

The Development of the Indian IT Industry

A Linkage-Agency Analysis

Abstract

Literature on the Indian IT industry has proliferated over recent decades, in accordance with its rapid growth and subsequent integration with the wider global economy. Yet despite this increase in scholarly attention, the dynamics behind the development of the industry remain obscured. This paper reasons that the failure of existing studies to explain accurately the industry's pattern of development is grounded in the approach adopted: the scholastically dominant yet analytically weak 'state versus market' perspective. Whilst successfully serving a broader ideological purpose, such works continue to influence, negatively, IT policy discourse in India by misrepresenting the past levers of development, be they unfettered market forces and/or a 'developmental' state. In order to give a greater degree of insight into the formation, conduct and effect of IT policy in India, and by default provide a firmer basis upon which current IT policy can be understood and debated, an alternative analytical framework is employed – the linkage-agency perspective. Marxist in origin, this approach represents a fundamental break with a state-market dichotomy, maintaining that the state operates through the market and both are influenced by the same socio-economic interests. On application to the Indian IT industry, the findings illustrate that its pattern of development was not based on liberalisation *per se* but active state intervention in the form of subsidies, restrictive entry, protection, selective liberalisations etc from the 1960s onwards. Yet rather than reflecting the workings of a technocratic state, policies are identified as the outcome of the negotiation and conflict between different economic and political interests within the context of accumulation. The paper concludes by discussing the analytical implications the findings raise for mainstream approaches to industrial policy.

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1. Introduction

For the vast majority of people who may be familiar, to some degree or other, with the notion of an ‘Indian IT industry’, their perception is likely to have been shaped by the popular media, for the informed minority, mainstream academic literature. Unfortunately, both sources have provided a semi-inverted view of the industry, based on a combination of politico-ideological imperative, technical misunderstanding and, in some cases, a lingering colonial racism. As a result, it is necessary to refute six mutually reinforcing fallacies masquerading as conventional wisdom so as to clear one’s mind of any existing prejudices before embarking on the main body of the paper.

The Indian IT industry is a relatively new phenomenon, triggered following the 1991 liberalisation of the Indian economy.

...An active interventionist IT policy has been in effect since the 1960s, a specific software policy recommended as early as 1968 and implemented by 1972. All of today’s major Indian software firms have a history dating back to the 1960s, 1970s, or 1980s, and the industry itself has expanded at similar rates in the decades preceding liberalisation as after.

The Indian IT industry is based on low-skilled off-shore call-centres and is not an ‘IT industry’ in the Western-sense of the term.

...Call-centres are conceptually distinct from IT or software services and are categorised separately as IT-enabled services (IT-es).¹ Furthermore, in contrast to the IT industry, IT-es is a relatively new phenomenon beginning in the late 1990s and although growing, its size in absolute figures and relative to the IT industry is small and has been severely exaggerated due to its interaction [often literally] with Western users.² Furthermore, the Indian software industry is of a higher technical standard than all developing countries and even most of the industrialised countries

The Indian software industry has succeeded because of low wages and the English language.

...The industry has continued to expand exponentially even as wages have substantially risen.³ Furthermore, programming requires only the most elementary English - a very limited vocabulary and simple syntax.⁴

¹ While foreign corporations are responsible for 50% of exports in the lower-skilled IT-es industry, they only represent 10-15% of software exports (Chandrasekhar and Ghosh 2006)

² For example, imagine if one met a Chinese textile worker on every occasion one bought a cheap pair of socks but not for the purchase of any other Chinese-made garment – the inevitable mental conclusion would be sock-making is the biggest industry in China.

³ There are many countries where the programmers’ wages are similar or lower than India’s e.g. China, Pakistan, Philippines which have dramatically failed in developing a software industry despite massive government investment. As Commander (2005b: 15) observes, the Chinese government has explicitly targeted the building of a large software industry.

⁴ The idea that English language was a causal factor is based on two observations. Firstly, the erroneous but dominant perception of call-centres in [Western] people’s notions of an Indian IT industry Secondly, the dominance of the English-speaking market in export destinations. However, this is to replace a correlation with a causal relationship. In actuality, the export profile of the

The rapid growth of the Indian IT industry been triggered by FDI from US IT TNCs

...The presence of US IT TNCs provided the biggest obstacle to the development of any indigenous hardware capabilities up to the 1970s - the structural changes underlying contemporary growth occurred only after the removal of IBM in 1978 and was led by local capital. Furthermore, the current influx of FDI from IT TNCs, far from providing positive externalities and knowledge spill-overs, is in fact undermining the ability of local IT capital to remain [internationally] competitive.

The Indian IT industry has benefited from its diaspora in the US - as a promoter of FDI in the boardrooms of US IT TNCs, as a facilitator of venture capital, and as returning entrepreneurs

...The emigration which resulted in the diaspora and the resulting labour shortage has been and continues to be a major impediment to the development of local capabilities and a strain on educational resources. Furthermore, the returning 'entrepreneurs' are more trickle than cascade, especially when compared to the continued exodus from India to the US. In addition, far from being entrepreneurial dynamos, returnees are primarily returning to manage US IT TNC subsidiaries.

The rise of the Indian IT industry is an unequivocal good for the country

...The role of the IT industry in the Indian economy and in particular the direction it is taking is a deeply complex issue where benefits need to be traded off against substantial costs. For example, whereas the rapid rise of the industry has given employment to a previous epidemic of educated unemployed and been responsible for unprecedented foreign exchange revenues it has also reinforced and accentuated a number of contradictions in Indian development – namely a skewed pattern of elitist development that threatens to undermine its own growth.

Given the reality of a dynamic, predominantly indigenous high-tech industry in a semi-industrialised country, the purpose of this paper is to document and explain the most interesting question that arises from this scenario: how did such an industry develop and what has been the role of the state in this? As such, the next section will provide the context and framework. The section after will apply the framework to three phases of the Indian IT industry while the fourth and final section will summarise the findings and outline their implications for the study of industrial policy.

2. Context and Framework

Indian software industry closely follows the international market for such exports. By far the largest market, the US, just happens to be Anglophone. The perception is reinforced in British writings where there is an overwhelming tendency to associate any 'positive' development in India to colonialism while any failures are apportioned to the indigenous culture.

There has been a proliferation of literature over the past decade purporting to explain the development of the Indian IT industry. This literature has ranged from neo-liberals who deem the liberalisation of the Indian economy and the ensuing ‘freedom’ of comparative advantage, as the driving force (Ghemawat and Patibandla 2000; Economist 2004) to the ‘developmental state’ wing of U.S. political science which posits the industry’s evolution at the feet of Department of Electronics’ bureaucrats (Evans 1995; Pingle 1999). Although the ‘developmental state’ literature has been the more convincing, not least for its acknowledgement of the integral role of the state in the industry’s development, it has also exhibited major theoretical and empirical deficiencies.

For example, whereas it is correct to note that the state has supplied technical education, promoted exports, provided infrastructure, and pursued fiscal and regulatory policies that aided the IT industry, it has also been guilty of an array of anti-developmental policies, not least the continued deterioration of the hardware industry and the expansion of the Software Technology Parks (STP) programme. These run counter to, rather than in-line with, India’s developmental aspirations. Given the anti-developmental features of certain policies enacted by the DoE, the reasons put forward sanctioning a ‘developmental department’ in the Indian political economy, however compelling or convincing, become moot points.^{5 6}

The analytical approach of state versus market, which has dominated political and academic perceptions of development since the 1980s, is the major impediment to explaining both the rationale behind policy and its role in development. For example, both neo-liberal and developmental state literatures are guilty of an overwhelming focus on either the state or the market as mechanisms in bringing forth development with little analysis given to the why and how of agent behaviour. Interrelated, the strong, and for some works almost teleological, attention to the assumption of the state or market mechanism in bringing about development has meant a lack of understanding of the industrial conditions and therefore whether the state interventionist or liberalisation policies

⁵ Despite this, it is worth examining the justifications put forward by Evans (1995) and Pingle (1999) in order to illustrate their expediency and selectivity over the literature. For Evans (1995) autonomy came from the fact that the informatics sector represented neither a nationally crucial political constituency (like agriculture) nor a source of patronage (like railways) and was therefore free of clientelist politics. Yet Evans’ (1995: 115) argument that the DoE was autonomous as it was free of political patronage reduces rent-seeking to a process followed by politicians for individual political or monetary gain. Yet most rent-seeking is, in nature, for and by economic interests which may or may not benefit the political party or politician.. And the postulation of an ‘embedded autonomy’ suggests an expedient explanation. With regard to Pingle’s argument (1999: 153), autonomy came from the fact that software was unable to collectively lobby. Yet, due to a focus on the global market, the software industry has been able to lobby as a unit for collective goods (such as communications infrastructure) very effectively, contradicting Pingle’s (1999) argument. It should also be noted that Pingle’s (1999) assessment that it was the political encouragement of Rajiv Gandhi for an IT industry is to mistake his emphasis on computerisation with an emphasis on indigenous development.

⁶ The work of Evans’ (1995) can also be criticised for its approach. It attempts to prove the differing developmental capabilities of South Korean, Indian and Brazilian states through the comparative institutional analysis of the IT sector in each country – this assumes the relative position of each industry must necessarily reflect the relative economic development of each nation.. As such, national IT industry capabilities are uncomfortably located in a hierarchy based on national economic development indicators which do not conform to the industry hierarchy.

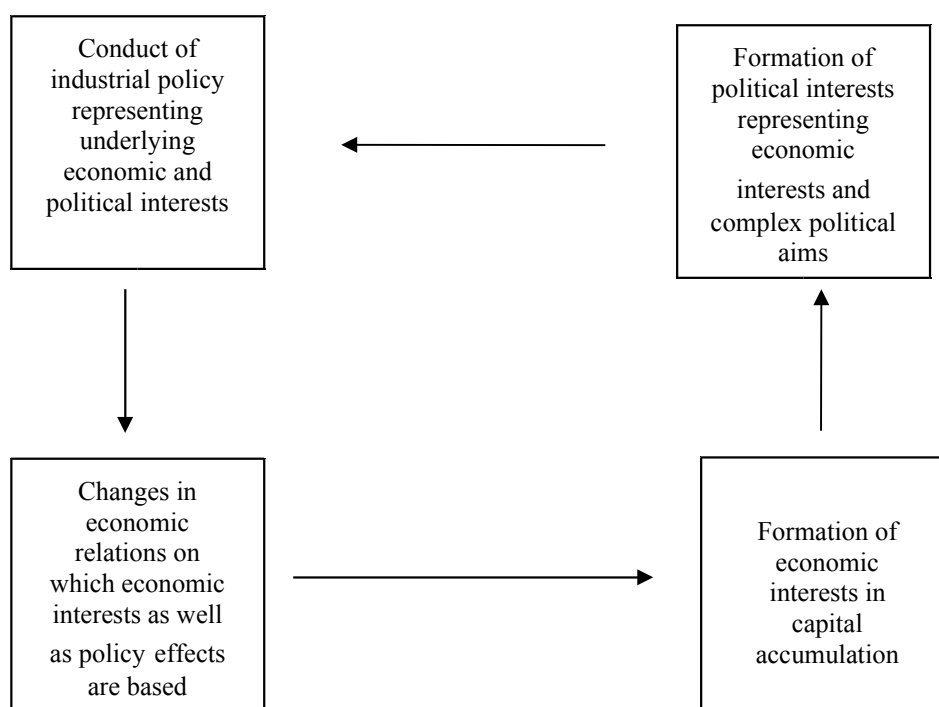
implemented are conducive or not to the industry's development.⁷ Therefore, no matter the degree of sophistication of scholarship, the analytical limitations of the approach will render any examination deficient in a number of ways - an unduly narrow focus and strong assumptions regarding state and market as institutions, expedient rather than accurate interpretations of policy rationale and outcomes, and a lack of close attention to formation and effect of policy.

The linkage-agency approach, developed by Fine (1992), represents a fundamental break with mainstream industrial policy analyses centred on a state versus market dichotomy. It argues that a richer understanding can only be gained by identifying the underlying structural phenomena that both drives industrial policy and is, in turn, driven by it. That is, rather than perceiving development as fixed between state or market-led paths, the approach analytically prioritises the socio-economic conditions, in particular the economic interests operating through both state and market, as prime determinants in the process of development. In a concrete context, analysis focuses on identifying the economic and political interests behind policy (agents), the effects of policy on the intra-industry economic relations (linkages), and the dynamic between them, i.e. linkage-agency. The rationale of agents is to be explained in the context of capital accumulation of the dominant economic interests, whereas the linkages forged, restructured, or broken can be understood through examination of the changes within and between the major economic relations underlying the industry.

Industrial policy is thus perceived as an institution through which various alternative linkages within an industry can be realised by influencing the behaviour of agents through the implementation of different tools of the state. Given their interest in accumulation, agents are not passive followers of technocratic policy but are heavily involved in the formation of industrial policy and the promotion of policy that creates conditions favourable to such aims.⁸ Therefore, industrial policy is dependent on coordination and conflict among various interrelated economic and political interests, and its final formation represents the outcome of a negotiated resolution between these agents. The schematic representation of the industrial policy is presented below.

⁷ For example, when viewing the industry in retrospect it is easy to perceive it as a schematic and development, resultant on a clear strategy dictated to by technocrats. Hereby, random events, luck (due to the withdrawal of IBM, UNIX was adopted in India years before it became the widespread computer language), and opportunities brought about by external technological innovations are seen as rationally foreseen and/or induced.

⁸ Fine and Rustomjee (1996) note the importance of addressing why the South Korean state acted as agent to broader developmental linkages in the economy whereas the South African state did not.



Restructuring of industry

Fig. 1 Schematic Representation of the Political Economy of Industrial Policy

Currently there are serious deficiencies with making concrete connections between the policy implemented and the effect of the policy on the industry. The effects of industrial policy cannot be analysed through some stylised linkage between industrial policy and aggregate figures of exports or production as these may be exogenous to policy. Export and production figures are prone to fluctuations independent of changes in policy. For example, although the Indian software industry is considered a phenomenal success, its share of the world software market has remained at 0.5 percent between 1986 and 1995, and only rising slightly in recent years (Gambhir 2004: 7-8). The increase in the international demand for software has played a major part in the growth of the software industry in India, independent of the vagaries of policy.

Thus, in order to develop a more concrete connection between the industrial policy formulated and the actual outcome at an industry level, more suitable indicators are required. As it is assumed that the effect of industrial policy is to provide specific conditions for sustainable capital accumulation by coordinating economic and political interests in an industry, it can be expressed as a policy intended to bring about a different set of linkages within the sector. These linkages occur between the economic

relations of the industry, with only the most extreme form being the new forging or breaking of existing relations. Therefore the changing of economic relations as an effect of industrial policy signifies industrial restructuring or structural (re-)adjustment in a sector through a set of new or enhanced linkages.

Although shifts in the underlying economic relations of the industry can be considered superior indicators of the policy effect, for these to be assessed, the material realities of the specific industry need to be thoroughly investigated as they are likely to be individual. Form and content of major economic relations and their industrial significance are different across industries. In this case study, the major economic relations of the industry are:

- Hardware-software relations
- Local capital-TNC relations
- Inter-capital competition structure

The analysis will be applied to the Indian IT industry in three phases in the next section.

3. Analysis and Findings

Instead of the simplistic dichotomies between hardware failure/ software success, state failure/liberalisation success, and non-developmental state/developmental state that has been the staple of existing literature, the linkage-agency framework is more concerned with the cumulative and idiosyncratic pattern of development, epitomised in the changes in economic linkages and the agencies that bring them about. Through an overview of the historical development of the Indian IT industry it is possible to discern three different periods in the development of the Indian IT industry, each characterised by distinct interests, policy directions and industrial outcomes - the state-control of the IT industry (1970-1978), the state abdication from the IT industry (1978-1986) and the promotional state (1986-2006). Each phase will be subject to the two interrelated questions below, which have thus far been ignored or answered in an expedient, rather than rigorous, manner.

- Why were different industrial policies implemented in different periods? In other words how did economic and political agents manifest themselves in state and market over time in determining industrial policy?
- How did the industrial policies affect industrial conditions? More specifically, what has been the impact of these policies on the linkages within the major economic relations of the industry?

3.1 Insulation of Industrial Policy (1970-1978)

The first phase of Indian IT policy witnessed the attempted isolation of industrial policy from economic interests. But to equate the form this attempt took with either a technocratic policy (Pingle 1999) or an overriding ideological motive (Sridharan 1996) would be erroneous. Instead of private capital interests, rival political interests within the state machinery were dominant in policy formulation, rendering any chance of a coherent and technocratic strategy for IT development impossible. The institutional rivalry between the Ministry of Defence and the Atomic Energy Council, of which ideology was merely one component, was expressed in two ways. Firstly, through the formation of the DoE as an institutional body responsible for the formulation and implementation of IT policy and answerable only to the Prime Minister. The formation of the DoE was championed by the AEC. Secondly, the close connections between the AEC and DoE resulted in the separation of BEL, under the authority of the MoD, from IT policy. This resulted in the separation of a potential supplier of peripherals and other components along with potential technology transfer (BEL) from the PSU ECIL, preventing technical learning through the development of economies of scale in BEL and also the maintenance of peripherals importation for ECIL.

Individual policies within this period, as opposed to the overarching policy framework noted by Pingle (1999) and Sridharan (1996), have also been subject to different postulations into their rationale. Grieco (1982) noted that a techno-nationalist attitude had developed in the 1970s that had taken up an anti-TNC stance in the government. IBM[and Coca-cola] as prominent American companies bore the brunt of this. This is to misread the motives behind the policy stances taken by the Indian government that resulted in the removal of IBM. IBM had been preventing the importation of the latest computers (and hence latest technology) into India in order to continue the lucrative rental of outdated computer systems to Indian businesses. Furthermore, its activities were leading to an outflow of foreign exchange. The implementation of FERA was designed to dilute IBM and was hoped to limit its damaging activities while securing benefits in terms of technology transfer. Although Grieco (1982) has noted the counter-factual had IBM been allowed to remain - a rose-tinted account of increasing domestic linkages and the establishment of India as an export platform for IBM machines – no analysis had been made of the actual effects of IBM’s removal on the economic relations of the IT industry.⁹ Addressing this oversight through the framework, it is noted that the removal of IBM had a number of positive effects. Firstly, the removal of the dominant player in the IT industry in the Indian market created a greater incentive for both Burroughs and ICL to seek compromise with the Indian government. Both the TATA-Burroughs venture and the obligations accepted by ICL created the conditions, in principle, for an upgrading of the IT industry.

Such ideological imperatives have also been used to explain the monopoly granted to ECIL, a PSU. Yet such an assertion ignores the techno-economic rationale behind their creation. The DoE had noted the potential of developing an indigenous IT industry in line with security imperatives of the country in the early 1970s. The Minicomputer Panel Report (1972) outlined the importance of economies of scale and the indigenisation of peripherals production in order to develop an IT production complex, reinforcing the general thrust of policy outlined in 1970. The necessity of such policies were also acknowledged by Taiwanese and South Korean policymakers.¹⁰ However, influenced by the ideological climate, more specific policies outlined by the DoE for ECIL involved extensive technological self-reliance and a foreclosure of technical collaboration with TNCs. Furthermore, a lacklustre effort was made by the DoE in indigenising peripheral production, with licenses only issued in 1977. No such lapse was made in establishing CMC, which was granted a monopoly on services of non-ECIL computers in India as IBM’s departure became imminent. The policy of establishing public sector capacity through ECIL and subsequently CMC succeeded in developing a significant indigenous IT base in the country which had hitherto not existed. How this base was utilised in the next phase will be summarised shortly. Prior to this, a note of the Software Export Scheme (1972) is required.

⁹ Grieco’s (1982) counter-factual was based on interviews at IBM headquarters years after the removal of IBM. There is no way to corroborate IBM’s compromise proposals were genuine or if so would have been implemented sincerely. The experience of ICL/ICIM’s activities in India following dilution in its commitments to domestic manufacturing and exports does not appear a convincing case – it failed to do either and continued as an export outlet for ICL UK.

¹⁰ Although South Korea and Taiwan tend to be grouped together in development literature, despite similar IT policies South Korea failed to develop an internationally competitive IT industry while Taiwan succeeded. As such, it would be wrong to suggest the general thrust of Indian IT policy, which was similar to both the East Asian countries’ policies, was at fault, but rather the idiosyncratic form that policy subsequently took on.

The Software Export Scheme, established in 1972, has been categorised by Pingle (1999) as the hallmark of a 'developmental' attitude in the DoE. Irrespective of whether it portrayed a 'developmental attitude', it does highlight an awareness of the potential of developing a software services export industry in India in the early 1970s and the implementation of policy designed to achieve this. This contradicts assertions such as Miller's (2001) where TI's entrance is proclaimed as the starting point for the Indian software industry. However, the initial policy placed onerous demands on would-be software exporters, and as such failed to act as catalyst for the rapid emergence of a software industry. The policy has been characterised as reflecting an innate bias in the DoE of the time towards protecting the domestic hardware market for ECIL. However, it is more likely that there was concern over a loss of foreign exchange and hence strict export requirements were placed on importers of computer.¹¹ Irrespective of the rationale behind the policy, the effects were limited. The demands on software firms, drawn up in a technocratic manner, rather than in negotiation with software exporters, resulted in few entries. After policy was amended, due to the discontent articulated by software exporters, access to the domestic market for imported computers was allowed.

In summarising the first phase, the findings suggest that the caricature of complete failure of the IT policy propagated by certain scholars is somewhat overstated. The general thrust of policy followed, derived from the Bhabha Report (1966), was both an economically sound strategy and politically essential. The subsequent intricacies that came to be attached to such broad thrusts highlighted how intellectual climate, bureaucratic incompetence, and the unintended effects (such as the departure of IBM) can combine to create quite a different result to what was predicted/intended. Yet to attribute success or failure to the phase is to fall into the trap of crude simplification. For a fuller understanding of the contribution of this phase to the development of the IT industry in India, its effect on and legacy in the subsequent pattern of development needs to be incorporated. For example, as the next subsection will explain in more detail, although the following phase dismantled the modest achievements that had been recorded hitherto, its indirect effects were to galvanise a software industry built on software model first propagated in the 1970s and used the TATA-Burroughs joint venture, induced by IBM's removal a decade earlier.

3.2 Integration of Industrial Policy with Capital I (1978-1986)

The second period represents a pivotal shift in the trajectory of the Indian IT industry. However, it has been misrepresented by Grieco (1982), Evans (1995) and Pingle (1999) as a positive step towards 'realism' in Indian IT policy, and for Sridharan (1996) as a sign that Indian policymakers were pursuing the East Asian model of export-orientation and import-substitution. Evidential support for

¹¹ As will be noted in the following section, concerns over import-intensity of the software industry are still valid. The difference is that such issues do not now receive the significance in policy circles.

such propositions stems from the substantial increase in the installed-base of computers in India from 1978-1980 following the Minicomputer Policy (1978) and also the rhetoric of policy documents.

The application of the linkage-agency framework raised both the deficiencies in rationale behind policy as well as its effects. Examining the policy effects, the importation of CKD and SKD kits from East Asia was observed despite the semantic disguise of self-assembly kits. Such relations with foreign capital cast a different complexion on assertions of the 'development' of the Indian IT industry – it is impossible to develop a similar model of export-orientation as done by Taiwanese firms, and therefore compete with them in world markets, when one is purchasing knocked-down kits in from them. The licensing regime also highlighted the problems with the idea of the policy designed to engender development. Licenses, far from being selective, were issued to dozens of companies in the first two years of the new phase. This created a competition structure which both undermined firms wishing to pursue a deepening of capabilities in that it created a fragmented market for computers and thereby reinforced a reliance on importation of CKD and SKD kits. The fragmented market for computer hardware which hindered the development of an indigenous IT production complex, as witnessed in Taiwan did, paradoxically, create an emerging market for systems integration. This was partially filled by hardware firms themselves as they developed software expertise alongside sub-assembly and marketing skills. In addition, independent software companies also provided software service provision. Such companies were often involved in both the provision of software services domestically and abroad, including what would later become the first Indian company to launch an IPO on NASDAQ, Infosys.

The Minicomputer Policy (1978) was later followed up by the New Computer Policy in 1984. The primary factor behind this policy was Rajiv Gandhi who had just been elected Prime Minister. Pingle (1999) has argued that this policy, which liberalised the importation of computers, was a strategic initiative by Gandhi to catalyse the software industry. While no doubt Gandhi was the driving force behind the policy, an analysis of the effects of policy as well as a cursory glance at the policy itself casts doubt on the assumption that this was directed at developing a software industry. Rather, although the software industry did grow from the effects such policy induced, its primary rationale was the increased adoption of computers in businesses and the expected productivity returns it would engender. The local software industry, which had been expanding due to the increasing installed base of hardware and the market that accompanied it, further developed as more businesses imported computers and more manufacturers imported kits.

In assessing the second phase, the rise of a domestic software industry is easily perceptible. Apart from TCS, CMC and Patni Computer Systems, which started in the previous period, all the major Indian software firms of 2006 emerged in the phase between 1978-1984. However, the linkage-agency approach illustrated that such developments were tangential to, rather than the direct product of, the policies implemented in this period. The dominant agencies influencing the Minicomputer Policy (1978) were interests in computer manufacturing and the business houses requiring cheaper computers. The computer manufacturers were not interested in developing capabilities but in encashing large profit

margins from the protected economy. The New Computer Policy (1984) was the product of Rajiv Gandhi, but reflected a pro-business house approach with only the partial consideration of domestic manufacturers. This highlighted the dominant political clout of the business houses over the domestic hardware manufacturers. The software companies, which had hitherto been the unintended primary beneficiaries of such policies which reshaped the structure of the Indian hardware industry and undermined its capabilities, were to begin to exert their influence on policy-making in the third and final phase.

3.3 Integration of Industrial Policy with Capital II (1986-2006)

In the mid-1980s, the third phase of policy began. While the software industry had been recognised in 1984 New Computer Policy as an industry in its own right and classified as a 'thrust area', pro-software policies would only be implemented from 1986 onwards with the Computer Software Export, Software Development and Training Policy. Of its 56 measures, addressing issues as varied as marketing, education, access to technology, regulation, only 6 were specifically directed towards the domestic market. A year later, the '10 Crore' rule was implemented, allowing software companies with export revenues of over Rs.100 million to pay off their import obligations in any manner they chose. At the same time, another regulatory change allowed companies with up to 40% foreign equity holdings and very large companies (covered by the MRTP Act) to become software producers. 1987 also witnessed a promotional financing programme, under the leadership of the ExIm Bank which introduced a scheme for loans for computer import, post-shipment credit and export credit guarantees amongst other measures (Heeks 1996: 276).

During this period of promotional software policies, there were major shifts in policy towards the hardware industry. Joint-ventures and wholly-owned subsidiaries were promoted by the government, ostensibly as a means to encourage technological development of the hardware industry. Due to both export obligations being placed on wholly-owned TNC subsidiaries, most transnational computers favoured joint-ventures. In addition to escaping export obligations, joint-ventures provided access to pre-existing marketing and distribution channels.

Despite these initiatives, the core policy issue of the period was the question of telecommunications infrastructure. The emerging market in the US for outsourcing of software services had already been tapped by Indian firms but the advances in telecommunications (optic fibres and satellite communications) meant that the logistically demanding 'body-shopping' process which required temporary worker migration from India to the US could be superseded by a transnational services model which was more efficient. Whereas at the beginning of 1986 no such infrastructure had been provided, by 1995 international telecommunications links were available, even for the small software

firms (Athreye 2005: 20). The government first intervened in 1989 by setting up the International Packet Switching Service (IPSS) network Heeks (1996: 291), which greatly facilitated the ability to export software via telecommunications. This effort was superseded by the development of Software Technology Parks (STPs), which provide satellite telecommunications in parks and to larger software firms at their pre-existing base. In addition to telecommunications provision, STPs also provide numerous subsidies, including water and electricity as well as tax incentives.

In examining the effects of policy, it is clear to see the continuation of the transformation of the structure of the industry which had started with the Minicomputer Policy of 1978. For example, the software industry continued to grow at substantial rates. However, there have been substantial changes to its economic relations in the process. For example, the software industry has witnessed increasing concentration, with the top five Indian software companies producing 25% of revenues, the top twenty over 50% by the late 1990s (Athreye 2005: 13). Much of this had to do with first-mover advantage, with four of the five largest companies being established prior to 1984 (see Athreye 2005: 11). However, financial and regulatory policies which consistently favoured larger firms also contributed to this trend. The deterioration of the indigenous capabilities of the hardware industry, which started with the anti-developmental Minicomputer Policy, continued apace with further fragmentation of the industry.

Furthermore, policies facilitating the software industry's growth had also undermined existing relations between hardware and software firms. The easing of import regulations, especially for those involved in software exports, catalysed this separation. By making it easier for local software capital to purchase foreign hardware through tax incentives, a disjuncture occurred in trading and learning relations between local software and local hardware interests. In addition, the general lowering of tariff barriers to the importation of computers and the ensuing commercial pressure on domestic computer manufacturers forced a number of indigenous hardware firms to move wholly into software or to form joint-ventures with computer TNCs.

These joint-ventures have undermined any independence local hardware capital may have enjoyed with foreign capital. Crudely simplifying, the joint ventures removed indigenous capabilities and replaced them with a set of capabilities focused within the FTNC's global strategy. This reorienting of the companies' focus away from their own capabilities and towards complementarity with their FTNC partner's global and national strategies tended to fall into two operations. Firstly, TNCs used local hardware manufacturers as domestic sales agents, with Wipro virtually discontinuing its own range and instead becoming a supplier of Acer and Apple machines. In addition, the main focus of many other joint-ventures was that Indian hardware manufacturers now produced software for integration with the imported computers. This is the case for HCL, which is allied with HP. As such, the partnership has tended to be highly unequal and detrimental to India's developmental objectives.

In contrast, the infrastructure provision in this period has reconfigured foreign-local software capital relations to the benefit of the latter. Due to the telecommunications breakthroughs, local firms could expand their range of services, increasingly indigenise software development, and therefore move from a single customer at a time to numerous clients. Thus, whereas software firms were vulnerable to the fortunes of their dominant client, and also suffered from reduced bargaining power with these clients, these changes were essential in increasing independence.

Examining the policies and their effects, one witnesses developmental and anti-developmental policies. Taken in isolation, many policies have been effective - they helped establish Indian companies as internationally competitive and, subsequently, India as an internationally-competitive software base. This has helped to bring in much-needed foreign exchange. At the same time, instead of promoting mutually beneficial hardware-software relations which are integral to the long-term sustainable development of the industry, policy has instead catalysed the deterioration of the hardware industry, and at the same time that the import-intensity of the software industry rises. As such, the 'developmental department' argument which forwards the idea of technocratic fine-tuning is clearly deficient. However, inability to convincingly portray the DoE as autonomous and developmental begs the question why, following a notable movement out of any purposeful intervention (1978-1986), was a greater degree of promotional support and infrastructure subsequently provided? In other words, who influenced IT policy in this period?

The most convincing explanation is to be found in the dominant economic grouping of the period – the software industry. The software industry had grown during the previous phase. However, the political mobilisation of the software firms and their efficacy in articulating their interests rested on a number of idiosyncratic reasons. Mobilisation was aided by the export-focus of the industry and the focus on general infrastructure provision (i.e. neither demand was a zero-sum game amongst firms), and the similar class and educational backgrounds and therefore close connections between the software CEOs. Articulation of these interests was aided by an enduring belief in the DoE of the capabilities India had in exporting software as early as 1968 (Subramaniam 1992: 5). As the influence of the hardware industry in the DoE had dwindled, and the demands of the software industry were not in opposition to the vested interests of the big business houses, the influence of the software industry in IT policy was uncontested. This interpretation differs from the developmental state literature as it sees IT policy in this period as a late-comer facilitator of the software industry, rather than direct instigator. That is, policy became increasingly driven by the software interests, but only once these interests had emerged tangentially and had become capable of articulating themselves.

4. Conclusions

The findings have illustrated that the pervasive role of the state in the idiosyncratic development of the Indian IT industry. The state has played a role in the supply of the technically educated, but more conspicuously in the provision of advanced telecommunications infrastructure, first through IPSS networks and then the STPs. Furthermore, it has provided protection under an infant industry strategy, privileged local IT capital over foreign capital, introduced promotional financial and regulatory initiatives, and played a major role in export-promotion. More recently, subsidies and tax breaks for foreign and local capital have been introduced. It has also failed to engender a competitive hardware industry in the 1980s and watched over its needless deterioration in the 1990s. The findings also illustrated that these policies do not represent the workings of a technocratic state but can be identified as the outcome of and resolution of competing economic and political interests in the process of policy formulation.

These findings are of significance. They demonstrate that in the case of the Indian IT industry, a non-autonomous state or body of it can effective industrial policy, conducive to development and in generating increasing social returns. Such evidence clearly contradicts 'developmental state' theory, whose conventional wisdom dictates state autonomy is a necessary prerequisite for effective developmental policy. If an autonomous state is neither likely nor necessary for development, devising industrial policy in the form of blue-prints awaiting implementation by an all-powerful and benevolent state can be argued to be a waste of academic time and energy – real industrial policy is determined by the broader socio-economic dynamics of accumulation which may, or may not, be conducive to development.

This raises a major analytical issue with regards how industrial policy is examined and formulated. The introduction of class and class fractions above the state and the market in this paper provided a greater degree of insight into the formation and implementation of industrial policy. And the analytical strength derived from perceiving state and market as forms through which agencies function and linkages are forged, rather than rival institutions, suggests the superiority of the linkage-agency approach over mainstream understanding of industrial policy. If so, academia must move away from the artificial perception of state and market as opposing institutions and associated debates over the relative efficiency of each. In the real world the state operates through and with the market, and both influence and are influenced by the same forces and dynamic processes of social conflict and capital accumulation that are present in society. Thus, the main role of academia should be to raise issues, forward questions, and provide answers to how state and market can interact to achieve desired and justified goals.

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