# Knowledge and practice for India as a developing country[1].

Milind Sohoni
CTARA, IIT Bombay
sohoni@cse.iitb.ac.in

India has always been a land of great contrasts, and more so now in the welfare of its people. While a mere 100 individuals corner about 20% of our nation's GDP[2], millions and millons must live their lives on less than two meals a day. Moreover, this inequality seems to be increasing not only in terms of earning power, but in most other attributes such as access to education, health, livelihoods or water--see for example, Das and Zajonc (2008) in the area of education, or WB-ICSSR (2010) overall. The reasons for this are hotly debated by many economists, policy-makers and public figures.

An assertion of this paper is that there are many systemic deficiencies which are unlikely to be corrected by purely macroeconomic arrangements. Addressing these deficiencies will require a deeper sectoral understanding and a more profound technological and intellectual inquiry about the engagement between society, government and its institutions. Two very diverse examples of such deficient systems are (i) the legal and judicial system, and (ii) the water and sanitation sector. Our main thesis is that the essential ingredient in the overhaul of our key systems is the management of knowledge. It has been clear that our knowledge systems are failing to meet not only our demand for technicians and professionals, but also for the *public intellectuals*, i.e., those who understand the theory, who can communicate its practice, and who can lead in the public discourse to revamp our key systems. It is this matter which is the subject of this note.

The main points of this paper are (i) practice is an essential knowledge system and requires distinctive skills, (ii) training in practice is largely absent in our education and knowledge systems, (iii) this practice deficit has severe consequences, foremost in poor development outcomes, and the hovering threat of *knowledge capture*, and finally (iv) a possible way out using the development agenda itself as a training tool. We add that the focus on knowledge generation and consumption as a basis for development has once more been explicitly pointed out in Stiglitz 2011.

The primary background for this study comes from the author's field work, largely in Maharashtra but also elsewhere, and largely in the area of rural drinking water, but also other sectors. It is also based on the decades of experience of CTARA with rural development in Konkan and west Maharashtra, and also its situation within IIT Bombay and the consequent dialogue between academicians, practitioners and researchers.

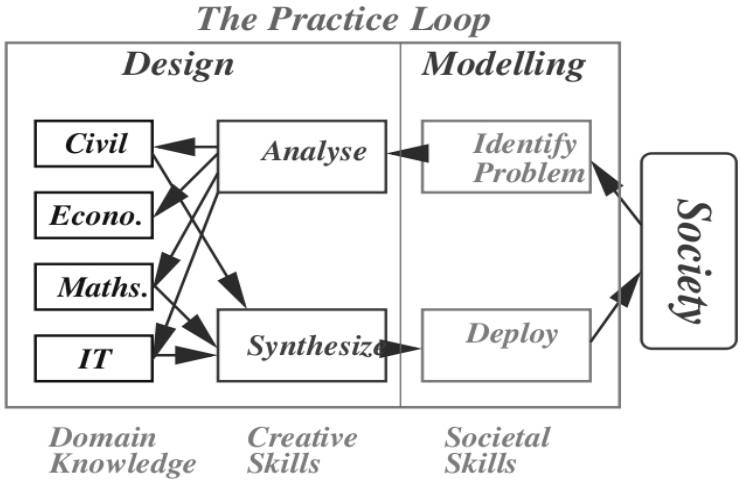
## 1. **An elementary theory of practice**

Practice, of course, is a well known paradigm of learning, and one which is closely connected to empirical observations. Be it personal, or societal, practice involves executing certain protocols, observing outputs, and then suitably modifying the protocols, and iterating this loop till a desirable level or nature of outputs are obtained.

Let me define societal or developmental *practice* as composed of the following interactions between *agents* and *society*: (i) a sequence of protocols to be executed by agents, with outcomes observable by society, (ii) a system of evaluation of these outcomes by society and a feedback to agents, and finally (iii) a system of adapting the protocols by the agents to achieve better outcomes as judged by society. A culmination of this iterative refinement is what we will call a *good practice*. This is a sequence of protocols which result in positive outcomes for a society, as judged by it. Economics is but one language of analysing or describing some good practices. Culture is another.

A typical practice loop is illustrated below. It starts with a societal modeling phase, and then a design and synthesis phase, and finally a deployment and validation phase. The transition from modeling to design is made by a decomposition of the problem into domain-specific problems. Conversely, the deployment phase is an integration of these specific solutions and delivery to society.

There are obvious similarities between the practice loop and the science loop of observation, theorizing and validation. While the science loop begins with observations and ends at it, the practice loop begins with society and ends at it. Both are iterative and incremental, start with concrete inputs and yet end in a desirable but abstract output. In our opinion, a *good practice*, the output of a practice loop, is also *knowledge*.




Take for example, the implementation of a village piped water supply system. The practice loop will take us through protocols to model and measure parts of this system such as the existing and desired quality of service, ability to pay, caste and class relations, nearby sources of water and their strength, and so on. This will lead to a number of domain specific design activities, such as design of a *paani samiti* and a tariff, simulations of various physical assets, and so on. This is then followed by a deployment phase where the creation of assets and institutions is carried out. The final part is a validation of the expected outcomes and if necessary, a second practice cycle. Thus a practice loop consists of many *protocols* of analysis, design and deployment, each being the subject of research and improvement. A good practice would be a culmination of this research. See the first 10 minutes of the video (Sohoni 2012b), for an expansion on this process.

The simplest good practices are perhaps artisanal, say the loop of a practising blacksmith or potter which consists of only a handful of protocols. Then there are the more advanced good practices, e.g., of companies, and now the massive loops engaging several companies and agencies, such as in large

urban systems. Indeed, most industrial societies have assimilated these good practices which are now embedded into their companies, factories, government bureaucracies, various departments at universities, consultancies and so on. Smaller sub-cycles and protocols are documented into textbooks and standards which are taught and transmitted.

A training in good practice must encompass three basic skills below. All of these have analogues in the method of *Science*, e.g., the skill of building and operation of instruments of observation.

- *Interfacial skills* of observing, modeling and parametrizing societal problems and of deploying solutions and observing outcomes.
- *Design (i.e., creative and interdisciplinary) skills* of assimilating feedback, analysing and decomposing problems into domains and then synthesizing solutions.
- *Technical or domain skills* of solving well-posed domain problems in the applied or pure, physical or social sciences.

The above classification of skills as being *interfacial, inter-disciplinary* and *technical* will be used later. We will also use the words *knowledge, development* and *education system* with their usual meaning. However, for us a *society* is an aggregate of its people, its culture, its incentive structures and includes its knowledge systems and practices.

## 2. **The coarse structure of modern Indian society**

The Indian polity actually boasts of several societies (our definition). These may be coarsely classified into two distinct (caricatures of) societies , viz., (i) *Bharat* and (ii) *India Shining* or just *India*[3]. In the world, there are several societies and one which we will frequently refer to is *West*, variants of which are followed in much of the western world[4].

*Bharat*, consisting of about 80% of India's population, is now largely developmentally stagnant and dysfunctional. The only major practice loop within it is agriculture. Most traditional knowledge resources, such as in artisanship, house-building, personal healthcare, and so on, whatever their scientific basis, are now dwindling. Its physical resources too are either (i) of increasingly poor quality or (ii) largely being expropriated by *India*. Its manufacturing output comes from small workshops and their jobs, largely casual and informal. Its people are riven by legacy problems, such as caste conflicts, asset inequality and so on. In fact, *Bharat* is not a monolith at all but is an overlapping collection of regional *Bharat*s, all similar to each other. Another peculiarity is the aspirational dysfunction: no role models exist within *Bharat* proper; all are related in some way to *India* (either as the petty *sarkari* official or as jobs in *India*'s cities). Compounding this is a broad insurgency of *Tribal* wishing to secede from *Bharat* and *India*.

The people of *Bharat* are supposedly eventually to *develop* into *India*. The current population of *India* is about 20% of India's population and is largely urban. It has nominal control over *Bharat* via a government whose upper echelons belong to *India* and lower *sub-taluka* employees come from *Bharat*. Most elected representatives of India come from or migrate to *India*. Commodity production, infrastructure development and most other industrial activities come from machines imported or good practices borrowed from outside, generally, *West* and now *China*. Practices developed in *India* are largely embedded as a *service or ancillary sector*, serving people of other societies[5]. These are

naturally shorn of interfacial or design skills and are restricted to technical skills. Thus, within the physical boundaries of India, there is largely no *good practical* knowledge production for the people of *India* or of *Bharat*.

*Global* is a recently proposed society modeled after *West*. It is based on a (reasonable) claim that *West* has served its people well, a (doubtful) claim that *West* or *Global* is sustainable, and finally the (unbelievable) claim that good practices of *West* remain so for *India* and *Bharat*. Proponents of *Global*, such as the World Bank, argue that *India* should adopt *Global*, which will lead to the development of both *India* and *Bharat*. This essentially means the subsumption of *India*'s knowledge structures into *Global* and aligning the institutional and incentive structures according to it. This also means borrowing interfacial and design skills (besides technical skills) from *Global* as well. This is already evident by the participation of *Global* as consultants to various statal and para-statal agencies and also the pressure to allow FDI in all sectors.

**3. Knowledge Institutions**

The educational system in a society is of course, central to its reproduction and the success of its development aspirations. Besides training agents who execute protocols, it is also an important partner and location for good practices to emerge, for it offers the necessary continuity and intellectual capacity.

In this section, we will look at the system of *professional* education in *India* and its recent trajectory. We will focus on the *practical* aspects of the output of such educational institutions, as opposed to their *blue-sky* research pursuits[6]. The engineering side (also see Sohoni 2012a for a longer exposition) of professional education in India began in 1847, with the Thomson College (now IIT Rourkee), and subsequently, the College of Engineering, Pune and others of similar vintage. These colleges trained engineers in the technical aspects of the field and for a reasonably clear professional trajectory either in the public services or in key industries. The interfacial and creative or interdisciplinary skills were acquired on the job. Good practices were developed and codified and maintained within the institutions and public departments. These have served as standards till today and much of engineering practice in India is through such standards distilled from the experiences of that time.

Nehru's dream of a modern India led to the foundation of the Indian Institutes of Technologys (IITs), and later, of the Regional Engineering Colleges (RECs). The RECs were to supply trained manpower to the large number of regional development projects then underway, and the IITs to assimilate international science and technological research and to adapt it for India's development. The IITs were based on a knowledge system and a notion of validity based on abstract scientific analysis rather than practice and long experience. This system was borrowed from elite institutions, such as the Massachusetts Institute of Technology (MIT), of *West* of the 1950s. At that point, the maturity of *West*'s companies, the breadth and depth of engineering practice, the centrality of *West*'s scientists in the second coming of Physics (in the form of transistors, nuclear energy and so on), the breadth of engineering education paradigms, all were important in the decision of *some of West*'s elite institutions to migrate to a more abstract scientific notion of engineering. All of this was ignored while installing this abstract DNA into the IITs. See (Terman 1976) on the history of the MIT electrical engineering department and (Basset 2009) on the strategic aspects of the MIT-IIT collaboration of that time.

Right from the first year, the IITs worked in quite the reverse way: instead of bringing in international scientific practices, it took away trained Indian scientist-engineers and put them in the international job market. Since the training at the IITs was what was meant for companies of *West*, these graduates were quickly absorbed there. The huge differential between the productive and remunerative power of *West* and of *India*, created a massive demand for the IITs among prospective students. This was construed as a vindication of abstract engineering and the influence of the IITs on the national discourse on engineering training and research increased. Thus an existing educational system of engineering practice was replaced gradually with an abstract notion of engineering. It also led to an unraveling of any special relationships between engineering colleges, engineering departments of various governments and key industries. The new abstract system, of course, had no need for any interfacial or interdisciplinary skills since it aimed at plugging itself into technical roles as employees embedded within good practices of *West*.

The liberalization of the 1990s saw first a de-technicalization of the job market, in the form of Information Technology (IT) jobs, and then consultancy, banking and finance, and then an ancillarization of Indian engineering to companies of *West*, esp. in the automotive sector. This created a mismatch between what was taught and what was found desirable in the job market for engineering graduates and a further shift of engineering curricula away from practice and towards the abstract. However, other than in the IITs and a few other colleges, there are hardly any teachers of abstract engineering. As a result, this curriculum is taught poorly and most students graduate with very little practical or abstract skills. Since the best employers are the banking, finance, consultancy, IT companies and then the ancillaries, the skill-set sought by employers has shifted away from technological to the inter-personal (see, for example, p.30 of the World Bank report WB 2011). The engineering college now serves as a finishing school where the peer group, student festivals and competitions and their organization, business plans, internships and so on, and multiple-choice aptitude tests, are the key metrics by which companies measure applicants. Thus, the engineering job market has essentially failed. It now works as a signaling game (see, e.g., Stiglitz 1975) for allocating wage-arbitrage jobs for *West*.

Yet we persist, not only with the abstract model but also with the incentives which have caused this failure. In fact, a recent World Bank and Ministry of Human Resource Development (MHRD) project, (see TEQIP 2012), attempts to cement the linkage between engineering education and the 'global' demand. In reality, the curriculum completely ignores the development needs of *India* or *Bharat* and the interfacial and interdisciplinary skills which these require. For example, the ordinary dug-well, the drinking water source for over 50% of our people, remains outside our curricula. Even for the urban-living *India*, first-hand familiarity of urban water supply systems, and the people and institutions behind them, lies beyond the pale of most curricula. Thus it is no surprise that India has an intractable drinking water problem.

The social sciences poses a more interesting, and perhaps a more ominous problem. Firstly, it is not clear if Indian social scientists have considered *good practices* and especially *design*, as objectives of a curriculum. At the bachelor level, training in social sciences stresses largely on scholarship and reading of a choice of texts with regional, national and international contexts. It does not usually probe the local context, and certainly not with a view of intervening. Thus, the question of developing or transmitting good practices does not arise.

The *social work* program, as conceptualized by the UGC (UGC 2006), is *practice* driven. This revision itself came after a 30-year lull during which the curriculum remained frozen in a framework of community service. The training here is closest to developing societal and interfacial skills within the limited scope of social entities such as the individual, group and community.

At the graduate level, the Tata Institute for Social Sciences (TISS), founded in 1936, is an exception to the typical graduate institute, in that it has a clear applied program. Some schools of TISS have indeed developed *research* protocols and performed much applied research and assessments for government agencies. However, these suffer from several deficiencies. Firstly, these protocols are usually limited to purely social attributes and their interactions, and thus fail to capture interdisciplinarity and design. Secondly, much of the protocols are based on ideological positions,
which seems common in elite Indian social science institutes (see, e.g., an analysis by Balakrishnan 2008). TISS specializes in the grassroot activist *genre* with a special stress on redistributive programs (as opposed to wealth creation programs). An illustration of all of the above is the design by TISS of the training program (MoRD 2012) for the prestigious Prime Minister's Rural Development Fellowship.

On the whole, other than the antiquated Participatory Rural Appraisal (PRA, an immersive protocol of documenting a village, formulated around 1980), there is no *social* protocol which is broad enough and in common practice. This is a serious lacuna for there are many situations which need analysis and design, e.g., in the cooperative sector or in self-help groups.

At the graduate level, the leadership in social science teaching and research lies within a small set of institutions. Most of these, such as the Jawaharlal Nehru University and Delhi School of Economics etc., have been pursuing excellence via research. The typical research methodology relies on textual analysis, use of secondary data and possibly some protocols for gathering primary data. The training and the output of these graduate schools is frequently contextualized by its relationship to *West*, and in many cases, financially supported by it. See, for example, Chatterjee 2002, on the extent and need for this, and also the Vaidyanathan review report ICSSR 2007, or Deshpande 2002. While many migrate to *West*, some graduates go on to form the backbone of the development and *policy* (see ahead) dialogue and populate the amorphous development space of NGOs, academicians and advisors to the government.

While most engineering curricula have a nominal representation of courses from social sciences, this window of influence is generally ignored by social scientists. No special courses have been designed to train the engineer in the interdisciplinarity that is required. On the other hand, presumptiously, no such inter-disciplinarity is required in the social science curricula. Indeed, though millions of rural women spend much time and energy at the dug-well, most social scientists do not see it as a social device at all, and worthy of study, say in a Gender Studies program.

There seems to be a perception among some of our social scientists that many of *Bharat*'s problems do not need trained engineers at all, and that that NGOs aided by *barefoot professionals* trained by *resource persons* suffice[7]. In fact, such training, called as *capacity building* is now a cottage industry which lies outside the formal knowledge structures. Moreover, we see that huge programs of several thousand crores base even their *asset creation* on such training modules.

Finally, there is the ever fashionable area of *policy*. Outside India, policy generally refers to the 'principle or rule to guide decisions and achieve rational outcomes' (see, e.g., *wikipedia*), i.e., a faculty useful in many situations, starting at the college cafeteria or the bus station. However, in India, it usually means the discourse of the anointed few for consumption (if at all) by the highest echelons of power. It is generally over-rated in its ability to bring about positive change on the ground. Policy in India engages only at the national level and occasionally at the state level. Decision-making at the district, taluka or levels below that are neither studied nor taught. Simple problems at the taluka level, e.g., fixing a policy for taluka-level public transport, are left unexplicated and unattended leading to poor outcomes, and contributes to their politicization. See, e.g., Challam 2002, who raises this locality question in particular, Balakrishnan 2008, and 0:20 of the video by Smita Srinivas (IIHS 2012).

Thus, nowhere do we see a curriculum that actually teaches protocols which start from society and end at it. Or an understanding that societies function because of virtuous cycles which generate value and which need careful nurture. Nowhere is there a mention that an educational institute should function as a regional knowledge resource and problem solver.

**4. The developmental consequences**

The developmental consequences for *Bharat* are of course, devastating. Many of the millenium development goals, such as provision of water, health care, etc., are related to good practices. Our performance in most such indicators is absolutely dismal and we will not go into depressing details but just focus on one example, that of rural drinking water.

Drinking water in *Bharat* starts at the dug-well. Even so, its science and engineering are poorly understood. Design of suitable region and use-specific yield tests and their practice remain to be established. Simple design of piped water supply systems is error-prone and unreliable. Most schemes face repeated failure due to a variety of reasons--they are either too expensive to operate, or the community too fragmented or the source too weak, and so on, all of which should have been determined before the fact. The state machinery is too weak or ill-trained to deliver. Consider, e.g., the district of Thane, Maharashtra with a rural population of 23 lakhs across 900 gram panchayats and over 5000 habitations. The rural water supply department has 14 engineers and 28 diploma holders (and no other field professional and no applied social scientist) to serve this population, i.e., roughly 1 per 50,000. At that per-capita, the engineer must have superhuman technical and social skills and use the most modern tools and protocols. But in fact, the design and analysis protocols have not changed in 20 years. There is no simulation and no optimization. There is no algorithm for the location of standposts. There is no failure analysis and very few standards for reporting. In fact, there are dozens of professional colleges in Thane district, and many of them in rural areas, but none interact with the department in any meaningful way, simply because they have no knowledge to offer and the department has no way to receive it.

Why cannot there be more professionals within the department? Well, there is no protocol to measure the value created by a water supply scheme, and therefore of the professional who made it happen. Also, at the wages of a government water supply engineer, the training that he/she will have received at our engineering colleges, and the productivity of the system, a new employee may not add value. There is no serious protocol of knowledge and practice transmission within the department itself and

many senior engineers are demoralized. In fact, the department has lost its empirical and practice frameworks completely.

To compound this is a market oriented 'demand driven' policy of many state governments and recommeded by the World Bank, and implemented through various schemes such as Jal Swarajya. These have not performed well (see, e.g., Cullet 2009 and our own case studies) for various reasons. Besides, much of the benefits of a market depend on a large pool of qualified companies, reasonable skill of formulating contracts and a judicial process of enforcing them efficiently. Also see, for example the official strategic plan document of the ministry for drinking water supply, Govt. of India, DDWS 2011, which sees the emergence of large schemes based on surface-water sources. This seems largely oblivious to ground realities, especially in Maharashtra, which is dismantling its technical practice of designing such schemes.

The people suffer immensely. Many parts of Maharashtra cannot bathe or wash clothes for months together. Women walk several kilometers to fetch drinking water or fight with their neighbors when tankers arrive, never on schedule. Many migrate to towns or to hard temporary jobs such as brick-making, leaving behind their children and their old. All this creates a charged backdrop ripe for politicization of the simple function of drinking water provisioning. The people may have mobile phones, a technology from *West*, and which adapted well in *Bharat*, but *Bharat*'s own water supply has used the same technology for about 20 years now.

In fact, most government departments are poorly staffed and are caught in a downward spiral of diminishing expectations and returns. There are hardly any academic institutions of standing who engage with these departments in their day-to-day research requirements.

This absence of practice has also led to a variety of phenomena, foremost among them, is the large space for NGOs (see, Shah 2008, for a discussion on this matter). They seek to bring this missing knowledge workers to development problems. However, the scale of the problem has led NGOs to speak of *capacity building*. It includes among other things, an attempt to create barefoot professionals who should actually have been trained in our colleges, or to build accounting or map-reading skills, which should have been taught in our schools, and so on. Poverty of trained professionals and of poor protocol design has led to a monitoring gap which is to be compensated by *community based organizations*. The language of capacity building, community participation etc., has now entered government lexicon and has led to an NGO-fication of many development functions. This is leading to a serious erosion in the morale and legitimacy of government departments and eventually of the government itself. This is also leading to a theory that good intentions and commitment are enough to bring about change. This is incorrect on both counts: good intentions are certainly no substitute for hard analysis of outcomes and a feedback loop. Also, it is unreasonable to demand *commitment* (e.g., 'community participation') as a basis for designing systems as opposed to *community adherence* to a well-chosen set of rules implemented by professionals. This aversion to professionals is all the more curious if we look at some of the massive asset creation programs, e.g., the National Rural Employment Guarantee Scheme (NREGS) and the Integrated Watershed Management Project (IWMP). Nowhere have these sought to influence engineering curricula or research, or science teaching in schools, instead relying on *capacity building*. Thus we have the ridiculous situation of the daughter struggling with *parallelogram ABCD* at school, while the father learns to draw contour lines on his lands.

Let me add here that there are many exceptions. As an example, there is the cooperative experience in various states which is largely practice oriented. It has led to many innovations, both technical and socio-economic and the cooperative sector remains an important source of energy and knowledge. Secondly, there are a few state administrations which have tried to bring about change *and* which is routed through both professionals and NGOs. This was brought about by many different devices-- strict monitoring structures, special-purpose vehicles, and collaborations with somewhat independent practice-oriented educational institutions and so on. Indeed, there is a variety of education and knowledge structures of all hues in the interface between *India* and *Bharat*, but their existence is largely in regional pockets outside the mainstream. A careful study of these would be very useful.

Now, coming to *India*, the effect of this practice vacuum on *India* is also extensive. Foremost, is a complete inversion in the so-called engineering job market (see for example, the interview of of Mr. A. M. Naik, of Larsen and Toubro, Economist 2012a). This has led to a steep drop in the overall quality, efficiency and competetiveness of engineering. It has also contributed to a stagnation in the organized manufacturing sector. The small innovative engineering firm, the work-horse of the European economies, is absent in India. See the new World Development Report 2012 of the World Bank (WB 2012), especially Chapter 3, and Table 3.13 on page 112. At the higher end, the organized service sector contributes much more to GDP growth, is much more responsive to education, and far more attractive than manufacturing (see Ramaswamy and Agrawal 2012). This skew in the sectoral composition of growth and output is worrying many economists (see, e.g., Singh 2008). In fact, many social scientists fear a further delinking of growth and employment (see, e.g., the recommendations of WB-ICSSR (2010)).

Our cities are in a shambles. There are few who can plan a sewage system or persuade citizens of its utility, or who will design and optimize public transport. While engineering students may study the very same material in their classes, they fail to see its immediate applications. Large cities may have the money to employ foreign consultants, but smaller cities have no access to routine consultancy. The overall absence of practice has also changed how we govern ourselves. The absence of interfacial and interdisciplinary skills in our training has contributed to poor stake-holder rapport, poor planning and decision-making and a limited solution space. Our knowledge and policy space too is now dominated by multi-lateral agencies and consultancies (see for example, the influential and apocryphal report McKinsey 2010), whose interests may conflict with broader social interests.

**5. Knowledge and Society**

The wider implication is of course, a discourse of education which has lost its bearings. The small set of elite institutions and their definition of excellence has led to their own stultification and exploitation by *West*'s institutions, by the students and a *rentier* faculty body. This excellence of science has created notions of 'taking science to the rural areas'[8], i.e., science as an output of the urbanized and developed world to be distributed evenly (much like the polio vaccine). It has created a small upwardly mobile elite set, which subsists on the value that it has for *West*, rather than for *India* or *Bharat*. This actually causes the broader *society-to-society* accountability loop of an educational system to unfold into a hierarchy of societies, and a *personal* (as opposed to social) outcome where 'excellent' members of a lower society aspire to prove themselves fit to migrate to the next society. Accountability *within* is substituted by an *upward accountability* called 'merit' which is generally aligned with class. It also

provides a 'meritorius' mobility which serves to diffuse some of the class tensions. However, it is extremely bruising and wasteful, and as we have noted, especially devoid of value creation. It also destroys the contemplative and intellectual nature of an education which is societally answerable. At the higher end, it has made education into a negative-sum game where thousands compete on a narrow metric for limited positions with disproportionate personal rewards.

Moreover, it has modified the very definition of education as a process which helps in *conveyance* to a better society rather than on *in situ betterment*. Education is seen as the only train out of Jhunjhunu (and not a better life within it) thus making every student a temporary resident in her own town, and one waiting for the right opportunity. This causes a restlessness in the educated with their own location and a highly distracting aspirational mobility. The first casualty is empiricism, the very basis of science. It is obviously difficult to teach a student to observe and record the village well, or to read his village map and locate standposts, if he regards himself as a temporary resident. He would much rather learn about the city and its ways. The second consequence is to change the development problem and the solution space from the the long-term with more efficient outcomes (i.e., the repeated game setting) to the short-term (i.e., one-shot) version.

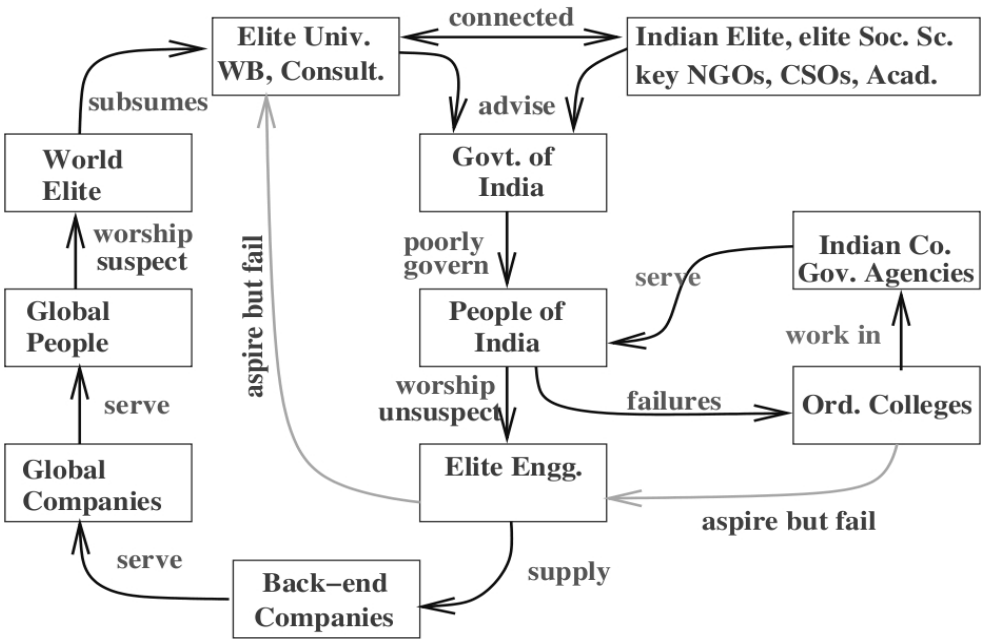
A corollary is also a society dominated by 'failures', i.e., those who could not migrate, and 'cranks' or 'social workers', who would not. The effect of this on the economy is two fold. Firstly, it creates a large number of jobs driven by wage arbitrage, i.e., of migrant labour competing on costs rather than on distinctive value. Secondly, the absence of positive value loops also depresses employment growth.

More important, this sequence of graded societies terminates at the ultimate role-models for *India*, and these are the elite knowledge institutions of *West*, i.e., the MITs, the Harvards and the World Bank and elite consultancies. This crystallization of the knowledge hierarchy is recent and has led to the Indian version of the *knowledge society*. In this version, we have a collective recognition that (i) knowledge, like perfumes, is branded, i.e., has social value besides its use-value, (ii) only branded knowledge is true, i.e., only it has the ability to discern, and (iii) true knowledge can bring desirable outcomes and change. It is the collective outcome of these three points that closes the practice loop for us, completely subsuming *India* within *Global* (see figure below). Thus, this ends with the truly knowledgeable international elite institutions advising our government on most issues ranging from adolescent girls and drinking water to massive urban systems. We may illustrate this knowledge cycle as below.

**6. Knowledge Capture**

Several features are illustrated in the picture. The first is the general regard, unalloyed with suspicion of any kind, that Indian people have for their elite educational institutions. This is in contrast to the situation in *West*, where excessive 'mertiocracy' has always been dubiously regarded. The second feature is the joint 'advising' of the government of India by the international knowledge elite on the one side and the *idealists*, i.e., social science elite, a few elite NGOs, etc., on the other side. The usual home of the idealists is the Planning Commission from where they hope to engage with the development agenda. The final point to note is the long cycle by which our people influence their own governance in the matter of knowledge.

This long cycle has several important consequences. First of all, it makes the practice loop very very expensive. We see that simple advice, such as '*please ensure that your design has a separate drinking*




*water source for each community'*, must come from an expensive and branded consultant for it to be believed by the Principal Secretary and put into practice by the Junior Engineers. We see further that monitoring of outcomes must also be done by the knowledge elite, for only they can discern truth. This leads to a complete shut-out of local institutions, local intellectual leadership and entrepreneurship. Thus, this globalization of the practice loop leads to a complete breakdown in local empiricism, i.e., the local capacity to gather data and organize it to ones benefit.

This relegation of empiricism to a higher knowledge elite and the subsequent loss of scientific temper, we term as *knowledge capture*. This is of course, a political and anthropological issue, related to the nature of legitimation of knowledge and complicates the benign view of knowledge as a purely clarifying and liberating force, e.g., as in Rabindranath Tagore's poem *Where the mind is without fear*. This relationship between knowledge and power has been commented on by many authors, e.g., Weiler (2010) and the authors cited therein, e.g., Focault, Kothari and Nandy. Economically speaking, such relegation is of course, irrational, and leads to very inefficient outcomes such as rent-seeking by the knowledge elite, poor suitability of solutions and so on. It is also concomitant with a devaluation, delegitimization and demoralization of indigenous knowledge structures[9].

Indeed, these rents are already visible in the disappearance of the Indian public intellectual. More and more of our newspapers, in their own search for excellence, now purvey foreign content or Indian content by foreign or NRI authors, and other *professional intellectuals*, i.e., intellectuals without stakes. This is almost total in the physical sciences, where the domination of *West* is complete. More worryingly, it is happening in the social sciences as well. Many NRI and foreign professors are now corresponding editors, regular contributors to our big newspapers, or hold positions of eminence within the government. Many of them have personally benefited from and will benefit from multilateral agencies which have a direct *financial and strategic* interest in influencing policy in India. The brand equity of the professional intellectuals is also crowding out the local intellectuals, especially *those with stakes*, and is also exacerbating an existing divergence between the vernacular or the experiential and

the english-speaking or the analytic intellectual. The proliferation of research on South Asia by researchers and institutions from outside India has been observed by many authors, e.g., Balakrishnan (2008) and especially Deshpande (2002), who wonders about the distinction between researchers on South Asia and researchers from South Asian institutions. But they miss that, ideally speaking, *practice*, proximity to the field and personal stake of the researchers, should give native institutions an insurmountable edge in quality.

The power of the international knowledge elite within India is a part of a global phenomenon of knowledge concentration, i.e., of a widespread belief that there are only a few institutions (or knowledge systems) in this world who can bring about change of any sort. Thus, in a sense, there is a *universal* science, or even worse, *universal* engineering, both commodities of great value, and held by the very few. In India, this belief is almost complete. The children of our ministers, bureaucrats, professors, the rich, the professional, etc., all study in these institutions. Those who return, form networks and alliances which make this belief self-fulfilling.

The behaviour of the global elite institutions is not very heartening, for they see concentration as a strategic advantage and not as the iceberg in the path of Science, which will destroy its internal machinery, and ultimately sink it. The World Bank (and the consultancies) studiously avoids bringing about collaborations between regional premier institutions and regional governance. In fact, it supports a globalization of engineering through projects such as (TEQIP 2012). Sadly, the Harvards and the MITs (which are not banks) also seem to propagate this knowledge concentration. This is seen by several initiatives which make effective use of their brand-name. Foremost among them: (i) pushing their own practices, research and open or specialized course-ware which substitute for local material and prevents local, cheaper, more applicable protocols to develop and find legitimacy (ii) gaining access to regional administrators and representatives, without regional collaborations, knowing fully well that this undermines local institutions. These institutions and the amateur experimenter-inventer which they contain, are the foot-soldiers of Science and their delegitimization is inimical to Science itself, and certainly to the development of the people.

A case to illustrate the point is the recently established *Indian Institute for Human Settlements* (IIHS, www.iihs.co.in), a Section 25 company to train future urban planners. It is partnered by MIT and a host of other international entities and boasts of (academic) advisors of the highest international repute and an illustrious board of some of the most influential corporate citizens of India. Not surprisingly, even though it has to graduate its first student, it is the only educational institution mentioned by *The Economist* in a recent article on Indian urbanization (Economist 2012b). Also see the interesting video (IIHS 2012) of Prof. Smita Srinivas, an advisor to IIHS, and note the localization of policy argument at 0:20 and graduates as valuable assets at 4:20.

**7. The way out and who is to do it**

Development is a very complex process mediated by many forces such as the political economy, governance and so on, besides just knowledge structures, and it would be foolish to assume that fixing one of them, will be adequate to bring about change. Moreover, current macroeconomic incentive structures, the global phenomenon of knowledge concentration etc., are all very serious headwinds to the process. All the same, knowledge has proved an important ingredient in transforming both governance and the political economy. Even in our recent past, it was only when the monopoly on

technical analyses of projects was broken that some rationality and efficiency came to their design. The first step is a re-design of our processes of accumulation and transmission of knowledge and practice to *enable its generation and consumption at the lowest and broadest levels*. Our recommendations are towards this specific objective, and that too, limited to *Bharat*, where we find conditions more pressing.

This in turn leads us to the problem of creating practice loops of positive value as locally as possible, i.e., at the district and *taluka* level. In principle, this is easy since most public systems are in such a decrepit and inefficient state that an increase in efficiency will easily pay for itself and the knowledge bearer who brought it. Establishing of such positive loops will require (i) identifying such problems and preparing agents with the requisite skills of solving them and delivering value, (ii) solving the 'realization' problem, i.e., creating models for the gainful participation of such agents within and outside governance, and (iii) putting in place the right institutional framework. The key definition here is of the *development protocol*, i.e., a tested good practice which generates societal value and which is also financially sustainable, e.g., of the design and implementation of watershed programs, village electricity plans, and so on. Thus, it is both, a pedagogical device as well as a knowledge commodity.

The second question is to solve the problem of *agency*, i.e., who will lead in the transformation. Here, the situation is more dire and is best understood as a variation of the signaling game, as in Stiglitz 1975, which pointed out the sorting and labeling role of educational institutions. This classification of students as *less* or *more* able, benefits employers for achieving better productivity. However, it translates into a redistribution of wages of individuals, with the more able receiving better wages generally at the cost of less able. Whence, rationally speaking, employers and the more able should pay for the sorting and labeling, i.e., for educational institutions. The costs of running public educational institutions (e.g., IITs, IIMs, JNUs, and so on) are justified only if (i) the overall productivity benefits of sorting exceed the unsorted case, and (ii) these excess benefits are distributed so that everyone is better off. For if not, the less able will vote against the expense of running the educational institution. Sadly, both these aspects are largely absent in the Indian mobility-based educational system. Even more, the conflation of *merit* with the current bases of sorting, and its reward, distracts attention from what is essentially a transfer of productive assets. It is only when the population of *India* and *Bharat* wise up to this absence of social outcome with education that the agency problem will be satisfactorily solved. The first approach would be to enable this line of thought by examining *merit* closely, thereby leading to a more public understanding of its mechanics. The second is the more constructive approach of solving the *capacity* problem and redirecting the 'failed' to gainful employment within their own society. This should lead to knowledge generation and an eventual contestation of merit. It is the second approach that we recommend here. Even here, we must rely on our skills at appealing to the wisdom of the political class, the elite and the bureaucrats and to try and proceed in small steps.

Here then are our specific recommendations[10]:

### 7.1 The development sequence

The foremost intervention is the design and implementation at all degree colleges, of a sequence of courses, called the *development sequence*. This should equip students with the necessary interdisciplinary and interfacial skills, and familiarity of a sector (say water), to understand

and to gainfully participate in regional development projects. Material in the development sequence should include topics such as (i) rural and urban systems and a certain amount of discourse, (ii) census and regional data and its analysis and other quantitative and programming skills, (iii) design and implementation of regional development projects and their outcomes, (iv) field visits and meetings with regional administrators and elected representatives. This should be supplemented by training in a particular *development protocol* in a chosen sector and its field execution.

**7.2 Avenues for regional knowledge generation and application**

The second intervention is the creation of avenues for local institutions and actors to participate in regional development. Much of the administrative space is already there but is ignored by state governments, e.g., the district planning committee (DPC), see PRIA 2009. Districts should be incentivized to absorb local and regional consultants and experts into the DPCs, especially in monitoring and evaluation roles, as is provisioned in the law. Regional educational institutions should be recognized as knowledge providers and problem solvers, and as agents for monitoring and coordination. Department of Science and Technology, Govt. of India (DST) grants should be reserved for such activities which engage with regional administrations, NGOs, people's representatives, etc., and which have a clear backing of the bureaucracy and elected representatives. CAPART and RUTAG's activities already come close to this function.

The District Innovation Fund (13th Finance Commission (DIF 2011)) is also a step in this direction. However, automatic approvals for certain development protocols, such as for analysis of failed assets, should be formulated. Enrolling as Technical Service Providers (TSPs) of regional institutions, companies and groups of students, should be encouraged.

**7.3 The Development Research Institutes: A grand reconciliation**

This calls for setting up regional centers of 'excellence' in development action and study within *existing* educational and research institutions. The faculty of these centers will be inter-disciplinary and support both action research and critical studies. It should help regional institutes develop partnerships with local administrations so that problems for further study are identified and solved. These should also redirect research funding from the ICCSR and DST and push it down to regional institutes, while monitoring outcomes.

These centers should be bring about a reconciliation between the social science, the vernacular and the technical discourses within India, and be tasked with the design of the *development sequence* above, the required *development protocols* in all sectors and all streams, the training of teachers and the graduate version of the development sequence. The reconciliation of the three discourses around the practice of development will serve as an asset to the development dialogue and stem the mutual bewilderment with each other's methods. It will hopefully align with the NGO and CSO interests and help in producing a common well-rounded front to resist knowledge capture and give an empiricial and outcome-driven foundation to our knowledge systems.

Much of the above three recommendations are being pursued by CTARA, and it is hard work. See our (pending) proposal (CTARA 2012), for *development professionals* made to MoRD where we explicate much of the above recommendations, and also the role of the Development Research institutes. Also see the M.Tech in Technology and Development curriculum at www.ctara.iitb.ac.in. See also the

attempt at www.cse.iitb.ac.in/~sohoni/tdcc to create a market for development professional by incubating consultants who will work in the sector.

### 7.4 The Ministries

Ultimately, the biggest push must come from the state. This will need an agreement of (i) the demand side, e.g., rural and urban development, collectorates etc., (ii) the supply side, i.e., the engineering and services departments, and ultimately MHRD and DST, and (iii) the finance side, to come together and formulate a common response. MHRD should push for implementing the development sequence and also its backward linkages with school education, stressing on practice-based training in the sciences and the humanities, and the forward linkages for curriculum design in tune with requirements of the engineering and development departments. It should create the incentives for bringing around the institutes of excellence to the development agenda. It should also persuade the social sciences to come around to inter-disciplinarity and practice (inter-disciplinarity in emerging areas has already been recommended by the review report ICSSR 2011). The development ministries should create openings at the collectorate, within district planning committees, at urban local bodies for a variety of positions as advisors, consultants, evaluators and so on, where professionals may deliver value. Finally, the Finance ministry should drop its preoccupation with just macro-economic variables and do what Solow did, viz., endogenize into its macroeconomics the external variable called *technology* or in modern parlance, *knowledge*.

## Endnotes

1. An earlier version of the paper was presented at the seminar "Concepts, Theories and Practices: The Changing Relationship between Science, State and Policy" on 26th-27th November, 2012, at the Indian Institute of Advanced Studies, Shimla.
2. See, for example, Arundhati Roy in Financial Times-January 12, 2012. Or see *For Richer, For Poorer*, in Economist, October 13th 2012, where we see 48 individuals acounting for 11% of GDP. This fraction varies as the stock market moves.
3. This is based not only on the urban vs. rural divide, but also on the *practices* of various segments of India's population, as gleaned from the NSSO data on employment, household commodities and so on.
4. There are of course many other societies such as *East* or *China*. However, its is the *West* which seems to influence most our formal knowledge systems.
5. In 2011, only 3% of Infosys' revenue came from India. For Ranbaxy in 2011, only 20% of its revenue came from the (highly regulated) Indian market. According to Ranbaxy, it was only in 2011 that India developed its first (modern) drug molecule, and this was by Ranbaxy and it was for Malaria. India's demand for telecom. equipment for 2010 was about Rs. 60,000 crores and about 90% of this was imported or of imported components. In 2010, Jindal Steel and Power spent Rs. 12.25 crores on R&D (of which Rs. 6.45 crores were capital expenditure). This was out of a turnover of Rs. 13,000 crores. In the same period, it spent Rs. 2.8 crores on purchasing software licenses and Rs. 19 crores on vehicles.
6. The objectives and outcomes of India's blue-sky research and its relevance to *Bharat* or *India* is

another matter of concern.

7. See for example, the entries within Box 5.2, titled 'Particpatory Groundwater Management in India' on page 156 of the volume I of the cabinet-approved draft for the 12th Five-year plan. This is highlighted as a 'trail-blazing' solution to problems of groundwater management.
8. See C.N.R. Rao on 31st July, 2012, in http://www.highbeam.com/doc/1G1-298127308.html
9. I must stress the difference between this and *indigenous knowledge*.
10. Our choice is of modifying the processes of higher education and enabling a closer cooperation with regional governance. This choice is based on our situation in such an institute and also our desire to act upon our recommendations. There are of course, other options as well, such as fostering rural enterprises, or a revamp of vocational institutions such as ITIs and so on. All the same, a broad systemic intervention is required.

## References


Balakrishnan, P (2008), Social Science Research in India: Concerns and Proposals, EPW, vol. 43, February 2, pp 28-33 (2008).

Basset, R (2009), Aligning India in the Cold War Era Indian Technical Elites, the Indian Institute of Technology at Kanpur, and Computing in India and the United States, *Technology and Culture*, 2009, vol. 50, 783-810. Also available at:
http://muse.jhu.edu/journals/tech/summary/v050/50.4.bassett.html

Challam, K.S (2002), Social Science Research:The Social Context, EPW, vol. 37, Sept. 28, p. 4080 (2002).

Chatterjee, P. (2002), Institutional Context of Social Science Research in South Asia, EPW, vol. 37, Aug. 31, pp. 3604-3612 (2002).

CTARA (2012), Investing in the Development Professional, A Concept Note, at http://www.cse.iitb.ac.in/~sohoni/devprof.pdf. Also see the accompanying presentation at: http://www.cse.iitb.ac.in/~sohoni/capart.pdf

Cullet, P. (2009), New Policy Framework for Rural Drinking Water Supply: Swajaldhara Guidelines, EPW, vol. 44, No. 50, pp. 47-54 (2009).

Das, J.,, Zajonc, T. (2008), India Shining and Bharat Drowning-Comparing two Indian states to the world-wide distribution in Mathematics achievement, Policy Research Working Paper 4644, The World Bank, June 2008.

Deshpande, S. (2002), Social Science Research Capacity in South Asia Some Questions for Discussion, EPW, vol. 37, Aug. 31, 2002, pp. 3628-3630 (2002).

DDWS (2011), Rural drinking water strategic plan 2011-2022, accessed on Sept. 25th, 2012, at:
http://www.ddws.gov.in/sites/upload_files/ddws/files/pdf/StrategicPlan_2011_22_Water.pdf

DIF (2011){dif}, Guidelines for the District Innovation Fund, 13th Finance Commission, Govt. of India, (2011). Also available at:
http://finmin.nic.in/TFC/Guideline_District_Innovation_Fund.pdf

Economist (2012a), The firm that builds India, in *The Economist*, Sept. 22, 2012. Also available at:
http://www.economist.com/node/21563308

Economist (2012b), Concrete jungles--A mainly rural country is ill-prepared for its coming urban boom, *The Economist*, Sept. 29th, 2012. Also available at: http://www.economist.com/node/21563412

ICSSR (2007), Restructuring the Indian Council of Social Science Research, Report of The Fourth Review Committee, March 2007, The Indian Council of Social Science Research, New Delhi.

ICSSR (2011), Report of the Committee constituted by the Govt. of India to review the functioning of ICSSR, June 2011.

IIHS (2012), video of Prof. Smita Srinivas, advisor to the Indian Institute for Human Settlements, at (accessed on October 6th, 2012):
http://www.youtube.com/watch?v=XB5kgIhpkeA

McKinsey (2010), India's urban awakening: Building inclusive cities, sustaining economic growth, McKinsey Global Institute, (2010).

PRIA (2009), Status and Functioning of District Planning Committees in India, Report by Society for Participatory Research in Asia (www.pria.org), November 2009.

MoRD (2012), details available with the author on request. Limited documentation, as accessed on October 5th, 2012, is available at:
http://pmrdfs.tiss.edu/training.php

Ramaswamy, K. V., Agrawal, T. (2012), Services-led Growth, Employment and Job Quality: A Study of Manufacturing and Service-sector in Urban India, Working Paper WP-2012-007, Indira Gandhi Institute of Development Research, Mumbai, March 2012.

Shah, M. (2008), Rainfed Authority and Watershed Reforms, EPW vol. 43, pp. 105-109 (2008).

Singh, A (2008){ajit}, The Past, present and future of Industrial Policy in India, Centre for Business Research, University of Cambridge Working Paper No. 376, December 2008.

Sohoni, M. (2012a), Engineering teaching and research in IITs and its impact on India, in Current Science, vol. 102, June, pp. 1510-1515 (2012).

Sohoni, M. (2012b), *Engineering and Society*, lecture at IIT Bombay, also at :
http://www.youtube.com/watch?v=G71maumVZ1A

Stiglitz, J. (1975), The theory of screening, education and the distribution of incomes, in The American

Economic Review, vol. 65, No. 3, 283-300 (1975).

Stiglitz, J. (2011), Rethinking development economics, in World Bank Research Observer, vol. 26, Issue 2, pp 230-236 (2011).

TEQIP (2012), National Project Implementation Unit, (at www.npiu.nic.in), the unit of MHRD in charge of monitoring and implementation of TEQIP.

Terman, F.E. (1976), A brief history of electrical engineering education, *Proceedings of The IEEE*, 1976, Vol. 64, 1399-1407. Also available at:
http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1454602

UGC (2006), Report of the Curriculum Development Committee on UG and PG Social Work Education. Available at:
www.ugc.ac.in/oldpdf/modelcurriculum/report.pdf
Weiler, H. (2010), Whose Knowledge Matters? Development and the Politics of Knowledge, essay, also delivered at the Colloquium on Research and Higher Education Policy of the UNESCO Forum on Higher Education, Research, and Knowledge in Paris in December 2004.

WB-ICSSR (2010), Report on the Workshop on Human Development in
India: Emerging Issues and Policy Perspectives, supported by the World Bank and the ICSSR (2010).

WB (2011), More and Better Jobs in South Asia, An Overview, The International Bank for Reconstruction and Development/The World Bank, (2011).

WB (2012), World Development Report 2013: Jobs. Washington, DC: World Bank (2012).