other. The main cause of extensive and gross degradation of environment is the lack of appreciation of the holistic concept of environment and interlocking, interdependent concept of ecosystem particularly by the industrialist, planners, decision makers, politicians and the common man, who go for short-term gains and growth only in the desired direction. Important constraints which affect sound environmental and developmental activities may be broadly taken up under the following headings.

Long-term investment

To restore the quality of environment efforts on a long-term basis are required Although it is currently fashionable to talk of long-term strategies, yet the economic and political constraints override it and result in a short-term quick return investment activity. The financing agencies also require quick returns even at the cost of environmental degradation. The losses cannot be easily quantified in terms of money.

Less opportunity for creative freedom

Scientists generally value the opportunity for creative freedom. They also enjoy satisfaction in conducting research that has direct relevance to developmental problems. But these days research is driven by wishes of granting agencies. The reason lies in the manner in which research work is assessed. Scientific community recognizes research by the discovery of new and valuable information and the publication of research results in peer-approved media. But policy-makers hardly consider the merit of technically excellent publications. They go by newspaper publicity values.

No security for career structure

To the scientists and researchers, there must be an assured employment, personal securities and a career structure. In developing countries like India research is restricted by financial constraints and researchers often are unable to pursue a career in research while still retaining promotional prospects.

Insufficient cooperation between government body and non-government organisations (NGOs)

In government organizations, although there are very efficient, trained and qualified personnel, they have limitation for taking decisions under certain rules and laws. They have very limited options. NGO's are free from this and play important roles. They are free to take immediate decisions regarding capital investment, expense, suitability of place for running a project etc. They can act as a tight link between micro-level or grass-root level to policy-makers of governmental body. The government must take the benefit of these organizations and should provide strength. The performance of NGO's should of course be assessed and should be answerable.

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Technology development: The role of the State

R. Narasimhan

The strategic importance of technology

Increasingly, independent access to technology and control over its deployment are becoming determining factors in the kinds of roles nations can play in the global arena. Control over technology is vital not only for national development but for success in bilateral and multilateral trade negotiations and, also, in political bargaining in international fora. In this modern world 'technology literacy' – that is, a thorough understanding of the potentials and implications of existing and emerging technologies – is an essential prerequisite for effective diplomacy. Technology literacy, coupled with a perceived strength in developing and deploying cutting-edge technology, is essential for a country to be heard and treated as an equal partner by highly industrialized countries.

In the recent past, on more than one occasion, India has had to learn this lesson the hard way. In the recently concluded GATT negotiations India found herself having very little leverage with the highly industrialized countries to renegotiate the terms of the Dunkel Draft. Senior Indian government officials closely involved in the GATT negotiations admitted that India had no choice except to sign the Draft as agreed on by the Western countries (including Japan)[1].

India, again, cut a sorry figure in her attempts to purchase cryogenic rocket engine technology from Russia. In bilateral negotiations with the US government for accessing the so-called dual-use technologies and equipment, India has invariably been a loser. Significantly, in analogous contexts, China has been able to succeed in negotiating from a position of technological strength.

Notwithstanding serious failures in the diplomatic front as indicated above, the developmental and political impli-

cations of technology are, unfortunately, not yet fully grasped in India. Thus, technology considerations play a negligible role in the shaping of our national policies – whether economic, political, or developmental. There are no think-tanks, brains-trusts, or other kinds of study groups in India whose primary focus is technology. There are policy research groups, economic research agencies, social and manpower development study groups, and so on. But technology issues play little or no role in the deliberations of these study groups. Consequently, long-term, mission-oriented, technology-based approaches to improve, for example, educational methodology, transport, public health, literacy, and so on, find no place in draft plans at the national and, even more importantly, at the state levels. In such contexts, instead of independently analysing the issues involved and assessing the role technology can play in their solution, we tend to follow blindly the prevailing fashions in the Western world.

Technology development is a government responsibility. This is true equally of developed and developing countries. Technology development calls for deliberate planning, informed management, and calculated market intervention. Market forces left to themselves will not help a country to acquire technological competence and strength to meet its strategic needs. Nor can a country hope to achieve this by opening its doors to multinational enterprises (MNEs) without any constraints.

Both these assertions assume major significance in the current context of India's efforts to implement the 'new industrial policy'. The central thrusts of this policy are, of course, globalization, privatization, and export-driven growth of the economy. I shall argue in this paper that unless the government equips itself with the requisite technology literacy and management skills to guide deliberately the market forces, the desired socio-economic goals are unlikely to be achieved.

There are two main parts to my argument. In the next section I shall summarize the main conclusions of a major, on-going study being carried out for the US congress. This study analyses the kinds of constraints that ought to be imposed on MNEs and foreign direct investments (FDIs) to ensure that a country's long-term socio-economic and strategic interests are safe-guarded.

The rest of the paper is concerned with the so-called *East Asian economic miracle* – the spectacular economic success achieved in a remarkably short time by Japan, South Korea, Taiwan, Hong Kong, and Singapore. In a careful and detailed recent study, Wade[2] has persuasively argued that the respective governments' informed management of the market was of central importance in bringing about this 'miracle'. I shall summarize the gist of his arguments by taking Taiwan as a typical example.

We shall see that the lessons to learn from the *East Asian miracle* – as identified by Wade – parallel surprisingly closely the formula being followed by India prior to the enunciation of the 'new industrial policy' for economic growth. Why didn't these guiding principles work in India when they succeeded so spectacularly in the East Asian countries? In the concluding section I shall offer some speculative thoughts to come to grips with this puzzle.

Multinationals and the national interest

One of the central tenets of India's 'new industrial policy' is to place our total faith on foreign investments and multinationals (MNEs) to 'demarginalize' ourselves. The 'new industrial policy' statement, in fact, spells this faith out in unambiguous terms:

Foreign investment would bring attendant advantages of technology transfer, modern managerial techniques, and new possibilities for the provision of exports [3]

Elaborating this sentiment, the Finance Minister has been quoted as affirming:

We are not just considering foreign investment, but are trying to seek and welcome it on attractive terms. If we want first class technology, it is with the multinationals So we will learn to do business with multinationals [4]

In this context, it is highly significant that the US congress has recently commissioned a major study[5] to analyse to what extent reposing total faith in multinationals to serve national interests is, in fact, justified. The immediate reason for undertaking such a study is the steady fall in the economic status of USA in comparison to, for example, Japan and the European community. In the late 1960s, of the 500 largest MNEs, more than 300 were from USA. Today only 157 are US-based, while 168 are from Europe and 119 from Japan. Can USA continue to base its faith in MNEs to retrieve the situation and recover its technological and economic pre-eminence? Preliminary findings of the study would seen to call for some amount of *willing suspension of belief*.. Here are some selected quotations from the first report of the study.

What do nations want from the MNEs? In the end, the US wants MNEs to conduct business here and interact with local firms in ways that generate and retain wealth and quality jobs within its borders. This is what all nations generally want and increasingly demand from MNEs. For US it translates most immediately into high-wage, high-valued jobs for Americans, indigenous technology development, advanced manufacturing that draws on local talent, an expanding tax-base, and ultimately generalized economic well-being[6].

The US economy (or any other, for that matter) cannot remain competitive unless MNEs that sell and conduct business in America also contribute to its research and technology base, employment, manufacturing capabilities, and capital resources[7].

The interests of MNEs, however, do not always conform to those of United States... MNEs are understandably less concerned with advancing national goals ... than with pursuing objectives internal to the firm ...[8].

If a US-based [MNE] principally operates screwdriver assembly plants in the United States, exports critical technology development functions, and moves most or all of its production facilities abroad to take advantage of low wages and lax environmental standards, it would not be acting in the national interests .[9].

Many industrialized countries have imposed local content rules and have set up technology promotion programs that encourage companies to implement strong local commitments Such rules .. have forced US and Japanese companies to adopt more locally-oriented production strategies as a condition of market access ...[10]

If the sentiments expressed in these excerpts are relevant to the economic situation in USA, clearly, they are all the more relevant to the economic scene in India. We cannot take refuge in the comforting belief that having dismantled all controls and opened up our markets to the world, all we need do to solve our problems is to seek and

welcome MNEs who have all the technology and who would only be too glad to transfer their knowhow to us and contribute to the growth of high-value-added employment in India.

As Wade points out: 'Even a government committed to free-trade must be purposeful, must have a system of policy management that recognizes the effect of interactions between its own activities, and must be able to insure that desired responses are forthcoming from the commitment of public resources. ... *Free-trade policies are no means of escape from the need to improve the capabilities of governments.*' (emphasis added)[11]

The East Asian miracle: The case of Taiwan

Hong Kong, Indonesia, Malaysia, Singapore, South Korea, Taiwan, Thailand, and Japan are, together, often referred to as the eight East Asian *superstars*. 'Since 1965 these economies have together grown ... more than twice as fast as the rest of Asia, and three times as fast as Latin America. The export performance of these East Asian economies has been particularly dramatic with their share of the world exports of manufactures leaping from 9% in 1965 to 21% in 1990. ...[These economies] were also successful in sharing the fruits of their growth, with low and declining inequality of income. ... What was the secret of this economic miracle?'[12].

Of these eight countries, the dramatic economic growth and transformation of South Korea, Taiwan, and Japan have been particularly noteworthy and have attracted considerable attention. It used to be routinely argued that the *East Asian Miracle* is a direct outcome of allowing market forces free play without any government intervention. But systematic and detailed investigations of the actual market functioning in these countries have shown that the respective governments have, in fact, played a deliberate and calculated interventionist role to guide their economies to shift in desired directions. The accumulated evidence is so compelling that even the most committed free-market ideologues now grudgingly admit that government intervention in the market has, in fact, contributed significantly to the 'miracle'[13].

Wade's recently published study[2] is perhaps one of the most systematic, detailed, and carefully documented investigations of the contributions of the concerned governments in bringing about the 'East Asian miracle'. His discussions concentrate on analysing the cases of Taiwan, South Korea, and Japan – Taiwan, most elaborately. I shall, in the rest of this section, summarize his analysis of the case of Taiwan[14] and his description of the kind of interventions and guidance resorted to by the Taiwanese government.

Taiwan's 19 million population had a per capita income of US $3600 in 1986, about the same as Greece, and ten times that of China. Income distribution was more equal than in Japan, Korea, or USA. Unemployment was below 2% during the period 1968–1982. Almost all households in 1982 had electricity, TV, refrigerator, and motor cycles while two-thirds had piped water, telephones, and washing machines.

By 1982 life expectancy at birth was 75 years for women and 70 for men. Virtually all primary-school-aged children went to school; almost all of them went on to junior high school, and 80% of the senior high school graduates went on to higher education. By 1982, population growth was down to 1.2%.

Taiwan was the biggest exporter of manufactured goods from developing countries to OECD. Between 1979 and 1984 its share rose from 17% to 21%. These exports included not only textiles and clothes but also radios, TV sets, cassette recorders, electronic calculators, sewing machines, car parts, machine tools and PCs.

In 1955, 85% of the exports were agricultural products; today industrial products make up 90% of the exports.

Taiwan and Korea now have highly integrated economies made up of high-wage, high-technology activities. They have achieved in 15 years what took Japan 25 years and Great Britain over 50 years. Import substitution played a crucial role, in the case of Taiwan and Korea (more so in the case of Taiwan), in achieving growth in the manufacturing sector. Taiwan aspires to be known as the Switzerland of Asia, emphasizing high-quality in selected industries with relatively small-scale firms.

The government played a critical guiding role in this transformation of Taiwan from a predominantly agricultural country to a highly industrial one in a remarkably short time. The industries specially promoted by the Taiwanese government include. steel, shipbuilding, machine tools, automobiles, electronics and information. To get some feel for the kinds of intervention the government resorted to, we shall consider the electronics and information industry in some detail.

To strengthen R&D capabilities, the Industrial Technology Research Institution (ITRI) was established in 1973. By 1987, ITRI's budget was US $215 million with a staff of 4,500 organised into 6 institutes specialising in: electronics, machinery, chemical engineering, energy and mining, industrial materials, and standards and measurement. A similar institute was set up to deal with military technologies.

The state officials planned as early as 1972 for Taiwan to acquire expertise in semiconductor technology. In 1974, the publicly owned Electronics Research and Service Organisation (ERSO) was started under the ITRI umbrella with the specific mandate to acquire a foreign collaborator to transfer know-how in semiconductor technology and help to commercialize it. In 1977 ERSO signed a technology transfer agreement with RCA for IC design. By the late 1970s, the Taiwanese government broadened its vision to growing an information industry linking together semiconductors, computers, telecommunication and software. This was given a very high priority. An Information Industry Task-Force with two cabinet ministers was formed directly reporting to the prime minister.

To commercialize the technology, ERSO formed a subsidiary – United Microelectronics – with 45% equity shared by 5 private local firms. In 1982, United Microelectronics opened a state-of-the-art fabrication facility to make a variety of ASICs. It also formed agreements with 3 Silicon Valley Chinese American firms for advanced IC design.

In 1986, the government reached an agreement with Philips to start a foundry-type VLSI factory. The government persuaded domestic private and public firms to collaborate with Philips in this deal and contributed half the $135 million start-up cost. This new company is called Taiwanese Semiconductor Manufacturing Corporation (TSMC). By mid-1988, TSMC was fabricating 10000 wafers a month with linewidth down to 1.5 microns and a yield of 1.5 to 2.5 defects per square

inch, compared to the Japanese average of 0 8 to 1.5 defects per square inch.

A second $ 220 million plant was scheduled for completion by late 1989. Taiwan has the largest pool of chip design talent outside Japan in Asia. There are 58 design houses in Taiwan compared to 218 in the whole of Europe. Taiwan has over 100 computer manufacturers compared to less than 60 in Korea. Although all the computer firms are privately owned, ERSO continues to play a leading role assimilating and transferring advanced technologies. ERSO has been active in the software industry also. But a separate publicly-owned institute (Information Industry Institute) established in 1979 has taken over leadership in software, transforming itself into a profit-making public enterprise.

In information industry Taiwan, which used to be looked upon as a cost-effective base for unskilled assembly operations, has transformed itself into a cost-effective base for high-quality, high-skilled, professional (i e., design and fabrication) operations.

Lessons to learn

Based on the detailed analysis of the experiences of Taiwan, Korea, and Japan as primary players in bringing about the *East Asian miracle*, Wade lists in his book six prescriptions which encapsulate the strategies used by these governments for managing and guiding the markets[15]. These prescriptions are quoted below with some of the explanatory comments Wade provides to motivate them. In the next section we shall discuss the relevance of these prescriptions to the Indian experience.

***Prescriptions (I)**: Use national policies to promote industrial investment within national boundaries, and to channel more of the investment into industries whose growth is important for the economy's future growth*

Wade points out that state assistance is especially needed to promote capital goods industries and microelectronics. He emphasises that *microelectronics constitutes more than just a radical change of technology. It constitutes a change in techno-economic paradigm, a set of changes which not only lead to new industries and products, but pervade almost every branch of the economy*

***Prescription (2)**: Use protection to create an internationally competitive set of industries*

***Prescription (3)**: If the wider policy calls for heavy reliance on trade, give high priority to export promotion policies.*

Wade argues that it is misleading *to present import substitution and export promotion as mutually exclusive strategies*. According to him, so far as particular industries are concerned, *import-substituting incentives and export-promoting incentives can be complementary*.

***Prescription (4)**. Welcome multinational companies; but direct them towards exports.*

Foreign firms, according to Wade, *should be under pressure to direct their sales towards exports and their input purchases toward local suppliers*. This is important to ensure that MNEs base their production on cutting-edge technology to stay internationally competitive, rather than opt for outmoded technology which would still enable them to compete effectively in the protected domestic market.

***Prescription (5)**: Promote a bank-based financial system under close government control.*

Command over the financial system ensures governmental clout to move the economy in the desired direction. Governmental leverage could easily lead to abuse, of course. Wade discusses in detail institutional safeguards needed to prevent (or minimise) such abuses.

***Prescription (6)**: Carry out trade and financial liberalisation gradually, in line with a sequence of steps*

According to Wade, the East Asian experience suggests the following sequencing: macroeconomic stabilization; external financial assistance; import liberalization tied to exports; import liberalization to promote competition in the home market; assistance to export promotion; financial stabilization.

For these prescriptions to work, additional initiatives are needed which are of a more organizational and political nature. These are discussed in great detail by Wade and lead to four more prescriptions. These have to do with setting up an informed bureaucracy, ensuring coherence in the actions of the various government agencies, and so on. We shall not discuss these aspects any further here since, for the most part, they are necessary components of any effective government.

Ends and means

Looking at the six prescriptions listed by Wade as contributing to the *East Asian miracle*, what strikes one immediately is how closely they parallel the strategy for economic development being followed in India prior to the enunciation of the 'new industrial policy'. If these prescriptions resulted in a 'miracle' in East Asia, wny did they fail so miserably in India?

World Bank[16] takes comfort in the belief that the *East Asian miracle* cannot be replicated in other developing countries because for market intervention to work a unique institutional factor is needed: viz. *the competence and relative lack of corruption of civil servants*. And this is, according to the Bank, hard to come by in general in developing countries. This may be one explanation for the prescriptions not working in India, although the explanation, itself, is not persuasive enough. After all, lack of competence and corruptibility are not peculiar features of the Indian bureaucracy. One has, for example, come across enough news-stories of corruption and kick-back scandals in Japan at high levels in the government.

Wade[17], himself, believes that protection of the domestic market did not result in India in the growth of internationally competitive industries because there was a *failure to integrate protection with a wider industrial policy, or link it to export performance, or make quid pro quo condition credible, or to maintain macroeconomic stability* This explanation certainly sounds more plausible and credible.

I would like to suggest here, tentatively, yet another explanation which is of a psycho-social nature and is based on a pervasive trait which seems to be characteristic of our culture. It is this. In any action that we engage in – whether as individuals or as institutions – we do not clearly distinguish between means and ends. Ends are never formulated in a way which would enable us to evaluate to what extent we are succeeding in our efforts (to attain the ends). Our entire preoccupation is with the means (without operationally defining

the ends). This excessive preoccupation with the means very soon results in confusing the means with the ends.
Here are some illustrations.

(1) Procedures are means to some end. Since the end is not operationally made clear, procedures become ends in themselves. Comforming to procedures becomes the end objective of all administration.
(2) In formulating a plan, budgeting is a means to some end. Again, since the end is not operationally defined, budgeting and spending the allocation become ends in themselves. Achievement is assessed on whether the allocated budget was fully spent or not.
(3) Government is a means to some end. Again, in the absence of an operational definition of the end, government becomes an end in itself. The mere survival of the government is taken to be the measure of its success.

In the current context of the 'new industrial policy', consider the situation with foreign direct investments (FDIs). An FDI, clearly, is a means to some end. Our preoccupation, however, is with the amount of FDIs successfully approved; not on how much of the investment has been implemented; and least of all on what results have been achieved (i.e. on the ends for which the investments are only the means).

One can readily think of additional examples from other spheres of our life; for example, the role of ritual in religion. But the main thrust of my assertion should be clear.

Given this pervasive cultural trait of our obsession with the means and consequent losing sight of the ends, it is not surprising that even if the six prescriptions (listed by Wade) had been meticulously followed, they did not result in any 'Indian miracle'. That, clearly, was never perceived to be the end objective by any of the actors.

The lesson to draw should be clear. In the absence of any radical change in our cultural trait, one would be surprised if the 'new industrial policy' were to be any more successful than the 'old industrial policy'. After all, the same actors are involved, only in a new permutation. Earlier, the public sector was the favourite son and was enjoying various exclusive privileges. Now, the private sector is the favourite son enjoying various exclusive benefits. The public sector has not only fallen from grace, but is being positively discriminated against. Whatever national technological capabilities had been built up over the years – especially in design, consultancy, and management – are now being allowed to wither away due to neglect and absence of support. One has to be a stubborn optimist to see any 'Indian miracle' taking shape on the horizon.

1 See the interview with Mr Ganesan in *The Economic Times*, Bangalore, 8 June, 1993, and the editorial in the same issue
2 Wade, R, *Governing the Market Economic Theory and the Role of Government in East Asian Industrialization*, Princeton University Press, Princeton, 1990.
3. Statement on Industrial Policy, 1991, Para 24
4. *India Today*, July 31, 1991, pp 24–25.
5 US Congress OTA, *Multinationals and the National Interest Playing by Different Rules*, OTA-ITE-569, Govt Printing Press, Washington DC, 1993, the statistics about MNEs are taken from this publication.
6. *ibid*, pp. 2–3.
7. *ibid*, p. 4
8. *ibid*, 'Foreword'.
9. *ibid*, p. 2.
10. *ibid*, p 4
11. Wade, R., 1990, p. 380. (ref. 2, above)
12. *The Economist*, 1993, Oct 2, p 29
13. See for example the extended coverage of the World Bank Study *The East Asian miracle* in *The Economist*, 1993, Oct. 2, pp 29–30.
14. The description of Taiwan's experience and the statistical facts are taken from Wade, R , 1990, pp 38–51, pp 84–85, pp 99–108.
15 Wade, R , 1990, pp 350–379.
16 See the account of the World Bank study cited in 13 above
17 Wade, R , 1990, p 359

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Survey of Indian computer professionals/students in USA about taking up employment in India

Pankaj Jalote

Contrary to expectations, a majority of the respondents want to return and take up employment. Two other important points emerged in the survey. First, the salary expectations for many of the respondents who want to return are not too far off what are currently being offered by many companies. And secondly, most persons want to get an offer while in the US, and are unwilling to return without an offer in hand. Other important factors mentioned for returning are help in housing, travel opportunities (which most companies offer), and career opportunities (which are good).

The survey clearly shows that there is a substantial pool of highly trained professionals in USA which can be tapped by the computer industry to alleviate the current manpower shortage and to bring in new expertise. An important point that the survey brings out is that to tap this pool, *the industry will have to actively recruit in the US and make offers to these professionals while they are in the US*. One of the complaints was that if people inquire with companies about positions, they either do not get a reply or get a reply saying that 'contact us after you have returned'. This needs to be changed and offers have to be made in the US. If the companies want, this can be done easily. Besides a careful evaluation of vita, with many companies having some base