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The IITs in India: Symbols of an Emerging Nation

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Abstract

This paper, based on policy documents of the Indian government and the UNESCO archives in Paris, tries to sketch the underlying dynamics of the decision to invest in a technologically intensive mode of modernisation in India in the 1950s by briefly focusing on the politics behind the setting up of the Indian Institutes of Technology (IITs), specifically, IIT Kharagpur (1950, IIT status in 1951). This process had both national and international dimensions and reveals the complex internal dynamics of deciding to create a post-colonial knowledge society. It touches upon the international dynamics that enabled India to seek help from across the Cold War ideological divide and the link between IIT alumni who migrated and India's Information Technology industry.

Introduction

After liberalisation in 1991, the knowledge economy[2], by which I mean a service sector that relies on knowledge whether of the English language or software programming to fulfill tasks, has been instrumental in creating a substantial portion of the Indian GDP. In 2009, the IT BPO sector contributed 5.8 percent of India's GDP (NASSCOM 2010). The high growth rate of IT-BPO industry has helped the industry to increase its contribution to India's GDP by five times over FY 1998-2009 to reach 6.0 percent, and the sector directly employs 2.2 million people and millions more in related industries (NASSCOM 2010).3 India's share of the global outsourcing industry in 2010 was 54.33 billion US dollars or 43.7 percent of the total (XMG Global 2010). This knowledge economy has been crucial to the rise of India during the last two decades.

Indian GDP growth, which had been termed the "Hindu" rate of growth[4] (Raj 1984) at about 3 percent per year until liberalization in the 1990s, has consistently been above 5 percent since then (BBC 3.12.1998). For the fiscal year 2009 to 2010, Indian GDP grew by 7.4 percent (WWWa). However, the extant literature has a crucial gap. Why was India able to carry out this sudden transition from a predominantly feudal economy, buttressed by a socialist system of government that controlled the "commanding heights of the economy"5 (Kapila 2008: 470), to a liberalised economic system that leveraged crucial advantages in a globalised knowledge economy? This has not been closely looked at in the extant literature.

I argue that part of the answer lies in the continued legacy of a specific construction of development and technology that had its roots in colonial India, and was institutionalised in the post-colonial state, notably through the setting up of a series of world class technological universities, the Indian Institutes of Technology (IITs). Using these as a methodological tool, I look at how certain modes of technology were accepted and others rejected in tune with the broader aims and transformations in the post-colonial state. My key argument is that the the roots of Indian technological awakening can be traced to a conscious decision to invest in the knowledge economy by India, in the years immediately following independence from Britain in 1947. This decision epitomised the power of an indigenous elite that had accepted the western way to modernity as the sole way to progress, and who were instrumental in creating the IITs, adapting a certain mode of development in preference to other available modes. After liberalisation in 1991, these alumni, who ironically because of the nature of the teaching at the IITs, were far more successful abroad than in India, were instrumental in giving Indian companies access to an international set of contacts, through their informal networks in the foremost technological power of the world, the United States (2009) and by heavily investing in India.

A clear line can be drawn between colonial decisions taken to adapt certain forms of technology and definitions of development, the institutionalisation of these in the post-colonial state, and India's contemporary success in a technologically mediated service industry. In India, colonial and post-colonial development projects included the creation of a knowledge society. Adapting the idea that knowledge is inherently transgressive and trans-disciplinary (Nowotny 2001; 2003) and in contrast to a top down linear diffusion model of technological transfer, my

paper explores this process as a critical arena of transnational and local negotiation that was a crucial element in the legitimizing strategies of non-state governance in the post-colonial state.

The crucial role that technology played in the nation-making process, especially as an arena of negotiation and translation between nation-states, and within nation-states, has not been analysed. This is a rather surprising gap in the history of nation-states and nationalism but refers to a broader gap in the history of technology. In his history of perhaps the most technological of all extant societies, the United States, Adas points out that the "peripheralization of the technological dimensions of both nation-building within the United States and its subsequent emergence as a global power has been the norm rather than the exception in mainstream American historiography" (Adas 2006: 5). A similar gap exists in the historiography of post-colonial India. The key role that technology and technological decisions played in the making of the Indian nation-state has not been the subject of mainstream historians. In addition, especially in the post-colonial states, the tacit acknowledgment of the superiority of the West has dominated and has continued to dominate the transfer and adaptation of knowledge[6]. I argue that this is a confining process that encloses ideas of development by laying claim to a seeming "objectivity" and universalism. It is only recently that the cultural underpinning of scientific awareness has begun to be analysed (see for e.g. Helmholtz 1995; Bell 2006) even in such "universal" and "objective" areas such as mathematics (Ascher 1998). Historians have begun to explore how science was shaped by race, gender, global, imperial and national assumptions (Campbell 2007; Moses 2008; Briggs 2002) and are now looking at the link between colonial expansion and the ascendance of western science and colonial empires (Adas 1989).

The conscious decision to invest in a knowledge society made by the Indian state also is a stellar example of how government policy influences science and how the scientific decisions of the state are connected to particular visions of the nation. The story of the IITs is not one of independent technological initiative; it is also an understanding of how technological systems come about and how closely they are aligned with social, economic, ideological, and even spiritual systems in ways that have been replicated in other countries such as the United States (Larson 2001). All these are critical to understanding why India, a country where in certain regions standards of living are lower than that of Sub-Saharan Africa, was able to create an internationally renowned corps of engineers.

This paper tries to sketch the underlying dynamics of the decision to invest in a technologically intensive mode of modernisation in India, in the 1950s, by briefly focusing on the setting up of the IITs. This process had both national and international dimensions, and reveals the complex internal dynamics of deciding to create a post-colonial knowledge society. However though this happened with all the IITs, I will for reasons of brevity focus in detail only on the first one, IIT Kharagpur (1950, IIT status in 1951), to illustrate the argument. For the same reason, I shall not go into detail on other aspects of the IIT story which are part of a larger project I am working on - the complex international dynamics that enabled India to seek help from across the Cold War ideological divide, the intricate process of technological transfer and cultural transfer that such tie-ups meant, and the link between the IITs and information technology, though I shall briefly allude to them. In this paper, I analyse only one aspect of this process, the internal and external politics that revolved around the setting up of the IITs.

The colonial knowledge society

In many ways, the foundations of India's modern knowledge society were laid during the colonial period, especially in the latter half of the 19th century and in the early 20th century, when demands emanating from the metropolis made a partial modernization of India a colonial imperative. While there were pre-modern knowledge societies in India (Pollock 2003; 2006), these revolved around literature and philosophy (ibid. 2003). Beyond the overt forms of colonial legacy in the form of engineering schools and technical colleges, there were also insidious ones, legacies that operate both at the material and discursive levels. Colonialism, in addition to control, also bequeathed a tradition that equated engineering expertise with superiority. Ever since the expedition of Matthew Perry to Japan (1857) technological superiority has been seen, especially in Asia, as a marker of an higher level of civilized development This unquestioned assumption led to policies of technological advancement that were bestowed upon colonial subjects, including American engineers who sought to "uplift" the Filipinos (Adas 2006: 10) or the setting up of engineering and technological institutes in India to train a core of engineers who would be subordinate to the demands of a metropolitan economy. Such a fascination with

Western technology and the acceptance of the western version of a sole modernity, especially by colonial elites, is a crucial feature of the history of non-western nations.

Throughout Empires, colonial and post-colonial projects were often justified in a rational manner that side-lined indigenous people and their concerns in favour of the concerns of the metropolis and Empire, a state of affairs that lasted well after the British Empire formally ended (Vine 2009: 1). Interaction and collaboration between elites and colonial powers also led to newer classifications and newer constructions of both social categories and knowledge (Kramer 2006). Intermediary knowledge brokers were a pattern of imperial rule. Thus, the role of the Brahmins as a knowledge intermediary under Mughal (1526 to 1857, formally) and British rule (1757-1957) was similar to that of the African middle men who helped the Portuguese in Angola, who were themselves conveyors of other forms of knowledge indispensable for colonizers. These Africans were the 'obscure companions' of Europeans, although their presence was essential for European agency in this part of the world (Santos 2010: 543).

Moreover, the precise way in which technology, and what kind of technology, was chosen for the creation of the nation-state has profound implications. Nationalist discourses that challenged western power show that they did so in terms of political power, but significantly not in terms of cultural power. At the heart of nationalist ideology that was accepted as "modern" and "progressive"[7] was the idea that it was essential to accept and modify the post-colonial state in the image of the metropolis. Thus, science was not a top down affair; it was a process that was hybrid and co-operative, a tool of imperial authority and a potential basis for post-colonial national identity (Harrison and Johnson 2009: 3). Scientists played a key role in the operations of the imperial state, and some colonial subjects, engineers, doctors, and other elite professionals, though very few in number, did have a role to play in the process of making knowledge - a strategy that has the effect of integrating "science" into a broader community, in this case colonial society.

However, this educational elite had an influence in the post-colonial state out of all proportion to their numbers. A characteristic example of such an intellectual was Sir Ardeshir Dalal, who in 1944, as the first head of the Department of Planning and Development in India, drew up

the blueprint of the Indian Institutes of Technology, making the crucial decision that technology rather than capital was key to India's progress. Dalal, whose career I examine in depth in this paper, to illustrate the role foreign trained elite played in development decisions, was an alumnus of Cambridge.

Often, this commitment to modernisation meant a looking down upon other indigenous modes of protest, of technology, and alternate modes of living. Nationalist discourses implicitly accepted the definitions that saw pre-industrial (or pre-modern) people as risk-averse and enslaved to obsolescent ideologies. In effect this had the effect of sidelining them in future visions of the nation-state and sentencing them to second-class status in the future nation-state (Dinerstein 2006: 572). The post-colonial history of nation-states in Asia and Africa has often been marked by conflict between the imperatives of a modernising nation-state, and the struggle of indigenous people to preserve pre-industrial modes of living whether it is mobilising against the Narmada Dam in India or the struggle of the Ogoni tribes in Nigeria against exploitation of the oil resources in their traditional homelands.

This division reflects and continues broader patterns of political mobilisation against colonial power. Subaltern historians, who rose to prominence in the 1980s, argue that Indian political mobilisation had two levels of hegemony, asserting that there "was no such unified and singular domain of politics and the latter was, to the contrary, structurally split between an elite and a subaltern part, each of which was autonomous in its own way" (Guha 1997: ix). This paper argues that such a dichotomy existed in technological aspects, too, and continued into the post-colonial era.

Nationalist movements and technology

Nationalist movements throughout Asia, Africa and Latin America in the last decades of the 19th and early decades of the 20th century elevated the nation-state, to the exclusion of other categories of political space, to the guiding light of their anti imperialist movements. Nationalist discourses, across regional and cultural contexts, stressed both their difference from and similarities with other nation-states and nations. Both nationalist movements and nationalising states presented themselves as universalistic within the spatial confines of a particularized national

community, but as unique without, that is, in relation to other nations and nation-states. As Harrison and Johnson point out, "[w]hether in Indonesia or in France, the nationalist's goal is to construct a nation that resembles and, therefore, can compete with other nations. Nations may have their own distinctive characteristics, but they resemble nothing so much as other nations" (Harrison and Johnson 2009: 5).

The historian of technology Carroll Pursell points out that the most significant engine and marker of modernity is "technology [which is] almost always seen as masculine in our society" (Pursell 2007: 5) and that only the West invokes modernity as central to its self-definition. Thus what is important is that in colonial states it was not a technological response to the needs of the emerging nation-state that was firmly rooted in an understanding of indigenous problems, it was the transfer of a universalistic science that was seen as having succeeded elsewhere. It was this conception of science that was transferred to those who were educated in Britain. To be western one need not be European. "Science" became a broad scientific enterprise that took on specific, local meanings attuned to national settings and circumstances (Harrison and Johnson 2009: 3f.). And so the vision of modernity that influenced the construction of science and knowledge in the post-colonial world was a particular and not a universal form of modernity.

All this took place against the background of what has been termed the first wave of globalisation. The deepening and widening of colonial territorial and capitalist expansion during the last third of the nineteenth century saw material and symbolic struggles pointing to the transposition of a range of modern social forms (territorial states, nation form), ideologies (developmentalism, imperialism, nationalism), and categories (national economy, national space) across the world in tandem with the growing discursive overlap of nationalist discourses (Goswami 2004: 16).

Just as the Japanese were determined to improve on western technology, especially military technology, Indian policy makers were eager to adapt applied science and industrial technology to ensure Indian dominance in science and technology. Post-colonial states had to decide between two different types of technological advancement, and the acceptance of westernised modernising papers perspectives was in no way a given. In India, this was reflected in the famous conflict between Mahatma Gandhi (1869-1948) who led India to independence through non-violent struggle against the British, and India's first prime

minister Jawaharlal Nehru (1889-1964, first prime- minister of India, 1947-1964) over the mode of development that India would embark upon post-independence. Nehru, in contrast to Gandhi, had a boundless belief in the power of science which was typical of the spirit of the age. Thus, he insisted that:

> It is science alone that can solve the problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people […]. Who indeed could afford to ignore science today? At every turn we have to seek its aid [...] the future belongs to science and those who make friends with science (Ram 1961: 564f.).

On the other hand, Mahatma Gandhi, symbolises alternative conceptions of modernity. In May 1919, he wrote in his weekly paper Young India, "[t]he industrial arts and handicrafts, considered as inessential luxuries, are practically ignored even by recognised authorities on economics [who] found it impossible to realise the connection between art and industry and to appreciate the value of quality or a high standard of workmanship." (Gandhi 1991: 3)

However, Gandhi's was a lone voice. Modernisation plans along western lines had immense appeal. The idea that India had to be industrialised along socialist lines, with a powerful state providing patronage was the most powerful one in the discourse of Indian economic nationalism. The two most influential leaders of the Indian National Congress after Gandhi, Nehru and Netaji Subhas Chandra Bose (1897-1945), though they radically differed on many issues, agreed that the only way for India to progress was through heavy industrialisation of the socialist kind. This was in contrast to Gandhi who favoured a less intrusive, decentralised mode of development that is now, many years after his time, hailed as sustainable development.

Moreover, the commitment to national planning cut across ideological and political divisions. In spite of their bitter disagreements this vision was something that the future leaders of both India and Pakistan believed in. Both India's Bombay plan (January 1944) and the Muslim League's Economic Planning Committee emerged in an intellectual climate which had rejected traditional laissez-faire beliefs, but also dismissed indigenous, small scale development alternatives (Talbot 1994). The Bombay Plan[8] was the work of eight prominent business-

men who were associated with the Congress. It set targets at both the macro and micro levels of the economy in pursuit of the goal of doubling per capita income in fifteen years. This private sector initiative aimed at the industrial resurgence of India by investing Rs.10, 000 crore (roughly 1590 million Euros). The signatories were India's elite who passionately believed that modernisation along western lines was the only way forward. They included India's prominent industrialist JRD Tata (1904-1993) with interests in iron, steel and aviation, G.D. Birla (1894-1983), with interests in textiles, insurance and jute, Sir Ardeshir Dalal, Lala Shriram, a prominent North Indian industrialist who founded the Delhi Cloth Mills (DCM) and then made it the Delhi Shriram Industrial Group, and established or was a major influence in a number of institutions including the Shriram College of Commerce, Lady Shriram College for Women, Indraprastha College for Women, and the Shriram Institute for Industrial Research. Others included Kasturbhai Lalbhai, the director of the Reserve Bank of India from 1937 to 1949, who had started the Ahmedabad Education Society which grew into the Gujarat University, D. Shroff, who was India's unofficial (since India was not an independent state) delegate to the Bretton Woods Conference in July 1944, John Mathai, a professor of economics at Madras University and Director-General, Commercial Intelligence and Statistics, 1935-40, and Purushottamdas Thakurdas, a Bombay based businessman and business leader who along with G.D. Birla, was involved in building Indian business associations like the ICC, IICC and FICCI (Sanyal 2010: 5). What is significant is that the signatories of the Bombay plan were representative of India's colonial elite, were often trained abroad, were interested in education, and adhered to a specific vision of modernity.

India and the IITs

In 1946, Sir Jogendra Singh (1877-1946), executive member of the Viceroys Executive Council, Department of Education, Health and Agriculture, set up a committee whose task was to consider the creation of Higher Technical Institutions for post-war industrial development in India. The 22-member committee, under the chairmanship of Sir Nalini Ranjan Sarkar (1882–1953), in its report recommended the establishment of four Higher Technical Institutions in the Eastern, Western, Northern and Southern regions, modeled on the Massachusetts Insti-

tute of Technology (MIT), USA, with a number of secondary institutions affiliated to it. The report urged that all four institutions be set up as soon as possible, with work on the ones in the East and the West to commence immediately. It recommended that the institute have both undergraduate and research education with a standard equal to those from the best institutes abroad. The proportion of undergraduates and postgraduate students was to be 2:1 (ITT 2011). It was this report that laid down the foundation of the IITs.

The IITs, in order of their establishment are Kharagpur (1950; as IIT 1951), Bombay (now Mumbai 1958), Chennai (1959), Kanpur (1959), Delhi (1961; as IIT 1963), Guwahati (1994), Roorkee (India's oldest engineering college founded in 1847, made IIT 2001), Ropar (2008), Bhubaneswar (2008), Gandhinagar (2008), Hyderabad (2008), Patna (2008), Jodhpur (2008), Mandi (2009) and Indore (2009). Apart from these Institutes of Technology Benares Hindu University (ITBHU) in Varanasi is also slated for conversion to IIT Varanasi. However, this paper deals only with the first five IITs, since the later IITs from the 1990s onwards, are beyond the scope of this paper and follow different dynamics.

Central to Nehru's vision of a new India was what he called the temples of modernity. While in its original context this meant dams, industries and hydro electric power plants, the definition could also be stretched to include India's incubators of technological expertise such as the IITs that were designed to provide the new nation-state a corps of engineers. Through this act India asserted two things simultaneously: the independence of the nation-state from foreign technology (though not foreign experts and shared technological know-how) and the ability of the nation-state to create its own scientific manpower. This was a perception that foreign experts who were sent to India to help set up the IITs shared. For example, Inge Lyse, Senior Member, UNESCO Team at the Indian Institutes of Technology, who became Head of the Civil Engineering Department at IIT Kharagpur, wrote in his report to UNESCO on IIT Kharagpur for December 1951:

> Looking at the present situation from an Indian point of view, I must fully agree that the Indian Institute of Technology, which is in its making here must be given priority far ahead of any research institution. This Institute, supposedly being molded in the pattern of the Massachusetts Institute of Technology is in my opinion, the most important undertaking for the advancement of technical knowledge in this country, and consequently the most important factor in the

industrial and economic development of India. (Lyse 1951: 4)

Defining progress in western terms was in the interests of the local indigenous elite. Thus, Green Revolutions, nuclear power plants, jet fighters and big dams were logical extensions of western technological progress and expanded the power and prestige of local elites, but often did little good for common people who needed potable water, latrines, literacy, and family planning (Pursell 2007: 303). Throughout the post-colonial world, science was an instrument of national power. This was true in Indonesia (Lankester 2004; Houben and Schrempf 2008), India, China (Chevrier 1991), and Korea (Chang and Lee 2006). Whether it was steel plants, dams, roadways or the IITs, science was an actor and an instrument of power in forging the nation-state.

The idea that knowledge and technology are at the heart of scientific progress was and is particularly strong. Thus, the ideas of India's First Five Year plan, and the raison d'être of the Sarkar commission report that asserted that only investment in western technology and expertise, labeled universal knowledge, could lead to national success were echoed many years later in a report by the French ministry of education (1998) that questioned why France was lagging behind. Explaining how a knowledge society is closely connected to the idea of national greatness, the French education ministry wrote: "les travaux de l'Observatoire des Sciences et des Techniques (rapport 1998 de l'OST) convergent sur un diagnostic clair: la position de notre pays, comme d'ailleurs celle de l'Europe, est meilleure sur le plan scientifique que sur le plan technologique" (Guillaume 1998: 2). The second Indian five year plan (1956-1961) laid out the rational that the only way to succeed in an increasingly competitive world was to industrialise. It said:

Underdevelopment is essentially a consequence of insufficient technological progress […]. Countries which start late on their industrial career have some advantage in that they have, in the main, to take over and apply techniques that have been worked successfully in more advanced countries. But, there is need simultaneously for keeping abreast of the latest developments in science and technology, if the time lag in economic advance is to be progressively narrowed. (WWWb)

Similarity to other national plans

India was only following a pattern of development that appealed to anti-colonial struggles all over the world. There is a striking similarity in the rhetoric of progress that post-colonial leaders employed and it betrayed their faith in the progress through technology rhetoric that was the basis of colonial science. Thus for example Nasser, in his 23rd July 1970 address to the 4th National Congress of the Arab Socialist Union in Cairo (his last speech), equated war with technological progress saying:

> On this memorable day, the anniversary of the 23 July revolution, after 18 years of that revolution, we must pause to consider two distinct lines in the UAR [United Arab Republic] if we are to understand the essence, the objectives and the forces which have animated our struggle. The first line is to the south, on the Nile; I refer to the High Dam, construction of which was completed today. The other line is to the north, along the Suez canal. It is the battlefront on which the Egyptian people and the national army are engaged in the noblest and most violent of conflicts. To the south, on the Nile, there rises the High Dam and the giant power station whose twelfth and last turbine began turning today, thereby signalling the completion of one of the biggest electric power stations in the world. (Nasser 1970)

Nehru, in his , argues for the same technologically intensive mode of development. Referring to the fact that the India could contribute an amount that was greater than the total investment by the British in India in the 19th century, towards the British war effort during World War Two, Nehru, again referring to the power and capacity of central planning wrote, that this "demonstrates the enormous capacity of India to advance with rapidity on all fronts. If this striking effort can be made under discouraging conditions and under a foreign government which disapproves of industrial growth in India, it is obvious that planned development under a free national government would completely change the face of India within a few years." (Nehru 1941: 505)

In their insistence on big dams, both Nehru and Nasser were following the symbiotic relation between large scale irrigation works and powerful governments, and colonial patterns of top down power (Headrick 1988: 171-208) and a faith in the ability of a universalist science to serve as an instrument of power in the territorially bound nation-state. In the vision of both leaders there is an implicit belief in the primacy

of technological power, in the "imperative of forging an autarkic, self-sufficient national economy" (Goswami 2004: 4). Thus, rather than see their views as representative of a colonised mind, or rather than trace a binary opposite between progress and backwardness, "it is time to open critical spaces for new narratives of becoming and emancipation and to question these ideas in a way that is trans-modern, moving beyond both the post-colonial and post-occidental." (Venn 2006: 1).

For Nehru and Nasser science was rational, universal and an instrument of national power. "Science" referred to a common intellectual and political enterprise, even though different cultures conceived science in different ways. One of the key elements of this national discourse was the immense power that foreign-trained elite had in the creation of the nation-state. Indians who were educated in the best universities in Britain were instrumental in guiding India towards modernisation along western lines in the post-colonial period. I shall illustrate this point by closely examining the career of a man who was instrumental in the setting up of the IITs.

The career of Sir Ardeshir Dalal

The career of Sir Ardeshir Dalal (1884 to 1949) (WWWc), who laid the conceptual foundation stone of the IITs, encapsulates the transnational character of the Indian elite who chose modernisation through technology as the path for the new nation. Ironically, the products of their most famous legacy, the IITs, are other transnational elite. The well groomed Dalal, who one journalist described as "an image of the Average America's idea of big business" (WWWd), was the son of Rustomji Dalal, a broker at the Bombay Stock Exchange. In 1904, he graduated from the prestigious Elphinstone College, Bombay, at the top of his class. Awarded the J.N. Tata Scholarship in 1905 Dalal took the Tripos in Natural Science at St. John's College, Cambridge, and entered the prestigious Indian civil services, the "steel frame" of the British Raj in India, in 1908. After a career in the field, which included thirteen years he worked as Collector (the top official in an Indian district) in several provinces of British India. Dalal became Municipal Commissioner of Bombay in 1928. He was the first Indian to hold this position. After 23 years in Government, Dalal joined the premier industrial group in India, the Tatas, in 1931, as Resident Director of the Tata Iron and Steel Company (TISCO).

Dalal was knighted in 1939. In 1941 he was elected general president of the Indian Science Congress, held in Benares and was instrumental in the setting up of the Council of Scientific and Industrial Research (CSIR) and the National Laboratories. Dalal persuaded the US government to offer hundreds of doctoral fellowships under the Technology Cooperation Mission (TCM) programme that would play an important role in the early years of the IITs. In June 1944, the Viceroy, Lord Wavell, invited him to join the Executive Council as Member-in-Charge of Planning and Development. Dalal was also one of the signatories of the Bombay plan. In January 1946, Dalal resigned from the Government and rejoined the Tatas and worked there until his death in October 1949.

This career path, that spanned industry, science and government, and was transnational, typified the Indian elite who would choose to lead India along the lines of technologically intensive modernisation. This was evident in the first board of directors of IIT Kharagpur. Most of them had also been trained abroad. The first director of IIT Kharagpur was Sir J.C. Ghosh, who was awarded the Palit Scholarship to work for a doctorate at the University College, London, from 1919-1921. Dr. Bidhan Chandra Roy (1882-1962), the then chief minister of West Bengal, who completed both the Fellow of the Royal College of Surgeons (F.R.C.S) and Member of the Royal College of Physicians (M.R.C.P) exams simultaneously in a record two years and three months (1909-1911) was chairman of the board. Sir Nalini Rajan Sarkar, whose 22-man commission recommended the setting up of the IITs had two MIT trained engineers as its members (Bassett 2009: 787), and Sir Jehangir J. Gandhi, who worked with Tata Steel for 55 years starting in 1917 and was educated in the United States from 1918-21. The other members of the board were Dr. Tara Chand, K.R.K. Menon, India's first finance secretary and a member of the Indian Civil Service, T. Sivasankar, Dr. S.S. Bhatnagar, Dr. Humayun Kabir, the Education Secretary, an alumni of the Exeter College, Oxford, and director Dr. J.C. Ghosh (Malhotra 2007; WWWd).

Transnational influence on the creation of a state

More than 60 years after independence, the IITs, just like those who conceptualised them, instead of producing a national knowledge elite, have created a transnational elite that span government, industry and science. Their powerful and influential alumni network plays a key role in the intense knowledge economy driven modernisation that has become a feature of the Indian landscape. This has been the result of the "brain drain" from India. Figures of the exact number of IIT alumni who leave are hard to come by (Bassett 2009: 807). However, a survey of 677 IIT graduates by the consultancy firm Evaluserve of IIT, alumni who had graduated during 1964 and 2001, found that 35 percent moved to countries other than India, while 65 percent remained (EVALUESERVE 2004). While the majority of IIT graduates work in India, the best have a tendency to migrate, especially to the United States. Nearly 2000 IIT graduates leave for the West, mostly to the United States, every year (Bhatia 2007: 17). For example, of the 19 original graduates in computer science from 1983, one had passed away, 14 had gone to the United States, one to the Czech Republic, and only one had remained in India (Bassett 2009: 807). On the other hand, of the 1,400 B.Techs who graduated from IIT-Chennai from 1999 to 2003, only 15 percent migrated (John 2003).

However, it was those that went abroad that had spectacular success (Saxenian 2006; Friedman 2005). IIT alumni who work in the United States, mostly in Silicon Valley and in organisations such as NASA, Microsoft, and IBM include the inventor of the Intel Chip and major venture capitalist Vinod Khosla of Kleiner Perkins, Arun Netravali, the former president of Lucent Technologies' Bell Labs; Rajat Gupta, the former managing director of McKinsey; Gururaj Deshpande, the founder of Sycamore Networks; Arun Sarin, the CEO of Vodafone; Victor Menezes, the senior vice chairman of Citigroup and Raghuram Rajan, chief economist of the International Monetary Fund, among others. Even the comic strip character Asok, from Dilbert, comes from IIT. Business Week has called IIT graduates one of the "hottest exports India has ever produced" (Hariaran 2004). Others, such as Rajeev Motwani (1962-2009), a professor of Computer Science at Stanford University, who along with the eventual co-founders of Google, Larry Page and Sergey Brin, and Terry Winograd, wrote an influential early paper on the algorithm (WWWe), the basis for Google's search techniques, were immensely successful in academia.

Thus, paradoxically, the engineering colleges that the Indian state had created to fashion its knowledge elite became the best way to enter the high technology engineering society of the United States. Ironically the US national and technological landscape was much more receptive to those who graduated from the IITs, than India itself. The successful "acculturation" or "assimilation" of professional Indian immigrants in the U.S. workforce is based on a special provision of the 1965 Immigration and Nationality Act, which allows the entry of only a few, highly qualified, transnational migrants (Bhatia 2007). Students who made it into the IITs came and come from a narrow substratum of Indian society. Usually from the middle class, they share excellent foundations in the sciences, their fluency in English, and an intense work ethic[10], all of which enabled them to succeed in an intensely competitive society like the United States. Migrating to the United States was and is an enduring goal of most students in the IITs, epitomised by the Indian joke: "When a student enters the IIT, his soul ascends to America. When he graduates, his body follows."

However, policy makers in India, laudable though their intentions in creating a national knowledge elite were, were constrained by Indian social reality. Thus, while Indian engineers were trained in the latest methods and techniques emanating from the West, they also faced a social milieu where such skills did not count to a large extent. This was something that the foreign experts who were sent to India to train Indian engineers recognized, even when the IITs were being set up. Lyse wrote:

> […] after meeting a number of Scholars who have been in Europa (sic) or U.S.A on one or two years of study, I am somewhat at a loss to say what is the correct way of giving Indian engineers western training. It is not very encouraging to hear how they all wish to go back to the Western countries. They seem to doubt their own country's ability to go ahead and gain Western industrialisation and higher standard of living. It is a pity, but seems to be a reality (Lyse 1951: 8).

In fact, a constant difficulty that the IITs had, even at the beginning, was to find suitably trained Indians who would replace the foreign experts. Thus, Dr. Otto Walch, UNESCO Professor of Hydraulic and Dam Construction and one of the first experts sent to IIT Kharagpur, wrote in several letters about the constant struggle to find suitably trained Indian replacements once he left the Institute (Walch 1951: 2ff.). Dur-

ing his tenure, while he sought an expert in hydraulics to help him, the best that the Indian government could provide him with was an assistant professor who taught for eight hours. It is also worth noting that the hydraulic laboratory where he was supposed to teach was not ready until 1955, though he arrived at the Institute in 1952. Basic infrastructure was lacking even in 1995. UNESCO expert, S. Mackey, Head of the Department of Civil Engineering, wrote, "[c]onsiderable difficulties are being experienced in maintaining an electric power supply to the Department of Civil Engineering in view of the inadequacy of the existing power generating plant" (Mackey 1955: 1). In fact, when he wrote the report, the power had been down for 11 days in a hot and humid summer. Initially, the experts encountered barriers to the transfer of knowledge. Talking about the difficulty of changing methods of teaching, he wrote, "[i]n India, like in many other countries of the Near and Far East, the students are accustomed to learn by memory. They like this system and it is difficult to convince them that learning by heart means nothing especially for engineering." (Walch 1953: 3).

However, in an exemplary example of technological transfer, this was to change. Those who graduated from the IITs were among the world's best engineers. In fact, the cross applicability and universality of their knowledge, and the diasporic nature of the IIT alumni, are a good example of how societies do not have the same boundaries that they had previously, even when societies and nation-states do not inhabit the same place. One could see the beginnings of a global cosmopolitan society in this transnational elite network, and the breakdown of the inside/outside, us/them, national/international borders and spaces that were closely connected to India's earlier phase of nation-state centered development. Thus, the history of the IITs is also instructive in the way borders and nation-states are increasingly redefined. Increasingly, the products of India's elite universities inhabit a borderless space, symbolizing the "cosmopolitan [who] lives in and across borders" (Rumford 2006: 163), even as national borders are fortified.

Alumni from the IIT play a key role in the intense knowledge economy driven modernisation that has become a feature of the Indian landscape. In fact, the two biggest IT companies in India, Infosys Technologies Limited, founded by N. R. Narayana Murthy who took his masters in electrical engineering (1969) at IIT Kanpur, and Tata Consulting Services (TCS) relied heavily on computer science graduates from IIT Kanpur who had succeeded in the United States to attain crucial network-

ing advantages (Bassett 2009: 800-803). IIT alumni have also been prominent in venture capital funding. For example, Kanwal Rekhi, who graduated as an electrical engineer from IIT Bombay in 1969 was chairman of the The Indus Entrepreneurs (founded 1992), one of the major Venture Capital firms in Silicon Valley, and continues to play an active role in venture capital funding in India. Rekhi gave US $3 million to IIT Bombay to help set up a new School of Information Technology, named KReSIT (Kanwal Rekhi School of Information Technology), which opened in 1999.

IIT Kharagpur: Symbol of Indian renaissance

The national dynamics of a national knowledge society are revealed by the intense lobbying by Indian states11 for the setting up of new IITs, the ultimate success symbol of national educational prestige. In its first draft, on the ground Bengal had the highest concentration of engineering industries, the Sarkar Committee suggested that Bengal might be a good site for the first IIT. Armed with this, even before the Committee had submitted its report, the state Chief Minister B.C. Roy (1882-1962), persuaded Nehru to pass a special act to establish the first IIT in Bengal. Roy, who had been jailed during the freedom struggle, also proposed that the institute be set up at the former Hijli detention camp for political prisoners, in Kharagpur in Eastern India, thus glorifying those who had fought against the British. He was to chair the board of IIT Kharagpur when it started. The symbolism of housing India's premier engineering college in a former prison had enormous symbolic value, which I will explore in detail.

In May 1950, the IIT started functioning from 5, Esplanade East, Calcutta (WWWf; Malhotra 2007). The name, the 'Indian Institute of Technology' was adopted before the formal inauguration of the Institute on August 18th, 1951, by Maulana Abul Kalam Azad, India's first education minister. In September 1950, it shifted to Hijli, in the district of Midnapore where faced with intense resistance to British rule in the early 20th century, the British government set up detention camps, first at Buxa Fort, and then the Hijli detention camp in 1930.

The Hijli Camp was symbolic, especially for the Hijli firing incident that took place on 16th September 1931, when police at the camp fired on unarmed prisoners killing two, Santosh Kumar Mitra and Tarakeswar

Sengupta, and injuring many others (Malhotra 2007: 44). The incident stoked nationalist fires. Netaji Subhas Chandra Bose, the militant Congress leader who later would raise the Indian National Army that fought against the British in the Second World War from among Indian soldiers taken prisoner by the Japanese and the Germans, and expatriate Indians in Japanese Occupied Asia, was the then chairman of the Bengal Congress Committee. He came to take possession of the bodies. Gurudev Rabindranath Tagore, India's Nobel Prize Laureate, then aged 70 and ailing, addressed a condolence meeting on 26th September (1931) at the foot of the "Monument" (presently the Shahid Minar (Martyrs Column) at Kolkata). Sometime later, he penned the famous poem "Prashna" (The Question),[12] based on this episode (WWWf).

In 1937, as the intensity of the national movement waned, the Hijli camp was closed down, only to be reopened in 1940 when nationalist sentiment exploded with the Second World War, and many freedom fighters were, under the Defence of India Ordinance 1939[13], detained without trial. The camp was run by retired British military officers due to the demands of the war (Chattopadhyay 2002), but when Burma fell to the Japanese, the camp was closed in 1942 and the prisoners were transferred to Midnapore jail, Buxa prison and Dacca Central jail. The Hijli camp was given to the US Air Force, being deployed against a possible attack by Japan. When the war ended, the building fell into disuse, to be revived in 1951, when Prime Minister Jawaharlal Nehru, on the advice of B.C. Roy, agreed to set up the first IIT (IIT Kharagpur) there. More than anything, this symbolized the industrial resurgence of India that was central to the Nehruvian vision of India. India's reawakening was the key theme of Nehru's midnight address when India won independence when he declaimed:

> Long years ago we made a tryst with destiny, and now the time comes when we shall redeem our pledge, not wholly or in full measure, but very substantially. At the stroke of the midnight hour, when the world sleeps, India will awake to life and freedom. A moment comes, which comes but rarely in history, when we step out from the old to the new, when an age ends, and when the soul of a nation, long suppressed, finds utterance. (Nehru 1947)

Nehru, who laid the foundation stone of IIT Kharagpur in March 1952, returned to the theme at the first convocation on April 21, 1956:

> […] Here I stand at this place and my mind inevitably goes back to that infamous institution for which this place became famous, not now but twenty or thirty years ago—the Hijli Detention Camp. Here in the place of that Hijli Detention Camp stands the fine monument of India (IIT), representing India's urges, India's future in the making. This picture seems to me symbolical of the changes that are coming to India. (WWWf)

This was a belief that foreign experts shared. Lyse wrote in his report of December, 1951: "This Institute […] is in my opinion, the most important undertaking for the advancement of technical knowledge in this country, and consequently the most important factor in the industrial and economic development of India" (Lyse 1951: 4). In his report to the Conference of the Chiefs of Missions in South and South East Asia in 1955, S. Mackey referred to how IIT Kharagpur was a factory for engineers:

> The value of the project at Kharagpur must not be measured in terms of the size of its buildings, the number of its workshops and laboratories, or the amount and complexity of its equipment. Its 'raw materials' come from all parts of India, are moulded into shape at Kharagpur, and return to take an important and active part in the major engineering developments of the several states. Since there is a pressing need for skilled technologists throughout India and since any expansion of engineering development on a major scale is dependent on the availability of such men, it is evident that Kharagpur must play a major part in planning at country level. (Mackey 1955: 1)

In every way India's technological renaissance was starting from scratch. Lyse reported that Kharagpur was a very primitive town with no modern stores, not a single hotel, not one taxi, no high school, etc. and it was necessary for foreign experts to travel 72 miles to Calcutta by train to do shopping. Lyse adds, "because of the complete lack of modern comfort the European will not readily be at home here, at least not during the construction period which may last for 3 to 5 years" (Lyse 1951: 10). Lyse pillion rode on his colleague Prof. Malanowski's motor bike to get around. In the small bungalows that the team members were given, there was "no warm water, no electric cooking range, no bath tub, no refrigerator, etc.. The furniture was second hand, with no sofas and no easy chairs. No comfort in the way we are used to in Western countries […]". Lyse ruefully observed, but recognized that the "Institute Campus is being created in a wilderness and here a modern technical university

is in its making." (Lyse 1951: 10)

A few months later, on Sept. 15, 1956, in an act that underscored the importance that the new institute of technology had to the national vision, the Parliament of India passed the Indian Institute of Technology (Kharagpur) Act, 1956, declaring it an Institute of national importance and more importantly giving it the status of an autonomous University. The act was later extended to all IITs making them institutions of national importance.[14] Practically, this was a major gesture that protected IIT Kharagpur from the intense political interference in academic matters that is the bane of several universities. This was a pattern that other IITs would follow.

The first director of IIT Kharagpur, who came over from the Indian Institute of Science (IISC) Bangalore, Sir Jnan Chandra Ghosh (Parthasarathy 2002), was a visionary, both administratively and socially. By the time he had left the Department in 1954, to become the Vice-Chancellor of Calcutta University, he had been instrumental in setting up most of the departments. Ghosh's lasting contribution was that he, with the support of the education ministry, vigorously implemented the provisions of the IIT act that gave the IITs autonomy. Today, unlike most universities in India, the directors of the IIT are virtually free to select faculty, apportion the budget, and make purchases. They are free to manage academic programmes without political or bureaucratic interference, and, to a large extent, the IITs have been allowed to admit students strictly on merit, and based on an entrance exam that the IITs conduct - the IIT Joint Entrance Exam (WWWg), one of the toughest entrance exams in the world with an acceptance rate of less than 2 percent. (Bhatia 2007)

However, this is subject to the reservation policy (affirmation act) that sets aside 22.5 percent of the seats for Dalits (15 percent) and indigenous people (7.5 percent) (called SC & ST or Scheduled Castes and Scheduled Tribes based on their inclusion in a government list), 27 percent of the total seats for the intermediate castes known as the Other Backward Castes (OBCs), and 3 percent in each category, including the general category, for the physically handicapped (IIT JEE call 2011). Thus, in effect, only half the seats are open to general competition, but, in a limited way, the IITs thus address the deep social inequities that are part of Indian society.

Foreign collaboration was a part of the IIT story right at the start. The campus at IIT Kharagpur was designed by the Swiss architect Dr. Werner M. Moser (1896-1970). European scholars, in addition to Lyse

and Walch, included the head of the first department of Mechanical Engineering, Prof. R.A. Kraus of West Germany (WWWc) while the Department of Electronics and Electrical Communication Engineering was headed by another West German professor, Dr. H. Tischner. At the same time, faculty benefited from exchange agreements with a collaborative programme at the University of Illinois, USA, through the TCM, that Dalal had been instrumental in creating. From this modest start in 1950, IIT Kharagpur has grown to an institute with 18 academic departments, including five centres of excellence. Currently the Institute has 450 faculty, 2200 employees and 2700 students on the campus.

Regional and international rivalries for the setting up of IITs

The fact that the IITs were seen as symbols of national importance was also underscored by the clamour for more IITs in different parts of India that arose as a result of the successful setting up of IIT Kharagpur. Anticipating that Indian states would see having an IIT as a prestigious mission, and to forestall accusations of regional favouritism, made all the more credible since most members of the Sarkar Committee hailed from Bengal, the committee in its Draft Report suggested that the second IIT be located in the Western Region to serve industries clustered around Bombay, the port city and hub of Western India. The report also favoured the setting up of a third IIT in the North to promote the vast irrigation potential of the Gangetic basin. Finally, to satisfy the South, the Draft Report hinted that a fourth one might be considered for the South too though it did not come up with an economic rationale for the same (Inderesan 2003).

At the same time, India's non aligned status enabled it to seek aid from all over the world. Crucially, it was able to step aside from the political implications of seeking technological aid that was a feature of the Cold War for most nations, technological assistance being tied up to ideological loyalty, with the United States rebuilding the scientific infrastructure of Western Europe (Krige 2006) and the Soviet Union doing the same (Kanet 1987). However, India was able to find foreign patrons across ideological divides. IIT Kharagpur, though it had the help of foreign experts, and was supported among others by the United States, the United Kingdom, and the Soviet Union through UNESCO, had no specific national patron unlike the succeeding four. The Soviet Union (through UNESCO) patronised IIT Bombay (1958), the West Ger-

mans IIT Madras (1959), the United States IIT Kanpur (1961) and the British IIT Delhi (1963), upgraded from the College of Engineering & Technology (Delhi).

In December 1954, Professor Humayun Kabir, the Minster of Scientific Research and Cultural Affairs, attended the UNESCO General Conference at Montevideo and had informal discussions with UNESCO and representatives of the USSR. UNESCO agreed to help in the setting up of the technological institute in Bombay. Further discussions in Moscow, Paris, and New Delhi resulted in a final agreement by which UNESCO agreed to provide 10 million Old Rubles (about Rs. 10.2 million or $2.5 million) in the form of equipment and technical experts, and the GOI was responsible for all other expenses, initially about Rs.50 million ($10.5 million). A bilateral agreement was signed between the GOI and the USSR on 12th December 1958, providing for further assistance from the Soviet Union, worth 3 million Rubles (Rs.3.6 million or $75,000) (UNESCO 1968: 9).

In December 1956, the first team of UNESCO experts arrived, led by Professor V.S. Martinovsky, Director of the Technological Institute of the Food and Refrigeration Industry, Odessa. They stayed for two years and along with the director came experts in machine tool building, fuel technology and the technology of iron and steel. Other experts joined in the coming months. The foundation stone of IIT Bombay was laid by Nehru on 10th March 1959. Work progressed under the leadership of Brigadier S.K. Bose, commandant of the Indian College of Military Engineering, Poona, a civil engineer by profession. The total investment in IIT Bombay, including equipment but leaving aside expenditures on UNESCO experts and local staff, amounted to Rs.74 million ($15,541,000) (UNESCO 1968: 7). The single patron system seemed to be deliberate. The UNESCO report noted that securing equipment from a single source was "far more efficient and effective than what would have been the alternative method of obtaining separate items from different sources and adjusting them all to work together." (UNESCO 1968: 9)

K. Kelkar, a member of the faculty of the Victoria Jubilee Technological Institute, now the Veermata Jijabai Technological Institute (established 1887) in Bombay who had a doctorate from the University of Liverpool (1936), was the chief planning officer in the development of IIT Bombay (Bassett 2009). With the Soviets in, the Americans were not far behind. In response to the demand for an IIT to be set up in all four corners of India, IIT Kanpur, was set up in North/Central India

(this spatial distinction became a bone of contention, as I shall explore below) with American assistance, and Dr. Kelkar was made the director.

The next IIT was set up in the South of the country. In 1956, the German Government offered technical assistance for establishing an institute of higher education in engineering in India and send a delegation. The German delegation that arrived in India was leaning towards setting up the first IIT in Bangalore, when, as a matter of courtesy, they paid a visit to Madras, the neighbouring province. On the spur of the moment, the Education Minister of the state offered prime real estate near the Governor's palace. Highly impressed, the Germans chose Madras over Bangalore to set up the fourth IIT. The first Indo-German agreement for the establishment of the Indian Institute of Technology at Madras was signed in 1959 in Bonn, the capital of West Germany. Some, including R.N. Dogra, the chief engineer of India's first planned city - the union territory of Chandigarh, designed by Le Corbusier, contended that the North had been left out. In pre-independence British India that included present day Pakistan, the current Indian states of Uttar Pradesh and Uttarakhand constituted the United Provinces, and were more in the centre than the north of the British Indian Empire. Going by this spatial categorisation, Kanpur (Cawnpore), though, in independent India it was located in a state whose name in Hindi means Uttar Pradesh (Northern state), was located in the Central Region, not really the North. Dogra was instrumental in persuading M.S. Thacker, then member of the Planning Commission to set up an IIT at Delhi, arguing based on British spatial categories of governance, that Delhi was the actual north of the country, and that every region, except the North, had been bestowed with an IIT. In making such an appeal, Dogra was appealing to the spatial categories of a British Empire that had disappeared. Thus, IIT Delhi was set up, with British help, as the representative of Northern India. The new IIT, then known as the Delhi College of Engineering & Technology, was inaugurated on 21st August 1961 by Prince Philip, the duke of Edinburgh, and two years later was re-christened IIT Delhi.

The IITs that were set up after the original five, though beyond the scope of this paper, also followed this pattern of regional rivalry. For example IIT Guwahati (1994), in the north eastern state of Assam, was instituted as part of the Assam Accords (1985) between India's federal government and the All Assam Students Union (AASU). As part of the agreement the Indian government promised the betterment of educational facilities in Assam, including the setting up of an IIT.

Conclusion

The story of the IITs shows the emergence of a nascent knowledge society as an instrument of the state to give shape to visions of the nation. Nations need pasts as well as futures, yet in both it was a matter of choice. India consciously decided to create a knowledge elite and it invested heavily in this. Like big dams or space programmes, the IITs were yet another vehicle to convey national glory. The IITs, in their "national" ethos of recruiting students from all over the country and in the clamour by various state governments to host an IIT, thus become more closely linked to the "nation in the making" process that the Indian state was in. At the core was an unshakeable belief that the national elite would lead the nation to greater heights of prosperity and progress. In all this, the IITs were the symbol of Indian aspirations in the knowledge society. At the same time, when the IITs were being set up to create a core of independent engineers, international agreements were being inked. In fact, the IITs were to serve as a bridge between the provinces of India, and as an outstanding example of the transfer of knowledge across international boundaries. Thus, the IITs demonstrate both the transnational and intensely national aspects of Indian's technological resurgence. However, the IITs did not create the Indian knowledge elite. The intentions were good and patriotic; they merely addressed the wrong need, as science is not neutral and rather reflects an alliance between scientific and more broadly cultural values. India trained a corps of world class engineers without providing them with the infrastructure of an advanced international knowledge economy. And so it was not surprising that the IIT success story was eventually written in the vales of Silicon Valley, and not in the hinterlands of India.

Endnotes

1 Sabil Francis is a PhD candidate at the University of Leipzig, Germany and the École Normale Supérieure (ENS), Paris, and works on the emergence of the knowledge society in India. He would like to thank Prof. Dr. Michael Mann at the Humboldt-Universität, Berlin, Prof. Dr. Matthias Middell at the University of Leipzig, and Maximilian Nahrang at the Freie Universität, Berlin, for their valuable comments and suggestions.

2 Terms such as the „knowledge economy" or the "knowledge society" are often used interchangeably and come up frequently in policy and academic documents, yet have not been clearly defined. In the many debates that flow around the concept of the knowledge society, the focus is on the implications of the knowledge society rather than the actual concept of the knowledge society. The definition I use is a rough and ready understanding of the term that is adequate for this paper.

3 From 2000, the sector grew 15 times to aggregate revenues of USD 69.4 billion in FY 2009, and is one of the largest employers in the organised private sector, directly employing 2.2 million people (NASSCOM 2010). According to NASSCOM's strategic review 2011, the Indian IT-BPO industry registered a growth of 19.2 percent in FY2011. Exports are estimated to grow by about 18.5 percent in FY2011 and reach USD 59 billion while the domestic segment (including hardware), grew by 21 percent in FY2011, to reach USD 28.8 billion. (NASSCOM 2010; 2011)

4 The term that has been criticized as derogatory was coined by the Indian economist K.N. Raj to describe the sluggish growth of the Indian economy since Independence. (Raj 1984) For perspectives on India's political economy that explore the terms see Desai 2003; Das 2006; Bhagwati 2001; Zagha 2002.

5 The origins of this term come from Lenin's writings, but in India it is strongly associated with Pandit Jawaharlal Nehru, the first prime minister, who decided to nationalise key industries, while allowing a private sector to flourish. (Kapila 2008: 470)

6 I distinguish between the terms knowledge and information, see-

ing the former as enhanced information to which analysis, experience, and "the condition of knowing" has been added. (Bouthillier 2003: 6)

7 In India this was brought out most sharply by Indian attitudes to the Revolt of 1857 which was the last gasp of the Old Guard in India, and which sought, along with the over throw of British role to restore practices like Sati (the burning of Brahmin widows on the funeral pyres of their husbands, and the restoration of the Hindu and Muslim dynasties. Indians who had adopted Western ways, most prominently the Indian intellectual and social reformer Raja Ram Mohan Roy (1772-1833), supported the British during the Revolt, seeing Britain as a civilising force in India.

8 See Sanyal 2010. The plan was published by Penguin in 1945 Penguin as A Brief Memorandum Outlining a Plan of Economic Development for India and had been published as a pamphlet The `Bombay Plan' for India's Economic Development, Bombay, The Commercial Printing Press, 1944. Though it influenced India's five year plans, it disappeared from public circulation soon after its printing.

9 This section is based predominantly on the websites of the IITs, and memoirs from alumni and former that are available as interviews, reminiscences, commentary, and interviews on various websites, a short stint of fieldwork in India in early 2010 and work in the UNESCO archives, Paris from September 2010 to July 2011.

10 Most students in the sciences aspire to a position in the IITs. However, as the entrance exams are extremely competitive, this means studying for 12 to 15 hours per day from the age of 13, and enrollment in crash classes, in addition to regular classes. Based on interviews during field trip to India, Spring 2010.

11 In India, the term "state" refers to the spatial unit of the province.

12 God, you have sent messengers life after life,
To this callous earth;
They have said 'Forgive all sins' they have told us 'Love-from your heart all malice remove'
They are venerable men, worthy of reverence, but we

In these dark days reject them with ritual futility.
I see secret violence under cover of darkness
Slaughtering the helpless,
I see the just weeping in solitary silence,
No power to protest, their only offence,
I see tender youths hitting out blindly
Cracking their heads against stones in their agony
Today my voice is choked, my flute is without note,
The prison of the no-moon night
Has extinguished my world, given me nightmares;
And this is why I ask, through my tears - Those who poison your air and blot out the sun;
Do you truly forgive them, do you truly love them?

13 This was a repeat of the British Emergency Powers Act, 1939.

14 Government of India. 1961. The Institutes of Technology Act, as Amended by Institutes of Technology (Amendment Act, 1963).

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