime collaboration with allies was discontinued in 1940, AEC slapped stringent controls on handling of all atomic energy technology.

It was until the outbreak of the cold war that the United States developed a more comprehensive policy toward the protection of its technology on national security grounds. The export control Act of 1949 provided the first multiple -year authorisation for export controls. The Act granted authorisation to restrict the exports on the U.S. national security grounds. In addition, it authorised to use the export controls to further the foreign policy of the United States and protect the domestic economy from the excessive drain of scarce materials and the inflationary impact of foreign demand.[9] The intent of this Act was to impose sweeping controls on exports of strategic materials and technology to communist countries and other adversaries Unilateral controls were to be backed -up by NATO administered, The Coordinating Committee for Multilateral Export Controls (COCOM), established in 1949. In addition, in 1951, the Mutual Defence Assistance Control Act (Battle Act) provided

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[9]U.S. Deptt Commerce, Bureau of East West Trade, Export Administration Report, on U.S. Export Controls to the President and the Congress by the Domestic and International Business Administration (1974).

authority to cut off U.S. military and economic assistance to any transhipping or re-exporting controlled products to communist countries. Treasury regulations in 1953 issued under the trading with the Enemy Act of 1917 extended the same controls to U.S. citizens and corporations residing abroad, even if the goods were of alien origin. Finally, the Mutual Security Act of 1954 authorised the State Department, to control export of arms, ammunition implements of war and related technical data.

The effect of these multiple regulations was to cast a restrictive net around U.S. strategic technology to prevent the export of a perceived U.S. technological advantage.[10]

In the post-war period, the United States had relied on a technological or qualitative superiority in weapons to offset a perceived Soviet advantage in conventional and quantative forces. Thus, technology, or, more precisely, a technological gap in the U.S. favour weighs crucially, it is thought, in the deterrence balance. The development of new technology must be continuously promoted and the diffusion of existing technology to adversary countries prevented or, at least delayed.

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[10]Howard Margolis, Notes on Technical Advice on Political Issues, (Arlington, Virginia: Institutes for Defence Analyses, April 1972) p.128.

U.S. Foreign Assistance Programmes and Technology Transfer

The value of technology as an instrument of foreign policy was not immediately recognized after the World War II. Even, with the inauguration of Marshall plan in 1948, which reflected the first major use of American economic resources for foreign policy purposes in peace-time. By this time, technical assistance or productivity programmes were viewed as only minor supplements to production efforts based primarily on larger inputs of capital and labour. Technical assistance activities under the Marshall Plan amounted to less 1.5 percent of the U.S. $12 to $13 billion of total U.S. aid.[12]

In aid to less developed/third world countries, it was believed, the need was for extensive technical assistance and relatively small quantity of material aid. President Truman noted, this need of foreign assistance was promoted, as much by limitations on U.S. capital resources as by an understanding of the value technology as a U.S. foreign policy asset.

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[12] Harry Bayard Price, The Marshall Plan and its Meaning (Ithaca: Cornell University Press, 1955) p.39.

Point Four Programme

In 1949, President Truman announced his Point Four Programme of technical asistance to the developing countries. By this time communist s were in complete control of mainland China and the U.S. foreign policy was being geared to meet the perceived communist challenge, particularly in Asia.

While the Point Four Programme was generally couched in humanitarian terms, the U.S. administration made little attempt to hide the political and economic objectives of the United States behind the move. A memorandum prepared in the state Department by Ben Hardy, an ex-newspaper man from Georgia, apparently to suggest some 'bold new initiatives' for President's inaugural speech in January. That explained the political objectives that could be achieved by U.S. offer of technical assistance to the developing countries.

The memo was appropriately entitled " Use of U.S. Technologal Resources as a weapon in the Struggle with International Communism". It said that "the U.S. has an excellent instrument at hand which with bold imaginative adaptation could be fashioned into a potent weapon in the present struggle (against communsim)..... ".13 By extending technical assistance to the developing countries the U.S. could be making full and affirmative use of one of the

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13 Memorandum, 15 December 1948, Point Four File, GF, Truman Papers, Hanry S. Truman Library.

resource in which it was richest, and the Soviet Union the poorest.

Since the point Four Programme was mainly based on this memo, it is clear that its primary objectives was political. This programme of technical assistance sought to "take full advantage of the almost universal yearning for better conditions of life throughout the world.... and harness their enthusiam for social and economic progress to the democratic campaign to repulse Communism..."[14]

That the move was mainly political was also borne out by the fact that very little planning had gone into the actual plan of technical assistance. As the memo itself admitted "ordinarily the announcement of a policy of this kind would be preceded by prolonged and detailed planning. In this case, however, circumstances appear to have forced the issue, and to call urgently for consideration of a bold decision to reverse the usual order of things".[15]

Gradually, however, the economic objectives of the United States in the Point Four Programme also became apparent. There was some hint of the economic benefit

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14 Memorandum, no. 13.

15 ibid.,

that could accrue to the US as a result of the new programme even earlier. For instance, in July 1949, in his message to the US Congress, President Truman had declared that "with many countries of the under-developed areas of the world, we have long had ties of trade and commerce. In many instances today we need the produce of their labour and their resources. If the productivity and the purchasing power of these countries are expanded, our industry and agriculture will benefit"[16] But the economic rationale became much clearer after the Point Four Programme was authorised by the Congress in June 1949.

The vital importance of this programme to American farmers was stressed by the Secretary of Agriculture Brennan in September 1949. In his testimony before the House Foreign Affairs Committee, Brennan explained that "the United States is geared to a high level of production, both farm and industry, and we need sound markets overseas in order to stay in that gear".[17] Technical assistance to the developing countries was expected to make those countries familiar with US products, and open up opportunities for increased US agricultural and industrial exports to those countries.

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[16] 'Technical Assistance', Final Report of the Committee on Foreign Relations, 85th Congress, 1st Session (Washington 1957) p.103,

[17] Washington Post, 29 September 1949.

The resource crunch which followed by the outbreak of Korean war gave even greater emphasis to the idea of technical assistance. In the reorganisation of U.S. aid programmes, however, defence needs overshadowed civilian and developmental uses of American technology. It was not until the Korean War that civilian technology emerged as a central element in U.S. foreign policy initiatives. The first such initiative was the Atoms for peace plan announced by President Eisenhower at the United Nations in December 1953. The nuclear initiative was followed by the Appolo effort to beat the Russians in space and land the first man on the moon. Significantly by the end of the 1950s civilian as well as military technology had become the new index of world power. The same trend continued in 1960s, 1970s and 80s.

Today, technology serves multiple purposes in U.S. foreign policy and diplomacy which include:

1. enhancing overall prestige and leadership in world community,

2. maintaining open lines of transportation, communications and economic exchanges around the globe,

3. expressing an American version of humanitarianism and noblesse oblige.

From Strategic to Economic Issues:

The trend emergedwith respect to issues or perspectives for evaluating U.S. technology transfer when there was an expansion from exclusive military perspectives to broader economic and social perspectives.[18]

This trend marks a broadening of perspective from the exclusive military -strategic point of view, which **prevailed** immediately after World War II to the much broader economic- commercial and in an incipient way, social-environmental point of view that has been existing today. In the middle and late 1950s it began to acquire a broader foreign policy significance, being valued as symbol of American leadership and prestige, as well as substantive contributor to military systems. In foreign assistance programmes, technology could be used to win friends and influence adversaries in ways that might maximise a favourable world order and make unnecessary the recourse to advanced military weaponing[19] by the receipient country.

In the 1960s, the economic costs and benefits of using technology transfer for foreign policy purposes began to be perceived. This trend continued even in 1980s. The dominance of military- strategic concerns permitted American political leaders to throw a blanket of national

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[18]James P. Grant, "Development : One End of Trickee Down" Foreign Policy (N.Y.) no.12 (Fall 1973), p.43-65.

[19]Irving Kristol, " American Diplomacy", The New York Magazine, November 24, 1978.

security around most economic issues, including technology transfer. This helped America to remain as leader, throughout the post-world war period, in the technological field. Nevertheless in 1980s, competitiveness and technological lead of US was losing in global context. No high US could retain technological lead and competitiveness based on military based R & D. Specially the dual-technology like computers , and other advance technolgical based goods on electronic, fine optics, cermonic, the US no longer provide the lead . Japan and Europe is fast emerging competitors in these fields. Hence, US had to enhance a new technology transfer policy to contain the technology gap and losing competitiveness.

THE EMERGENCE OF THE CURRENT CONTROL REGIME:

In the years since World War II, the United States has emphasised technology exploitation over sheer manpower in its military forces and in order to preserve its technological edge has sought to keep Western military technology out of the hands of the Soviet Union and Warsaw Pact Countries.[20] In 1949, the United States established the Coordinating Commission of Multilateral Export Controls (COCOM) whose members include Japan and

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[20] David Abshire, Preventing World War III: A Realistic Ground Strategy (Harper & Row, New York) 1988 pp.59.

16 members of NATO; Australia, Belgium, Canada, Denmark, France, Germany, Greece, Italy, Spain, Luxemberg, Netherlands, Norway , Portugal, Turkey, U.K. and the United States, except Iceland. It is an devise to limit the amount of military technology that could be acquired by non-allied nations. Cocom continues to be the primary organization for controlling allied technology exports to Communist nations.

By the mid-1970s, the civilian sector had begun to gain primary over the military sector in generating new technology with military applications especially in Computer.[21] Such dual-use technology (this term refers to technology with both commercial and military applications) charged the way the U.S. and West needed to think about preserving its technological edge. Computers, for example, were developed primarily by private Corporations, were not considered military hardware perse, and therefore were not covered orginally by Cocom regulations.[22] Establishing the criteria for militarily sensitive Technologies become increasingly difficult and friction developed as the civilian sector chafed under export controls imposed in the interest of national security. Moreover, new technology developed by corporations, often multinationals

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[21] Gary Bertich ,Controlling East-West Trade and Technology Transfer (Duke University Press, Georgia, 1988) pp.93

[22] ibid, pp.96

posed the difficult, practical prblem of restricting technology that would not under any one government's jurisdiction. There is no doubt that such technology needed some form of protection-dual-use technology was tought aggressively by legitimate and other means by the Soviet Union and its allies.[23]

In 1976 a Department of Defence task force issued a landmark report on the problem. Entitled "An Analysis of Export Control Technology" and nicknamed the Bricy Report after its Chairman J Fred Bucy of Texas Instruments, the report encapsulated the findings and recommendations of the Defence Science Board Task Force on the Export of U.S. Technology. It recommended a reorientation of U.S. efforts away from the protection of hardware to the denial to Communist countries of manufacturing techniques.

The export Administration Act of 1979 drew heavily on the findings of Bucy Report in attempting to cope with the problem of dual-use technology. The act restricted not only technology that might strenghten Soviet Military power, it also restricted technology that might strenghten the entire soviet industrial base and energy infrastructure.[24]

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[23] Abshire, no.20, pp.68

[24] Bertsch, no.21, pp.128.

The Reagan administration took an extremely firm line on limiting Soviet access to military.- significant technology and the policy that developed under the leadership of then assistant secretary of defence Richard Perle, and Stephen Bryen, deputy under Secretary of defence for technology security, was well known for its restrictiveness and combativeness vis-a-vis less watchful allies of the United States and anti-control advocates in the U.S. Department of Commerce(DOC).[25]

The legacy of this-mixed historical record is an export control system with multiple components that often confuse and sometimes conflict with one another. Lists of critical technologies have been created by various parts of the U.S. government and other entities. There are several : a Cocom list which is agreed upon by all CoCom partners; (the list is secret, never published); a much broader Commodity Control List (CCL) maintained by the U.S. Department of Commerce for dual-use technologies and that the United States would like to its CoCom allies to adopt. The Military Critical Technologies List (MCTL) maintained by the U.S. Department of Defence (DOD); and the Muni tions

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[25]Sherry C. Rice, "Technology Management as an Alliance Issue: A Review of literature" The Washington Quarterly (Washington, D.C.)(Winter 1990) pp.221.

Control List, that is administered by the U.S. Department of State. The MCTL and the State Department lists contain weapons and weapon systems exclusively so they are not in dispute. The other lists are the subject of heated debate. The DOD usually recommends adding the CCL while the rest of CoCom would prefer to see it shortened. Generally, the allies balk at U.S. recommendations to lenghten what they consider an already too long CoCom list of controlled technologies.[26]

Another protectionist measure appeared in the field of trade related to technology export had been during Reagan era; Omnibus Trade and competitiveness Act in 1988. The U.S. Congress enacted this act in order to promote "Free and fair trade", But, in contradiction to this very intention behind this act, it turned out to be protectionist in the process as it inserted clauses like "super 301" and "Special 301" in it, to bullying its trade partners. Super 301 , is a section adopted from (US) Trade Act of 1974, which was an instrument of unfair international trade practices.

This Act allows U.S. president to make a reciprocity a basic criteria for trade relations with other countries. Under this scope in the Act, a executive order has come out

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[26] Rice, no 23, pp.223.

which is posing more threat than the Super 301. This order says that the U.S. should have no scientific cooperation with any Country, that does not provide adequate patent protection to the American industry.

The General Agreement on Trade and Tarrifs (GATT), a multilateral institution to regulate international trade and tarrifs, sometimes seems to be an instrument in the hands of U.S. Clauses like ; trade-related intellectual property rights (TRIP), and trade-related investment measures(TRIM) in the GATT, seems serving the U.S. interests. GATT related Uruguary round of talks facilitate the developed countries for bullying the economically poor, third world countries.

U.S. Hi-Tech. Transfer Policy towards Third World:

The end of World War II and decolonisation shaped the logic of technology denial to the South (Third World) into East-West technology controls based on two predominating perceptions influencing the U.S. policy making process. First , the Cold War and the Truman Doctrine assumed that the Communist nations were natural adversaries of the free market economies of the West. Since all Warsaw Pact countries were Communist, and technology was freely shared amongst them, which included diverting hi-tech (dual-use technologies) from commercial to military applications.

It became a national security interst of the U.S. and its allies to impede the East's technological progress for reducing their threat potential. Second, not only were politico-economic advantages derived from the North-South technology gap, but it was perceived that most of the countries in the South, particularly the non-aligned were more fabourably disposed towards the socilaist bloc. Consequently, it was perceived that these recipients would be easy channels for diversion of technolggy to the East. (in this regard , the perception of India as a likely conduct of Western technologies to the Soviets gained currency to serve both these perceptions).

The United States followed more or less the same principles in transfering its hi-technology towards third-world countries, as it followed in case of Communist countries . Here it would be relevant to analyse the policies and mechanisms for U.S. hi-technology transfer in detail.

The foundations of U.S.'s export Controls policy is the Export Control Act of 1945. In 1969 and 1972 it was succeeded by the Export Administration Act (EAA), which was again amended by the Reagan administration in 1985. The Act holds control over exports of commodities/technologies as demanded by considerations of (a) national security (b) foreign policy, and (c) short domestic supply[27] implemented by means of the Export Administration Regulation (EAR) covering the export of all "dual-use" (high-Technology) products, it is exercised by the Office of the Export Administration (OEA) of the Department of Commerce (DOC) which evaluates applications of the U.S. firms for export licences.

The EAR, through its Control Commodity List (CCL), provides specific instructions on types of licences to use and types of commodity, technologies (including computer software), and technical data under control. The CCL describes commodities and areas of possible use of each commodity and identifies the country groups to which these controls apply. The export control regime has divided nations into six groups (P, Q, T,V, WY, and Z) . India is placed in Group V, to which the west European countries also belong. Main characteristic of this group is that, the case-by-case policy is applied in technology transfer.[28]

In the field of computers specifically, the EAR imposes control on computers by specifying limits on the

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[27]The U.S. Department of Commerce, 'Export Administration Regulation', (The U.S. GPO Office, Washington D.C., 1985.).

[28]'Country Groups, Export Licensing General Policy and Related Information, Supplement No.1 to Part 370-page 1.

performance of computer which can be exported under the distribution licences granted by the OEA. These controls also apply to any device, apparatus, accessory that upgrades computers beyond the limits. The importing country in no case shoudd be directly or indirectly engaged in nuclear weapon development programmes.

The EAA authorises the DOC to control not only material goods but by any information that can be used, or adopted for use, in the design , production, manipulation, utilisation or reconstruction of articles and materials, featuring on the CCL.

The second arm of control is the Arms Export Control Act (AEA) of 1976, out of which flow the International Traffic in Arms Regulations (ITAR) of 1959. The responsibilities for its administration lies with the State Department which controls the export of defence articles and defence services by oral visual or documentary means to foreign nationals of 22 items in the "United States Munition List".[29]

From the mid-1970's, rapid militarisation and arms expenditure growth perpetuated a new regulation of technology

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[29] R. Ramachandran, "MoV: The missing Under-standing," Frontline (Madras) Aug. 24-Sept., 8, 1985,pp.46-50.

exports. A report of the DOD, Defence Science Board (DSB), introduced in 1976 massive revision of regulations. It assented that the technological leakage to the East was making the U.S. lose its technological and economic lead over its adversaries. It recommended that the export control system should not only become stricter in controlling the flow of hardware, but also be extended to technical data. This recommendation was added to the EAA in 1979. Out of this emerged a list of Military Critical Technolggies List (MCTL) which also become a component of CCL.[30]

The DSB Task Force also proposed a four-tier regulation:

(a) no control over basic research,

(b) Commercially applicable research should be subject to EAR,

(c) dual-use research should be regulated by the ITAR, and

(d) exclusively military usable VHSIC projects should be classified. A new supplementary list, a 'non-secret' Military significant Emerging Technologies Awareness List (METAL) covering military-front technolggies also became operative.

However, many items on these lists are seen to be substantially or even primarily civilian application

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[30] Rainer Rilling, "The Arms Build-up and Freedom of Science in the USA", Part 2, Scientific World, (Washington) vol 30, no.3, 1986, pp.15-19.

technologies. All export applications to Department of Commerce are forwarded to the DOD as well as the State Department. Their evaluation is based on MCTL and possibly also on the expertise provided by think-tanks such as the Rand Corporation.

Later, two other controls also got activated; Nuclear Non-proliferation Controls as dictated by Nuclear Non-Proliferation Act (1978). The second, the multilateral control through CoCom, which is aimed at achieving uniform export controls. As discussed earlier, CoCom plays an important role in U.S. technology transfer.

To concretise the effect of its control measures on technology exports, the U.S. evolved a standardised method of ensuring against non-authorised use and spread from the countries to which it supplies sensitive technologies in the form of General Security Organization and Military Information Agreement (GSOMIA). This agreement demands inspection of military facilities using such technologies, the use and maintenance of the system only by trusted personnel with high security clearance in-accessibility foreign nationals, and amendments of export laws inhabiting removal of any material from the supplied systems. GSOMIA has become a standard agreement that the U.S. has with 70 or so countries and companies on classified items requiring special protection that is required from any purchaser.

It readily facilitates military to military pacts of the technology transfer.

Expanding regulation of technology exports based on criticality have begun to enlarge the scope and ambit of regulations to cover not only high technology hardware, but also to related information and collaboration and participation of foreign scientists. The defination of scientific and technical information is so comprehensive that even the presentation of unclassified material at scientific conferences could be interpreted as export.

CHAPTER -II

THE INDO-US SCIENCE AND TECHNOLOGY COOPERATION AND SUPER COMPUTER DEAL

Indo-U.S. Coorperation in Science and Technology:

United States involvement in India's technological development could be traced further back than India's interest in U.S. technology in post independence period. It began in 1942 when an American Technical Mission visited India to advise British Government on the "possibilities of American Assistance in developing the industrial resources of the country for the war effort".[1] This mission was led by Henery F. Grady, Former Assistant Secretary of State. The United States agreed to send this mission as it was believed that any considerable increase in India's war effort was dependent in large measure on the U.S. technological help. At the same time however, the mission was not averse to expoloring avenues for closer ties between U.S. and India. The Mission's purpose has been to attempt to inagurate a period of closer collaboration between India and the United States.[2]

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[1] M.S. Venkataramani and B.K. Shrivastava, Roosevelt, Gandhi Churchill (New Delhi, 1983) p.25

[2] Foreign Relations of the United States (FRUS), 1942, vol.I (Washington , 1960) p. 656.

The mission held many conferences in New Delhi and Jam shedpur with Indian Government officials and industrialists.

The United States interest in closer commercial and technical ties with India during the war years was also clear from the trends in the Indo-US trade of that period. While, U.S. exports to India registered a steep rise from US $ 68,428.000 in 1940 to US $491, - 257,000 in 1945. And U.S. imports from India also rose appreciably from US $102,204,000 in 1940 to US $173,157,000 in 1945.[3] What made India important economically for the United States was that, India was one of the sources of strategic materials such as, jute, jute products, mica and manganese.[4]

From this brief account of U.S. interest in the technological development of pre-independence India,it is evident that India's importance was perceived mainly as a supplier of primary products for the U.S. industry. Except for the arms and equipment transferred to India under the lend lease act the U.S. was more interested in survey and exploitation of India's mineral resources , than any large scale industrialisation plan for India.

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[3]Foreign Commerce Weekly (Washington), 11 October, 1949, p.32.

[4]FRUS, 1943 vol. 4 (Washington, 1964) p.287.

After India's independence , U.S. interest in providing technical assistance to India became enmeshed with its policy of combatting communism. But whatever the intentions may be, Indo-U.S. co-operation in science and technology were wide ranging , which began with the signing of a Point Four Agreement between two countries on 28 December 1950.

In the years since independence science and technology has become one of the most important areas of Indo-US relations .[5] In co-operation between two countries , basic and applied research have been conducted over a broad spectrum ranging from health and biomedicine to atomic energy and space. Applied research in agriculture made India self-sufficient in food grains. Average life expectancy, has risen from 35 to 58 years in the period since independence.

Indo-US collaboration in science and technology, in the earliest days; after independence , focused on training and fundamental development of Indian technology. Indo-American research has touched a vast rangeof scientific fields -- the green Revolution and Satellite Instructional

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[5]Rani Dutta, "American Attitude Towrds U.S. Technical and Economic Assistance to India" p.444, in Varindra Grover's ed., USA and India's Foreign Policy, vol.6. of International Relations and Foreign Policy of India Series (Deep and Deep Pub. New Delhi, 1992).

Television Expreiment (SITE) are perhaps the most dramatic successes.[6]

The Science and Technology Initiative (STI) has given new impetus to Indo-U.S. collaboration in science and technology. Therefore, a brief discriptive analysis of this aspect follows.

INDO-U.S. SCIENCE AND TECHNOLOGY INITIATIVE:

The Indo-U.S. Science and Technology Initiative(STI) launched by President Ronald Reagan and Prime Minister Indiara Gandhi in July 28, 1982 was an important sign of new directions in the Indo-U.S. scientific relationship. Both leaders saw this challenging collaborative programme as a way to recognize the scientific stature India has achieved over the past generations and to encourage both nations to apply their scientific talent not only towards fundamental new knowledge , but towards social and economic benefits as well.

STI was a clear declaration that India's technology has achieved international status. The programme was conceived in a spirit of reciprocity -- both countries must have proven expertise in areas chosen for STI projects, and both must invest resources for their mutual benefit. STI matches

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[6]Dutta, no.5. p. 446.

scientists at home and overseas, combined equipment and brains and establishes research networks.[7]

Endorsement of STI by President Reagan and Prime Minister Gandhi guaranted high priority to its activities and helped to streamline administrative procedures. This high-level support has enabled STI to attract some of the best scientific and engineering minds in both countries.[8]

The definition of STI began in earnest in November 1982, when George Keyworth , Director of the office of Science and Technology policy and Scientific Advisor to the U.S. President, led a high-level policy group to India to determine the major areas of collaboration. He and his Indian counterpart, M.G.K. Menon, Chairman of the Science Advisory Committee to the Cabinet, explored four areas of interest: health, agricultural, meteorology, and solid state science. The programme was further extended by three years when Prime Minister Rajiv Gandhi visited the United States in 1985.[9]

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[7]USIS Publication (n.d.) A Common Faith: Fourty Years of Indo-U.S. Relation (1947-87) p.10.

[8]ibid, pp.10.

[9]ibid, pp.10.

STI health projects so far have focused on the diagnosis and cure of selected infections diseases, immunological solutions to infertility and contraception, and preventioh of blindness caused by disease and multi-nutritional deficiencies. In agriculture , STI has identified nitrogen fixation and reforestation as areas of priority interest to both countries. Meteorologists have discovered that poor monsoons in India and abnormal weather in the Eastern Pacific may be linked to common cause and that one may predict the other. Short and long-term monsoon prediction, therefore, is a major research area under STI. The solid state science component of STI has been principally concerned with new technologies of photovoltaics; materials capable of converting sunlight into electricity.

Initial reports on STI have been extremely positive. As one Indian researcher said, "It has made it easy for India and the United States to collaborate .... It's as easy now to work with some one at the (U.S.) National Institutes of Health as it is to co-operate with some one down the hall".[10] This sort of collaboration increased understanding between scientists of different countries and made it possible to do things together that neither country do alone. The high-level support for

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[10] Times of India, 12 April 1983.

STI has speeded the normal pace of research, allowing researchers to start projects while their enthusiasm is still high. The greatest gains so far have been in the health field, with STI teams having made progress toward the first malaria vaccine, improving understanding of the immune system's role in leprosy and filariasis, and providing insight into the causes of cataract formation. The fruits of Indo-U.S. STI cooperation are expected to benefit not only the two partners but many other countries as well.[11]

In addition to STI, the two countries conduct programmes under the Indo-U.S. subcommission on Science and Technology, the subcommission on Agricultural and the U.S. Agency for International Development. Nearly 275 co-operative research projects, funded at level of $30 million per year, are sponsored by more than 20 U.S. technical agencies. Premier American scientific organisations, such as the National Institutes of Health, the National academy of Sciences and the National Science Foundation, are involved. This collaboration offers India a "window" on $ 120,000 million in annual research and development activities of the United States.

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[11] R.C. Jauhri and Harinder Sekhon "American Diplomacy and India: Commercial and Technical Under-currents p.275, Varindra Grover's ed., <u>USA and India's Foreign policy</u>, vol.6 of International Relations and Foreign Policy of India Series (Deep and Deep Pub. New Delhi 1992).

AGRICULTURE :

It is in the field of agriculture the Indo-U.S. collaboration has achieved the most spectacular results. The "Green Revolution" in Punjab, was the result of a combination of factors: the clarity of vision of Indian leaders, administrators and scientists: the carefully - planned assistance programmes offered by the U.S. government and American organisations such as the Rockfeller and Ford Foundations; and the grit and hard work of the Indian farmers.[12]

The Green Revolution was conceived on the basis of American research in the development of new seeds. New varities of corn, rice and wheat were planted in India in a concerted effort to increase the food production. Slander, long-stemmed cereal plants, after flowering, frequently collapsed when buffected by winds and rain. Dwarf varities with thick stems, however, not only yield more grain but stand erect until harvest. At the International Maize and Wheat Improvement Centre in Mexico supported by the Rockefeller Foundation, American agronomist Nobel laureate Norman E. Borlaug developed such a variety of wheat, which helped in raising the quality and

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[12] Jauhri and Sekhon, no.11, p.480.

and quantity of food crops in developing countries. He took a particular interest in India's agricultural development.

FERTILISER PLANTS:

Other factors also prepared the way for the Green Revolution and the Indian farmer's acceptance of revolutionary new materials and techniques. Beginning in 1951 when America's first wheat loan helped India combat severe famine, the United States remained in the forefront of countries providing assistance to India,. Much of the aid was repayable in rupees, which the United States used to support development programmes in areas indicated by the Indian government. The U.S., in a joint venture with the United Kingdom and India, built the Sindri Fertilizer Plant, arranged to export fertilizers and trained Indian Managers and technicians in the United States. Over the years, 3,000 American technicians- agronomists, engineers, educators and farmers - came to India to help with food and agricultural projects under U.S. government - sponsored programmes, and 6,000 Indians went for training in the United States. The results were far reaching in crop production, animal husbandry, food processing and preservation, and nutrition.[13].

[13]M.S. Swaminathan, "Indo-U.S. Cooperation in S & T " The Financial Express (Bombay) 8 July , 1989.

AGRICULTURAL UNIVERSITIEIS:

Between 1952 and 1972, American land-grant agricultural universities entered into partnership agreements with Indian institutions to establish agricultural universities. The American institutions participating in the 20-years programme were the universities of Illinois, Kansas, Misouri, Ohio, Pennsylvania and Tannessee. The agricultural universitiies which emerged from the programme were in Punjab, Haryana , Utter Pradesh, Rajasthan, Madhya Pradesh, Orissa, Maharashtr , Andhra Pradesh and Karnataka. Over the course of the programme, more than 300 American teachers gave more than 700 teaching-years of service to India, and more than 1,000 Indian faculty members and students studied in the United States. In addition, to these scholars, an untold number of Americans and Indians member of non-teaching were also involved in the programme in one way or another. These American-style Indian agricultural universities successfully transferred the know-how from the universities to the farmers and developed an American -style extension service.

Along with other American voluntary agencies, the Rockefeller and Ford Foundations supported renewal and growth of Indian agriculture. The Rockefeller Foundation provided grants to schools and research institutions for agricultural studies. Ford Foundation also launched educational and operational projects in farming family welfare , birth control, rural development and health management.[14]

American assistance played a major role in the establishment of large fertilizers factories at Visakhapatnam, Trombay and Madras. The huge Coramandel Fertilizers plant in Visakhapatnam, established as a joint Indo-American enterprise. The United States also helped set up the public sector fertilizer factory in Trombay. A private firm, American International Oil Co, joined the Government of India in establishing a fertilizer factory in Madras. Private sector Indo-U.S. collaboration has also resulted in construction of fertilizer plants in Goa. The Kandla-Kalol complex, built by Indian and American cooperatives, is described by the International Cooperative Development Association as the world's largest international business transaction by cooperatives.

Indian and American Agriculturists, using the latest technology, cooperate today on complementary projects ranging from plant improvement and food preservation to water resources management and reforestation.

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[14] Swaminathan, no. 43.

IRRIGATION:

Since the 1950s, the building of surface irrigation systems has been one of India's top priorities. Several Indo-U.S. collaborative irrigation projects , with multi-year funding of more than $300 million, promoto efficient irrigation management. American experts are working with Indian professionals in several states to strenghthen irrigation departments and local water- and land-management training institutes. Some hill areas, are adapting technology suitable for small-scale water systems. Indo-U.S. projects in Rajashthan has put 91,000 hectares of land under irrigation. In Madhya Pradesh agricultural engineers have improved designs for water systems affecting 26,000 hectres . Smaller -scale systems are being developed for remote regions in Maharashtra.

ICRISAT

India's efforts to become self-suffidient in food and its effective utilisation of technical assistance led to the establishment of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad. The ICRISAT was established in March in 1972, as a result of an agreement between the Ford Foundation and the Government of India. Many countries -- including India and the United

States --as well as the United Nations Development Programme, The Asian Development Bank and World Bank provide support for the institute and its research programmes.[15] Since 1989, ICRISAT has participated in 25 U.S. -funded studies on dry-land crops. ICRISAT has developed several new varities of sorghum, peas and millet, including a versatile and economically viable pearl millet which substituted for tranditional Indian varities when the latter were hit by serious desease.

TECHNICAL INSTITUTES:

Beginning in 1954, USAID brought U.S. educational institutions into direct contact with Indian educational institutions requesting technical assistance. Illinois, Wisconsin and Michigan State Universities, between 1954 and 1966, provided visiting professors, equipment and facilities to the Indian Institute of Technology, Kharagpur, and the College of Engineering , Pune, the College of Engineering in Guindy (Madras), Bengal Engineering College in Howrah, and the University College of Engineering in

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15 A common Faith; no.37.

in Roorkee. They also arranged advanced training programmes in the United States for Indian Professors. The American aid programme also provided funds for 14 new regional engineering colleges.[16]

A significant U.S. contribution to Indian higher education in science and technology was the establishment of the Indian Institute of Technology (IIT) in Kanpur. The Kanpur Indo-American Programme (KAP) began in 1962.

Indo-U.S. Summer Science Institutes were another means of revitalising science teaching in India. The institutes, scheduled during summer vacations, brought together science and mathematics teachers from all over India for training in new laboratory techniques and the latest teaching methods. American professors, recruited by four U.S. universities and the U.S. National Science Foundation, served as consultants to these Institutes. This dynamic programme started in 1963, remained a joint effort until 1970 when it was taken over by the Government of India's Ministry of Education. From 1963 to 1970, 30,000 Indian teachers received training from 1,000 American instructors.

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[16] Swaminathan, no. 43.

HEALTH:

In the last 25 years, the U.S. Department of Health and Human Services has supported 275 Indo- U.S. health research projects worth more than 100 million dollars. In addition, programmes funded by USAID, CARE and other organizations have contributed significantly to India's national plan for providing curative and preventive health services to its citizens.[17]

Indo-U.S. scientific collaboration is in the forefront of world efforts to ameliorate cancer, blindness, preventive childhood diseases and malaria. In the area of vision, for example, Indian and American scientists are studying the causes of senile cataracts, including the possible roles played by environment, malnutrition, or exposure to ultraviolet rays. They are collaborating on laboratory research and field programmes for early detection. Another project investigates vitamin A deficiency as a cause of blindness in children. One of the mechanisms being developed to address the problem is the fortification of oral rehydration salts with vitamin A.

The United States through the Integrated Child Development Scheme (ICDS), provides health and nutrition

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[17] The Hindustan Times (New Delhi), 27 March 1982.

care and preschool education to million of Indian Children. ICDS operates 4,200 anganwadis or village centres. A new U.S. programme, the 14 million dollar Bio-Medical research support programme has designed to support India's efforts to improve rural health care in India by strengthening public health laboratory facilities and by training epidemiologists. In tandem with this effort, the Rockefeller Foundation supports training in appropriate clinical practices for combating epidemics. The U.S. Food and Drug Administration is assisting in establishing a national laboratory for quality control of biological products, including vaccines. Another 32 voluntary private organizations in India receive U.S. grants to expand and improve basic and preventive health training , family planning and nutritional services at the grass-roots level.

SPACE:

The United States and India have worked together in Space research since 1954 when a satellite tracking facility was established at Nainital. The first Indian rocket launch, in 1964, was the result of Indo-U.S. collaboration. Using an American rocket, Indian space scientists launched meteorological payloads from Tumba, Kerala, and the scientists from the two countries shared data resulting from the project.

Collaboration between the National Aeronutics and space Administration (NASA) and the Indian Space Research Organization (ISRO) took a gaint step in 1974-75 with the Satellite Instructional Television Experiment (SITE). This early experiment in satellite communication provided broadcast of educational television programmes to remote Indian villages.

The Applications Technology Satellite; ATS-6, which went into Orbit in 1974 was, loaned to the government of India for one year to beam educational programmes to 5,000 villages in the Indian States.

Following SITE, Indian took the next step to design and manufacture of its own satellites to meet its specialised needs. The First Generation Indian National Satellite (INSAT-1A) was built to Indian specifications by Ford Aerospace Communications Corporation in California. INSAT-1A failed to perform because of a power loss, but its place was soon taken by INSAT -1B which has been in operation since 1983. The multi-purpose INSAT-1B is the first Satellite of its kind, providing a national satellite system for domestic tele-communication, meteorology and broad-casting -- alll in a single space platform.[18]

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[18] Manoj Joshi, "The Indian Satellites" Frontline, (Madras, May, 1984) p.28.

Another example of Indo-American Cooperation in space is Anuradha, the Indian space payload that made two trips into space abroad American space vehicles. U.S. scientists assisted in the building of Anuradha , sharing U.S. space shuttle data with their Indian colleagues. Sponsored by Tata Institute of Fundamental Research Bombay, the Physical Research Laboratory in Ahmedabad and ISRO, the highly sensitive Anuradha instrument package allowed Indian scientists to study cosmic rays in space . The resulting information on the Indian space environment provides the foundation for further studies and application of space technology.

Earth Sciences:

Since 1960, U.S. government technical agencies have, funded some 200 physical science research projects worth 25 million dollars and conducted some 40 workshops. Some of the Cooperatives projects deal with earthquake analysis, a subject of great concern to both India and the United States. One joint project in the Kangra valley of Himachal Pradesh has used 50 highly advanced instru-ments to collect earthquake data and has analysed recorded information on the strength and characteristics of tremors. While some geophysicists are collecting earthquake data, others are studying the structural formation of the Deccan Plateau.[19] These studies involve other "earth sciences" such as stratigraphy, geochemistry, and tectonics -- dealing with the interpretations of the geological of the region which would help to locate mineral resources.

Materials Science:

There are also important state-of the-art Indo- U.S. collaborations in the broad field of "materials reeearch". Investigators are working togather , applying the latest developments in solid state of physics to the needs of industries from iron and steel to aerospace.[20]

The U.S. National Bureau of Standards, the National science Foundation and the Office of Naval Research are some of the organisations working with Indian scientists on the 2.5 million dollars materials science programme under the Inod-U.S. Subcommission on Science and Technology.

One area of materials science with vast potential in India is the work on solar photovoltaic materials in rural areas of India, without central electricity sources, solar energy sources may have wide application for domestic and public lighting, irrigation, pumps, refrigeration for the storage of medicines, and television for educational purposes. The initial work in this area under STI concentrates on basic, rather than applied , research.

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[19] A Common Faith: no.13, p.31.

[20] The Hindu (Madras) 17 June 1983.

The Memorandum of Understanding (1984-85)

The Indo-U.S. Cooperation in wideranging areas of basic sciences acquired a fillip with the Science and Technology Initiative (STI) of 1982, signed between the President Reagan and Prime Minister Indira Gandhi. The American technology exports system was geared against meeting India's rapedly expanding demands for hi-tech. The situation was so bad that the importing government institutions and many private companies were either denied even much less sophisficated items or their applications remained pending for years. In some cases the military use apprehensions were extended to a level of absurdity by the Office of the Export Administration (OEA).

It is against this background that a Memorandum of Understanding (MOU) was signed between India and U.S. in May 1985 It marked the take off of Indo-U.S. trade in hi--tech areas of communications , electronics and computers. The basic aim of the MOU seems to have been to devise a system to provide India an all-purpose umbrealla to escape the inordinate delays in the case by case handling of its requests for technology transfer and the U.S. sufficient protection against misuse and diversion of its technologies.[21]

[21] G.K. Reddy, 'What's on, What's off', Frontline, June 29-July 12, 1985, pp.25-26.

"We were taking up each application on a case by case basis and clearing these , and that is a very time consuming process. Thus we started negotiating an MOU. The idea behind that was to have a standard policy which would apply to the bulk of all hi-tech exports to India. Dealing on a government to government level takes time ....."[22]

Thus, at its face value the MOU seems to answer Indian requirements and the American willingness to meet them.However, it remained as a secret document even after two years of its existence. Its validity could only be reviewed in the light of actual charges in American orientation towards hi-tech supply, the problems related to the supercomputer deal and the complexities of Indo-US relations at large. Yet, it was clear that,not only the conception regarding Indian needs completely differ, later developments indicate that the MOU did not satisfy American risk perceptions. The journey from STI to signing of the MOU and its implementation continues to be riddled with many bottlenecks.

Certain conjectures can be made on the nature of an agreement entered by the two countries on technology transfer. As a facilitator of this transfer it has to be

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[22]Michael J Hard, U.S. Commercial Attache in India, Dataquest (New Delhi, August 1985) p.96.

broad enough to encompass a wide area, and yet provide a basis for satisfying the fundamental objectives of the parties. To that extent the MOU has to be set of general principles not relating to any particular category of technology or area of co-operation.

Secondly, no efforts seem to have gone into the formulation of the MOU to evolve a methodology which would transfer major decisions into clear-cut implementation procedures. As a result , the case-by -case approach in establishing validated export licence remains in vague as was the case prior to the signing of the MOU.[23] This is largely done to the difference in approach of the US agencies regarding the licencing decision as well as the procedures. While a highly security concious Pentagon tends to overstep the whole set of established norms and procedures, the Department of Science (DOS) and the Department of Commerce (DOC) grapple with foreign policy and trade considerations.

Thirdly, the U.S. aims at keeping a technological gap between the 'state-of -art' and those technologies made available to India, while India is interested in the latest, the American seem to be interested in supplying 'safer

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[23] R. Ramchandran, 'MOU: The Missing Understanding, 'Frontline, August 24- Sept.8, 1985, pp.46-50.

technologies' and tend to, adopt 'go slow' and 'incremental approach' in which hi-tech sophistication and volume could be incrdased step by step, accumulating mutual confidence between the two sides. Regarding India's lack of response to implementation of the MOU, they pinpoint that Indian import procedures have notbeen modified particularly in case of government agencies which employ open general licence which are not legally accountable to the security of technology.[24]

Thus, these factors tend to make the MOU a weak instrument of bilateral technology transfer. Not only did its signing not precede a broad clearence of all pending items, but the Export Administration Regulation's (EAR) tight controls continue to prevail.

However, as the MOU was unable to facilitate acquisition to India super hi-tech systems, it has readily formalised the arrival of U.S. companies in the conventional sectors of not much strategic importance under the 'liberalisation on policies' of the Indian government. This flow, while having no implications for the American concerns for hi-tech leakage, makes India a free market for routine technologies and products. While the hi-tech

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[24] Bharat Karnad, "Hitch in Hi-tech Transfer ", The Hindustan Times, 18 February, 1987.

requirements of public sector and Rand D institutions continue to receive short shrift, the MOU seems to have helped NRIs and private sectors with liberal imports of technology.[25]

MOU, could explain the increase in Indo-US trade in hi-tech from 500 million dollars in 1984 to 1500 million dollars in 1985. But most of the bulk is in not-so- strategic hardware for which the licence granting process has become more streamlined and faster. The report "The Technology Security Programme", submitted to the US Congress, also states that, 3,000 Indian hi-tech applications constituting 82 percent of pending requests and worth $ 1.2 billion has been released.[26]

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[25] Ramchandran, no.23, p.48.

[26] The Hindustan Times, 24 August 1986, and The Times of India, 11 January 1987, and The Indian Express, 12 January, 1987.

SUPERCOMPUTER DEAL:

The Indo-U.S. supercomputer deal is a typical case which demonstrated the American ambivalence in matters of hi-tech transfer. And it showed how technology has become a major asset in American foreign policy. The supercomputer in the context of the MOU on hi-tech transfer signed between Indian and US, India sought American supercomputer Cray-X-MP/24. This Indian requirement was for running medium and long-term weather predictions, for the Indian Meteorological Department, New Delhi and Indian Institute of Science (IISc) in Bangalore. But the delivery of supercomputer to Indian by US had been a long irritating, frustrating, and confidence crisis negotiations.

Before analysing the deal in detail, a brief discussion of the nature, capabilities and relevance of supercomputer may be informative. Moreover, a discussion of the capabilities of the Cray-X- MP/24 is necessary as India specifically sought this computer and the US was reluctant to transfer it to India.

A super-computer is better described than defined. Simply put, a super computer is characterised by its high computational speed, fast and large main and secondary memories, and the extensive use of parallel structural software. A large memory than a traditional computer, enables the super computer to store all the required 'information's programmes as well as data. This helps computationally "near " the central processing unit (CPU) as possible, and hence, saving the CPU time in fetching the information. The access the memory should be fast for the same reason. The secondary memory would not be required at all, but for the fact that it has not been possible to make fast and massive main memories. Conceptually, the secondary is only an extension of the primary memory, and hence should be fast and large too.[27] The parallel structured software operates on data in a parallel fashion Thus, the primary criterian for a super computer is its high computational speed than any traditional computer.

The supercomputers of today largely owe their fantastic speed of processing to the development of three important concepts in computer architechture : pipelining, vector processing and parallel processing. Let us examine these concept breifly Pipelining:

The principle of pipelining is known through its extensive use in assembly lines. The assembly line is a

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[27] Rajan Chandras, " Computers Take a Super Leap" Dataquest (New Delhi) September 1988. pp. 928 - 946 .

"pipeline" of various functions. At each "stop" of assembly line, a different function is carried out. Thus, the pipelining in computers has contributed enormously towards faster programming.[28]

Pipelines may be arithmetic pipelines , instruction pipelines (where the execution of a stream of instructions can be pieplined) or processor pipelines which refers to pipeline processing of the same data stream by a cascade of processes, each of which processes a specific task.

vector Processing:

As the name suggests, this involves the processing of a "vector" , or an array of numbers. This requires spedial attention because of the enormous usage of vectors in scietific processing. For example, in studies of particle dynamics, we can have a two-dimentional list representing the positions of the particles at any given instant of time. As the situation evolves, the successive positions of particles will be stored in this vector. The difference in the positions of any particle over a period of time can be used to compute the velocity and acceleration of the particle. For treatment of the inter-particle forces, one may use another set of vectors - one per

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[28] Computers Today, (New Delhi, July 1985), p.26.

particle - in which one has to store the distance of every other particle from the given particle. Vector processing can be very neatly implemented using pipelines.

The concept of vector processing soon proved to be so useful and important that it was adopted into computer languages.

Parallel Processing:

Parallel processing is simply the concept of simultaneous processing. This does not necessarily imply multple processors (called processing elements, or PE). Several techniques of parallel processing have been developed -- and used regularly -- one single processor machines. Some of these are, the overlapping of C.P.U. and I/O ioperations, multi-programming and timesharing, etc. As a matter of fact, pipeline computers may also be considered as parallel computers which exploit "technical parallelism".[29] However, super computing is primarily concerned with multiple processors. Computers with multiple process rs may be array computers or multiprocessors. Array computers are those that operate synchronously on multiple arithmetic logic units (ALUS). The term "processing element" may be more strictly used to mean an ALU. Thus array

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[29] New Scientist (New York) , February 5, 1985, p.39.

computers achieve "spatical parallalism". Another popular term used to describe this concurrency to is SIMD- single instruction multiple data. The PRs here are passive device without instruction decoding capabilities. Array processors with associative memories are called associative processors.

Cray X-MP/24, is a model of supercomputer built by Cray Research Inc of United States. This super-computer is equiped with dual-processors and four memory system, was introduced in 1984. It has a performance speed upto 500 MFLOPS.

Another model from Cray research Inc. US, is Cray -X-MP/14, has a single processor with four million words of memory. It has the performance speed of 250 MFLOPS. This is a economy model and is not upgradable to dual-processor system.

The supercomputer may be required for various scientific, meteorological, nuclear research requirements. In addition, the machine may be put to use in demographic or social applications. The capability of the supercomputer has also been amply proven useful in the field of defence.

India's search for a super-computer has been largely prompted by the country's need for accurate meteorological forecasts. In the absence of any computer large enough to retrieve data fast enough from the INSAT-1B, weather prediction can rarely be made for more than a day's time in the subcontinent.

The weather prediction problem involves the solving of many systems coupled equations at the same time. Briefly enumerated they are :

1. The Navier Stokes equation with additional terms, for measuring the Earth's Rotation.

2. An equation for representing the conservation of Entropy.

3. An equation to represent the conservation of Mass.

4. An equation to represent the change in the phase of water vapour and the associated release of latent heat.

The unknowns or the dependent variables that come into play when calculating these critical masses are:

1. The three components of wind velocity.
2. The entropy of air
3. The mass or density of air
4. The water vapour content.

There are thus, six equations for six unknowns making the system highly non-linear. The equations can, and very often do, admit as its solutions a wide variety of irrelevant wave motions. One of the major problems of numerical weather prediction is to filter out these high frequency waves from the meteorologically significant low frequency waves before commencing integration.

Presently, there are two types of prediction modes that are in vague:

1. Grid Point Models: These models replace derivatives in the relevant equations, by finite difference analogues to embrace the entire atmosphere over the Earth's surface. This is necessary for long term production. The total number of grid points will be of the order of 200 km. This needs to reduce to 50 km for achieving greater accuracy in the future.

2. Spectral Models: In these models the meteorological field is expressed by an orthogonal polynomial. Spectral models represent the spherical geometry of the earth better than grid point models.

According to Professor P.K. Das of IIT Delhi, "to carry out a computational exercise of this magnitude, a computer with a capacity of at least a Gigafolp would be necessary"[30]

Under Memorandum of Understanding (MOU) India expressed its interest in the US super computer; Cray

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[30]Computers Today (New Delhi) July 1987, p.4.

X-MP/24, to use it for monsoon research and weather prediction. India has plan to install this super-computer either at Central Meteorological Institute in Delhi or in Indian Institute of Science in Bangalore. Since than US government has been agreed to it in principle. The actual negotiations for purchase and further agreements on controls on leakage of technology to third nation, were in pending.

On 11th , December 1986, India and the U.S. were understood to have agreed upon "arrangements" that would take each others susceptibilities into account in ensuring that the U.S. supercomputer , India has to acquire would be shield from access to third parties.

It was reported, no one of those agreements , signed between U.S. and India for the supercomputer, would impinge on Indian sovereignty. It was clear in the agreements that the supercomputer would handled entirely by the Indians trained in India and in the US.[31]

When India was seeking Cray X-MP/24, only one was sold abroad and that too only to Britain and West Germany for weather forecasting prupose. What US offered to India was a set of terms very similar to the one given to Britain and West Germany, its military allies. There was the

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31 <u>The Hindustan Times</u> (New Delhi), 13 December, 1986.

Indian demand , that its sovereign rights should not be violated in any arrangement in transfer of super-computer. One the other hand the US feared that the computer technology or programming should notfall into the hands of the third party. Thus, this kind of sticking of both the parties into their own principles was the bone of contention.[32]

There was also the US insistence that this hi-tech should be used only for the purpose for which it was given. At the same time, India could not be denied the right to use super computer for other calculations, which could be vital importance to it.[33]

It is recalled in this connection that US Defence Secretary Caspar Weinberger had intimated to the Prime Minister Rajiv Gandhi, during the former's visit to New Delhi that President Reagan had decided in principle to allow export of this technology to India.

The government of India, was prepared to have the computer located in Delhi as against its earlier idea of having it in Bangalore. The Department of Science and Technology (DST) will be named as the nodal agency to deal with this equipment.

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[32] A.S. Abraham, " Curious Computer Tale; US Confusion over Policy Goals" The Times of India.(New Delhi) 3 April , 1987.

[33] ibid

The US feared that the supercomputer might be used for purposes other than the weather forecast, weather research and agro-meteorology, were alloyed by pointing out, that the full Indian requirment in this sphere alone would necessiciate use of two and not one super computer. In this kind of atmosphere of suspicion, the two years of protracted negotiations, have brought to the fore differing perceptions on vital issues of security vis-a-vis cooperation.

The pursuit of the supercomputer deal by India was based on programme of completely transforming its computing capabilites in advanced areas like agricultural and meteorological applications. The study of Indian weather in the context of global weather system was a major thrust area.[34] Indian Meteorological Department (IMD) opted for Cray X-MP/24 because it is known workhouse of the European Centre for the Meteorological weather Forecasting. The cost of this super-computer is about US $ 20 million.. However, it was estimated that actual cost may turn out to be Rs.100 Crore.

The American perceptions of India's supercomputer needs, place Cyber -205 super-computer as the upper limit. Manufactured by the Control Data Corp (CDC) it is of 1980 vintage.[35] The country is free to buy any computer

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[34] The Hindustan Times, 17 August, 1986.

[35] Computers Today, July 1986, p.19.

of equivalent capability such as Cray -1 of approximately same Vintage or a single processor Cray-14. However, Indian experts argued that in the fast advancing computer field where models become absolete within months, Cyber-205 is several generations behind the state -of-the-art-equipment.

The crux of the problem is the US apprehension concerning the security implications of an American supplied super computer installation in India. It was felt , particularly by the Pentagon hawks, that the Cray - XMP/ 24 supercomputer with parallel processors would be put to use by India in the nuclear weapon programme, design of ballistic missiles andintelligence -related defence research such as analysis of satellite images. The Americans, in fact, become more suspicious when India after considering Cyber -205 for a year began to explore the supply of the Cray-XMP /24 becomes most handy in supporting most accelerated kind of nuclear and allied military research, and can be used to model a nuclear explosion, using fewer actual detonations to verify the power of the weapon. It is also argued that since only 20 percent of the computer facility is sufficient for executing monsoon models, the country may be tempted to use it primarily for its military programmes. Therefore, such supply would mean promoting the 'nuclear designs' of a nation which is adamant in non-compliance with the Non-Proliferation Treaty (NPT).[36]

However, at the end of the two years of prolonged negotiations between India and US, US indicated its readiness to supply a Cray X-MP/14 , as against the Cray X-MP/24, with two parallel processors desired by India. Eventually, after prolonged negotiations India accepted the offer of Cray X-MP/14 on 11 October 1987.[37]

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[36] The Times of India, 3 April, 1987.

[37] Indian Express (New Delhi) 22 October, 1987, and The Hindu (New Delhi) 23 October , 1987.

CHAPTER -III

THE POLITICS OF SUPERCOMPUTER DEAL

The United States control over the transfer of high technology and goods to other nations is a tangible weapon which is used openly and covertly to influence the foreign as well as domestic policies of those nations to suit the American perceptions.[1] At one level the US is extremely apprehensive of the implications of hi-tech leakage to the socialist-bloc for its national security.[2] and at another level equally bothersome is the military use of these technologies by the recipient nations who could become high risk spots in the realm of international security.

These preoccupations, however, are at loggerheads with the much-proclaimed American doctrines of "free trade" and "free flow of information". The US government had been attempting to control the flow of technology by converting the age-old free-trade practice to restricted trade. The very compulsions of international

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1 Ashok Raj, "US Hi-Tech Diplomacy and the Indian super computer Deal" Strategic Analysis (New Delhi) September 1987, p.735.

2 Jay Tuck, High Tech Espionage : How the KGB Smuggles NATO's Strategic Secrets to Moscow, (London; Sidgwick and Jackson, 1986)

trade- the need of market expansion of multinational companies and the competition with other Western nations, demand hi -tech to be regarded as any other commodity. These comflicting interests of trade and national security marks the prevailing of the American ambivalence in matters of hi-tech transfer.

The Indo-US supercomputer deal is a typical case which demostrates this ambivalence and shows how technology plays major role in American foreign policy. As stated in earlier chapter, the supercomputer in the context of the MOU, signed between India and US in 1985, has become controversial in India's needs of modern technologies and the American quest for new hi-tech markets. Thus, the Indo-US super computer deal which was ambivalent and controversial involved deep politics which need to be examined.

Cycle of Conflict and Co-operation in Indo-US Relations:

The discussion has to be begin with , looking at the Indo-US relations in a brief note. Relations between India and the United States have always been complex , as it is an mixture of ups and downs through all the years. India is a democratic state with the same political values as the United States but relations between the two have been more unfriendly than friendly. It has been on the opposite side of American policies in Southeast-Asia, Central Asia, Eastern Europe, and even at times, on Central America. India has befriended America's adversaries -- the Soviet Union, China (before the 1962 war), North Vietnam, and Cuba. On the other hand, it has maintained friendly ties with the Soviet Union and was the largest recipient of its overseas military sales. The Treaty of Peace, Friendship and Cooperation signed between India and the Soviet Union in 1971, Carried clauses of a quasi-military characters. There is provision of mutual consultations when one signatory to the treaty is involved in an armed conflict with a third party, and the avoidance of alliances with third party states that are adversaries of one of the signatories.

India was the largest recipient of US economic aid during the decade before the 1965 Indo-Pakistan war. While foreign aid to India has trickled down to relatively small amounts since the 1971 Indo-Pakistani war, US foreign investments in India and Indo-US trade have been increasing rapidly since the mid-1970. Over the last decade, the US has ranked first in terms of new investments in India as well as the level of annual trade, surpassing that of the next leading country, the Soviet Union. On the other hand, the United States has been the main source of lethal military weapons to India's main adversary, Pakistan , first in 1950s and again in 1980s. Those weapons were used against India in the 1965 and 1971 wars. The United States befriended India's two main adversaries, Pakistan and China (after 1971) , against whom India has fought four wars. During much of the last 40 years, India was never an ally, nor even appeared to be a friend of the United States.[3] India reacted with anger and hostility during the 1965 Indo-Pakistani war. When American arms were used against it, and again during the Nixon-Kissinger "tilt" toward Pakistan during the Bangladesh crisis that led to the 1971 Indo-Pakistani war.

On the other hand,the Indo-American relationship was not one of enmity either. Relations were cool during the Eisenhower and Carter administrations, and occasionally friendly, as during the Kennedy and the second Reagan administrations. Indeed, the peak of the relationship was the signing of the Memorandum of Understanding in 1984 and the follow-up 1985 procedural implementation agreement. Except for the brief period in the

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[3] Raju G.C. Thomas, "U.S. Transfers of "Dual-use " Technologies to India", Asian Survey (California) September 1990, p.838.

aftermath of the 1962 Sino-Indian war when some American light arms and ammunition were reshed to India and an Indo-US joint air-naval exercise was conducted , there has been virtually no US weapons transfer to India or any other form of military co-operation between the two sides. This is in contrast to the large-scale transfer of American weapons to Pakistan in the 1950s under the SEATO and CENTO defence pacts, and than again in the 1980s following the Soviet invasion of Afghanistan. In the pre-1985 period, Indo-US cooperation in science and technology was restricted mainly to low visibility civilian fields such as agriculture, animal husbandry, forestry and aqua-culture; the health and biological sciences; and the environment and ecology.[4] However, the cooperation also extended to the somewhat higher -visibility area of the physical sciences that included atmospheric, geophysics, and material sciences, oceanography, and basic nuclear Physics.

International Context of Technology Procurement:

To understand the politics underlying in the technology transfer between India and the United States,

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[4] U.S. Embassy Report, "Indo-US Cooperation in Science and Technology, New Delhi, 1986/87."

there is a need to look into the international context of technology procurement.

The shift from "high politics" emphasing East-West security concerns to "low politics" emphasizing North-South economic issues began in the early 1970s.[5] However, much of the transfer of weapons and military technology to the Indian sub-continent continued to occur under the pressures of East-West conflict issues and the linkages that prevailed between global conflict and regional conflict relations. The Cold War during its early postwar phase pushed Washington and Moscow to seek regional allies. About the same time, regional conflict issues between India and Pakistan, prompted Pakistan to seek advanced fighters , bombers , and tanks from the United States.

These Pakistan's military acquisitions provoked India into purchasing military hardware from Western Europe. Soon thereafter, followed the 1962 Sino-Indian and the 1965 Indo-Pakistan Wars, and India turned to the Soviet Union for close military and technological co-operations. Thereafter, much of its weapons procurement came from tethe Soviet Union. More than a decade later, the Soviet invasion of Afghanistan in 1979 triggered

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[5] Robert O. Keohane and Joseph S Nye, Power and Interdependence : World Politics in Transition (Little Brown and Co., Boston, 1977) p.24.

a new round of external arms procurement and licenced production at home by both India and Pakistan. The US again began military sales to Pakistan, and India turned again to the Soviet Union and Western Europe for weapons purchases and licensed production.

The situation was substantially different after 1979 when there was greater common purchase between the United States and Pakistan to dislodge the Soviet military presence in Afghanistan. As a consequence , US -- Pakistan economic ties were also strengthened, based in large part on US economic and military aid that totaled about US $ 7 billion between 1980 and 1990. Pakistan became the third largest recipient of US foreign aid after Israel and Egypt and its GNP grew at an average of about 7% in the 1980s. The decade was also marked by better Indo-Pakistan ties than during the first three decades after independence. But the arms build up in both countries continued through the 1980s at a faster pace than ever before, much of it apparently directed at each other.

Meanwhile, beginning around the mid-1970s, US trade with , and investments in India grew at a furious pace, establishing the United States as India's leading trading parter and foreign investor. But the US transfer and aid policy in the areas of high technology to both India and China has been subjected to close scrutiny in terms of the long-term strategic consequences. So long as India was perceived as a Soviet surrogate state and China as a Communist state that could threaten American interests in the future, American civilian technology transfers to these countries could prove to be strategically counter productive. Even with 'Perestroika' and 'glosnost' sweeping and disintegrate the Soviet Union, India and China remain large-states that could effect the global strategic military balance that may revolve around new ideological and conflict issues in the future.

The Domestic Context of Technology Procurement :

The domestic policy debate on technology procurement in a country like India revolves around the likely contribution and effects in the defence and development sectors. Given the necessities of maximising national security with a minimum resources, and maximising economic development through the allocation of a maximum of resources , technological strategies that can "kill two birds with one stone" are preferred.[6]

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[6] Thomas, no.3, p.840.

The government of India's declared objective, has been ultimately to achieve technological autarchy in both the defence and development sector. In a sense, its declared policy attempts to acquire a broad-based technoligical capability rivaling that of some of the advanced industrialised states such as France, Germany, Japan, if not the United States and the Soviet Uninon. In practice, however, India has sought limited objectives by attempting to buy much of the needed technology from abroad through the licenced production of various products at home. Where the cost of training, equipment and manufacturing is not prohibitive, research and development as well as production, are undertaken at home, for instance, in agriculture and in some basic capital and consumer goods industries even if cheaper and better quality goods may be obtained from aborad.

However, the criteria of defence technology policy in largely based on national security and therefore, is influenced by conditions of political necessity rather than economic viability. The need for high quality military and military-related equipment and services, no matter but the cost, has generated research and development in India in such areas as atomic energy, outer space exploration, computers and other electronic system that are badly needed by defence. Some of these programmes may be hard to justify in terms of civilian economic priorities, but on the other hand, high- cost defence technology has made important contributions to civilian economic development. Although many projects may have been justified initially because of their military applications , some of them have subsequently become justifiable from the civilian standpoint as well.

An example of the interplay between development and defence technologies can be seen in India's nuclear and space programmes. The present unit cost of power generated by nuclear plants is assessed to be more than the unit cost generated by hydroelectric and coal-fired thermal plants.[7] The Indian justification often provided for developing a nuclear energy programme rests on the need to fill in critical short falls in total energy requirements and the prospect that nuclear energy may prove to be commercially viable in future. However, as progress is made on the civilian front, pressures to exercise India's nuclear weapons option also increases. Similarly, the space programme at present may appear to ranklow in India's development priorities, but here too there are sufficient contributions to the country's economic development in meteorological and tele communications. As in the

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7 Raju G.C. Thomas "India's Nuclear and Space Progrms: Defence or Development?", World Politics, 38-2, pp.315-42.

nuclear energy programme, the space programme provides India with a potential nuclear weapons delivery system, since the civilian and military technologies are not very different.

Finally, it is important to note that the weapons procurement technological strategies from the perspectives of the political and military dedisions makers in India can be fundamentally different. From the political stand-point , the primary goal is to assert the nation's independence in defence policy making, and this is best achieved through technological self-reliance. From the military stand-point, the most important objective is to obtain weapons that are technologically comparable to those obtained by potential adversaries, and it is best achieved by gaining access to the latest weapons available overseas. From the policy planning stand-point, there is need to strike an optimum blance between the cost and quality of weaponing ; this is best achieved in the long run through a combination of external technology transfers and domestic production.[8]

Thus , India's politicians prefer technological

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[8] Rajendra K. Pachauri, ed., Energy Policy for India (Delhi: Macmillan, 1980) p.3

independence , its military prefers qualitative, sufficiency , and its economic planners are willing to settle for something between the two. Ultimately, these choices depend on the level of domestic technological capability achieved by India.

<u>The Nuclear Factor</u>:

The crux of the problem is the US apprehensions concernigg the security implications of an American -supplied supercomputer installation in India. It is felt by Pentagon hawks, that the Cray X-MP/24 super-computer with two parallel processors could be put to use by India in its nuclear weapon programme, design of ballistic missiles and intelligence-related defence research analysis of satellite images. The Americans, in fact, became more suspicious when India after considering Cyber -205 for a year began to explore the supply of the Cray X-MP/24.

To what extent such reluctance in offering the super-computer is related to the apprehension that India may be in the process of considering its nuclear option is a matter of conjecture. A facility such as Cray X-MP/24 becomes most handy in supporting most accelerated kind of nuclear and allied military research, and can be used to model a nuclear explosion using fewer actual detonations to verify the power of the weapon. It is also argued that since only 20 percent of the super-computer facility is sufficient for executing monsson models, the country may be tempted to use it primarily for its military programmes. Therefore, such supply would mean promoting the 'nuclear designs' of a nation which is adamant in non-compliance with the Non-Prolife-ration Treaty (NPT) [9]

The campaign of India going nuclear and the need to block supercomputer supply became so intense that a study accused India of having secretly imported around 293 tons of heavy water from China to cover the shortage in its nuclear programme and recommended thus:

> The remedy-- and there must be a remedy if controls mean anything -- is to halt nuclear trade with India as long as the public shor tage of heavy water remains. Moscow should not provide New Delhi with any more heavy water. The United States should not sell India anything with possible nuclear application, such as the super-computer now being considered.(10)

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[9] A.S. Abraham. "Curious Super-computer Tale, US confusion Over Polciy Goals" The Times of India, 3 April, 1987.

[10] Garry Milholin , " India's Nuclear Cover-up" Foreign Policy (New York) no.64 , fall 1986, p.161-75.

India, on the othr hand, has declared that the facility would be primarily used for agro-meteorological applications and monsoon studies and, in fact, has also given an undertaking that the super-computer would not be put to nuclear weapon development. However, it was unable to put to rest the US anxieties as it did not agree with the concept of limited sovereignty.

The problem of nuclear safe-guards, in fact, seems to be rooted in the MOU itself. Firstly, it is conjectured that it does not specify the levels of computers and their speeds that the US is ready to supply.

Secondly, the American demand of introducing nuclear clauses in the assurances of MOU as well as association of US officials in implementing these assurances in the absence of clear-cut definition of nuclear uses seem to have caused much confusion. A third problem was India's refusal to give a blanket guarantee against nuclear use. However, the Indian government ordered a review of the whole question of nuclear uses of American technology. In the light of these observations, critics were of the view that the MOU has not only failed to become passport to the super-computer deal, but remained a cleverly worded EAA, and a formalised but indirect instrument of imposing NPT. The demand for inspection of super-computer uses indeed is its back-door enforcement . In the American perceptions, only such an arrangement is the price to be paid for Indian access to its hi-tech.[11]

Russian Factor:

Another American concern was the proximity of the Soviets to Indian supercomputer facility. Since India "obtains much of its military equipment from the Soviet Union, it could gain excess to the supercomputer and use it to decipher American codes".[12] That apart, the technology which is extremely crucial to their own development of supercomputer, may leak to the Soviets. These apprehensions are obviously based on American perceptions about the presence of large number of Soviet scientists and engineers in critical military and civilian industry in India. This has made not only Indian arms industry highly flexible in policy over time, but also resulted in strong ideological tie-up with Soviet Union.[13] However, experts put aside such American fears because they feel that it would be easier for the Soviets, if they so

11 Raj, no.1 , p.738.

12 The Hindustan Times, 12 August 1986.

13 Bharat Karnad, "US still wary of Technology Transfer" "The Hindustan Times, 4 February, 1986.

desire, to spy on the super-computer technology .

The American negotiations have been consistently demanding that the computer sold to Indian research institutes could not be used for other purposes without prior US authorisation. Initially, the CIA hawks forced president Reagan to have rigid safe guards in terms of so e extra-territorial measures. They demanded the IMD room in which supercomputer was to be locked should be considered US territory. This idea was being rejected on being too stupid, they then demanded the control of the super-computer should be in the hands of Americans, who could monitor its uses by remote on-and-off switching using encrypted codes beamed down from a US military satellite.[14]

As the issue of monitoring was being grappled with, the scientists in the IIsc, categorically refused to associate American experts in running the supercomputer. Bogged down by this stand US embassy in India finally made suggestion that the American supervisors would not be posted on the campus of IISc, located in Bangalore. By this time even some officials of the Ministry of External Affairs of India began to oppose the demand of

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[14] The Hindustan Times, 15 August 1986.

associating American personnel with the maintenance and operation of the supercomputer. However, refusing the US any right to inspect, Indian negotiators offered to associate with the US in any inquiry about diversion of technology or misuse of it.

Apart from accepting the US safeguards, it has also been decided that the super computer would be installed at IMD, in Delhi, under the auspices of the Department Science and Technology (DST). It has been reported that India has agreed to random checks on the condition that no US supervising staff be present to operate the computer. However, security checks, at a fequency of two-to-six days by the US personnel needed for undertaking specific sophisticated operations would be allowed.[15]

As the stalemate over safeguards continued for months, the US inter-agency panel comprising officials from the defence, state and commerce departments and from several intelligence agencies as well, deeided to offer Cray X-MP/14 with a single processor in March 1987 It was perceived that such a facility could not be of much utility in advanced areas of defence - oriented research.[16]

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15 The Hindu, 12 December 1986.

16 The New York Times, March 28-29, 1987.

Free Trade vs National Security:

The American ambivalence as seen in the Indian super-computer deal amply demonstrates the US inter-agency conflicts. While the Pentagon insists on complete control of high technological transfer abroad, it comes to disputes with other organs of US administration , which support free trade. It became necessary under the compulsion of the expansion needs of the American market where other nations , particularly Japan, have emerged as formidable competiturs. In the hi-tech business scenario, India of course constitutes a huge market and the sale of super computer was to mark further opening up of Indian to American MNCS in other areas as well.

Such compulsions have made the American trade critical of the export licensing process of the DOC and many times succeeded in compelling the US government to loosen its grip on controls. Not only is the EAR cumbersome and difficult to interpret, it also leads to much delay. Pressures from big firms like Sperry Univac and CDC have resulted in loosening of trade restrictions even to the socialist bloc. Out of 700 listed technologies, the CDC company found only 126 controllable technologies of which 50 were already proprietary. The problem, it is argued, lies with the lack of defining the criticality of technologies in question.[17]

A study conducted by the National Academy of Science on national security and export controls shows that the policies of the technology protectionism are leading to huge financial losses and having corrosive effect on relations with the NATO allies . These nations charge the US of extra-territoriality infringement in their national security and violation of international law. The report recommended that the US should shorten and upgrade its embargo list and integrate the items with those on the CoCom list. The CoCom , in fact, should become the main organ and the US control system should become addition to it. In addition, as most of the technology gets directed to the East via approved third countries. the NATO control regime should exercise controls on these countries and even prohibit diversion of indigenous produce of hardware based on Western technologies. The report indeed was alleged to be inspired by the US trade lobby.[18]

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[17] Paul Wallich, "Technology Transfer at Issue: The Industry Viewpoint", IEEE Spectrum, vol.19, no. 5, May 1982, p.73.

[18] Indian Express , 14 and 17 January , 1987.

Apart from the US industry's opposition to the embargo of free trade, the protest against curtailment of scientific freedom among the academic community were also widespread. The academicians argue that it is difficult to separate military critical information from the total body of scientific technical knowledge. Research only can thrive in openness and rapid communication with colleagues working on similar problems elsewhere.[18]

Similar pressures began to work in case of the Indian supercomputer deal. When the CDC came to know about the rigid safeguards being argued , it warned the US government, that India would not accept them and opt for Japanese or French offer for which negotiations had already started. The American officials, had to soften their position when they found that Indians were assessing the Bull company of France as a favourable supplier of super computer. This change eventually became a major impetus for the Indo-US joint Commission to clear the deal.

In addition, India was given a grant of $7 million in 1986 to develop computer industry by the USAID to supplement $20 million loan from the US Export- Import Bank for the CDC-ECIL venture of manufacture of main-frame computers. This assistance would finally result in a purchase of $500 million worth hardware from CDC. This assistance package is one of the 12 mixed credits initiated by the US government and to

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[18] Wallich, no.16, p.75.

help CDC compete against Bull of France [19] in such arrangements CDC indeed has emerged as a major beneficiary of the MOU.[20]

CoCom Fraternity:

The Indo-US supercomputer deal also witnessed a glimpse of the hi-tech battle between the two hi-tech super-powers ; US and Japan. Disenchanted with the highly discriminating approach of the United States, Indian negotiators, signed a letter of intent with NEC of Japan for buying an SX-2 in 1986. At that time, there were only four such systems installed in the world, one being at the Houston Area Research Centre.[21]

Like many other fields, Japan has entered the super computer race at high speed with US. The Japanese continue to slash prices and give heafty discounts to its prospective customers helped by their large size of their companies and massive R and D subsidies from the government.

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[19] The Statesman (New Delhi), 1st October 1986, and The Hindustan Times, 17 August 1986.

[20] The Times of India, 9 February, 1986, and The Washington Post, 6 Feb., 1986.

[21] "Record Breaking Super-computer Figures in Trade Dispute" New Scientist (New York), 5 February, 1987, p.39.

Another typical feature of Japanese computer industry tie up in groups in order to collectively face out side competition.

As Japan has become a formidable competitor, the US attempts to control Japanese market by employing the CoCom instrument. In the Indian case, US cautioned the Japanese on the utmost necessity of upholding CoCom in order to safeguard western technological edge. An US team headed by the US Additional Secretary of State on visit to Europe was asked to go to Tokyo to finally jeopardise the Indo-Japanese supercomputer deal in the light of newly upgraded CoCom regime.

Geopolitics of Monsoon:

Another dimension of Indo-US supercomputer deal was the American accessibility to Indian meteorological information, while the US needed the Indian Ocean weather data to fill the gap in its own global data bank for the modelling of global weather predictions India needed it to acquire capabilities to work on its weather data to make prediction of greater accuracy.[22]

In this context, it is worth-while to note here that as per original plans the supercomputer was to be

[22] The Hindustan Times, 15 June 1986.

installed at IISc, Bangalore. The IISc scientist vehemently opposed the idea of US engineers super visiting and 'policing ' their use of the facility. They not only revolted at the suggestion that they needed the US assistance in studying the monsoon, but also suspected the data would be used by the US agro-business to manipulate agricultural prices and other related decisions to their advantage.[23]

India , possibly in view of the super computer need for meteorological research, has already supplied 100-year records of its weather data to the US. Parting such could mean helping US to enhance their capacity to forecast Indian weather patterns at seasonal and yearly levels with quite fair accuracy.[24] This, however, compelled Indians to make a serious observation that a constituency in its scientific community in S and T establishment advertently or inadvertently is top willing to submit to and appease the foreign interests.[25]

This indeed corresponds to yet another area of geopolitics of information in which the advanced nations are rapidly gaining the position to exploit the global weather data as an information resource and create serious politico-economic implications for the susceptible Third World. The privatisation of LANDSAT system, the global satellite system for remote sensing, and possibly that

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[23] Blitz (Bombay) March 28, 1987.

[24] The Statesman , March 28, 1987.

[25] The Indian Express, 13 December, 1986.

of American meteorological satellites in near future indicate that global weather and remote sensing information would increasingly become the trade monopoly of the Western nations.

The Concept of limited Sovereignty in the Super-Computer Deal:

The US's announcement to sell supercomputer to India for weather forecasting and "issues of mutual concern considered further by both governments". The USIS (United States Information Service) release has said, that the supercomputer will be located in Delhi and is "primarily meant for use in the agro-meterology area which will be coordinated by Department of Science and Technology.

The "issues of mutual concern" refer to conditions that the US trying to impose for the operation of the super computer. Washington was seeking control that it has said to effectively prevent leakage of computer data to the than Soviet Union or its use for Applications other than said in the agreement.[26]

US delegation sources have drawn parallel between the US decision to supply the equipment to India and its arrangement with its NATO allies must concede to the US in such matters. The government of India has been cautious

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[26] The Times of India, 3 April 1987.

proposals which will be considered further by both the governments", is tailored to prevent India from seeking a super-computer from other sources (there are indications that the Soviet Union has also made an offer) and to pressurise India into accepting at least the same kind of safeguards as do Britain and West Germany.

This was indicated by the US to Japan which also has super-computer for sale , that it must also apply same preconditions as does the US, if India seeks to buy Japanese computer. This is an illustration of the practice of limited sovereignty, whereby Japan is not free to make commercial deal with India in high technology without the consent of the US.[27]

Thus, it was the classic example of how high technology is increasingly being used to curb the national inspirations of developing nations which need the technology for their growth but have to barter away their sovereign right of choice and freedom of operation. So to say, this was on form of neo-colonialism.

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[27] The Times of India 3 November, 1986.

CHAPTER IV

CONCLUSION

Technology has been acknowledged as a major factor in the U.S. foreign relations, throughout the post-war period. Indeed, much of U.S. post-war global predominance has been based on the supremacy of U.S. military and civilian technology. The critical role played by technology in advancing the U.S. national interests is prominent in almost all contexts. The U.S. technology in foreign affairs is significant not only in terms of its military-strategic value but also increasingly in terms of its commercial and social value (that is its relationship to international economic competitiveness and to national development).

The role of technology in U.S. military strategy has been most important. Another has been the use of technology to enhance U.S. diplomatic influence and prestige (foreign aid, space exploration and so on). Third has been the role of technology in private foreign investment. In view of the expanded significance, the post-war U.S. policies or non-policies towards the transfer of technology across national boundaries had taken place in three separate and unrelated policy context.

In strategic-military context emphasis of role of U.S. technology had been in maintaining a qualitative strategic superiority over Communist bloc and other adversaries. Thus U.S. policy has been largely restrictive and heavily influenced by high level governmental agencies. In the foreign assistance context the use of U.S. technology had been to influence domestic and foreign policy conditions in friendly or neutral countries. This policy reflects a mix of restrictive/conditional and liberal/humanitarian considerations relating to public and private organisations. In private industrial context, the transfer of technology had been to subsidiaries of American MNCs in third world countries or to joint-venture industries, but the transfer has been kept in consonance with the declared American trade policies.

The U.S. because of its military and economic predominance and power controlled the multilateral institutions like CoCom, to influence the technology transfer policies of others to meet its own interests. In the name of adversaries of the West, U.S. had always sought and obtained a technological edge over the socialist bloc. The U.S. had been always expanding its apprehension of implications of technology leakage to the socialist bloc and also strongly expressed worry about other recipient nations who may use it for the military purpose or pass it on to the Soviet bloc of countries. With the advent of high technologies or dual-use technologies the U.S. was no longer in the control of technology transfer. The adversaries were benefitted by this dual-use technology products like computers, which alarmed the U.S.

The end of second cold war, disintegration of the USSR and changes in Eastern Europe, questioned the very basis of U.S. technological protectionism. With the global diffusion of technology, U.S. hegemony in trade and technology declined. Hence many U.S. technology export controls appeared impractical. The conflicting views and policies of U.S. hi-tech transfer policy became captive. Many Congressmen asserted that, resrictions on hi-tech exports cost the U.S. economy more than $ 8 billion annually in lost sales, undercut the competitiveness of U.S. companies, and caused needless friction with its allies which actually endanger U.S. security interests.

U.S. derived the politico-economic advantages by maintaining technological edge over third world by restricting technology transfer. It was also perceived by the U.S. that most of the countries in the third world, particularly the non-aligned, were more favourably disposed towards the Socialist bloc. Therefore, the U.S. perceived that any of these countries receipt should be easy channel for diversion of technology to the Socialist bloc. In this regard, the perception of India as a likely conduit of western technologies to the Soviets gained currency to serve both these perceptions. But, as mentioned earlier, this U.S. perception of technology transfer to the third world on the ground of leakage to the Soviets appears to be irrelevant with the end of cold war and disintegration of the USSR. Now the Russian Republic and other disintegrated republics would be less of a threat, as they are more dependent on western credit and civilian technology for their stability.

Another important aspect that needs to consider would be the U.S. interest to foster the flow of technologies to the new found democracies in the East, for promoting the cause of democracy. How does this altered perceptions affect other developing countries of the South, especially India, a consistently democratic country that has been espousing values which are now being aspired by the East European countries. Significantly, the U.S. foreign policy makers have currently identified the third world countries as the adversaries in American hegemony, replacing the USSR and its allies. Therefore the technology transfer policies and technology control regime is going to be more harsh on third world.

The U.S. ambivalence on "free trade" and "free-flow of technology" was explicit especially when Indo-U.S. super-computer deal was negotiated. Formal understanding was concluded for the transfer of super-computer from U.S. to India under the purview of MOU. The transfer was scuttled many times because of major conditional demands by U.S. and eventually U.S. supplied Cray X-MP/14 instead of Cray X-MP/24. This deal brought to the fore different perceptions of security and cooperation. Here it appears that the U.S. foreign policy makers have the objective of abusing technology transfer policy to control any nuclear proliferation by the recipient country. The super-computer deal appears to be one of that exercises. The repeated clarifications by India that the super-computer will not be used for any nuclear or military programmes, was hardly taken in seriously by the U.S. negotiators. They repeatedly insisted that the super-computer, Cray X-MP/24, that India was seeking, was not suitable to the India, as only 20 per cent of its capability was enough for Indian weather forecasting requirements. Therefore, the Americans tried and succeeded in transferring a lesser capability super-computer; Cray X-MP/24, in order to assume their objectivity of discouraging any nuclear proliferation by India.

The technology transfer policy of U.S., especially the Indo-U.S. super-computer deal also reveals that, the technology transfer policy is means to control the sovereignty of a nation. Technology transfer policy has also been used for gaining extra-territorial rights. This was also visible in the super-computer deal negotiations. But, India strongly resisted this trend in U.S. foreign policy. However, it is debatable, whether the other third world countries will be able to do so?

The super-computer deal also witnessed a glimpse of the hi-tech battle between the two hi-tech super-powers; US and Japan. Indian negotiators signed a letter of intent with NEC of Japan for buying an SX-2, being disenchanted with the highly discriminating approach of U.S. As Japan has become a formidable competitor, the U.S. attempts to control Japanese market by employing the CoCom instrument. In the Indian case, U.S. cautioned the Japanese on the utmost necessity of upholding CoCom in order to safeguard the western technological edge.

Another dimension of the super-computer deal is the American accessibility to Indian meteorological information. While the U.S. needs the Indian Ocean weather data to fill the gap in its own global data-bank for the modelling of global weather predictions, India needed a super-computer so as to acquire capabilities to work on its weather data to make predictions of greater accuracy. This U.S. data requirement was suspected as the data could be used by the U.S. agro-business to manipulate agricultural prices and other related decisions to their advantage.

The super-computer deal, the first major high-technology venture of the Indo-U.S. trade, has become victim of highly contradictory and wishful diplomacy as practised by the United States. The MOU has failed partly because the deal had been pursued without resolving the pertinent issues of the MOU. The MOU, in turn, has failed in softening the American attitudes except that its formulation and adoption has facilitated liberal flow of American hardware to India, particularly in the private sector.

The way U.S. perceived the Indian request for Cray X-MP/24, and offered Cray X-MP/14, with so many strings attached to it, amply underlines the bankruptcy of its much-proclaimed foreign policy goal of providing the third world nations an access to frontier technologies. It underlined the confusion which continues to blur their perception of relations with India, and also that their willingness to export high-technology goods to the third world in essence remained under confusion and suspicion. The deal also clearly indicated that the outcome of an unequal partnership in unilateral cooperative ventures in the final analysis is invariably determined by one who exercises greater political clout at the international level.

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