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BRIDGING IMPLEMENTATION AND RESEARCH

Pre-Conference

Draft Report

Working Group 4

The Kalam Conference Team

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Working Group WG4 Report

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List of Contributors

- Rohit Gupta
- Rahul Goswami
- Nivedita Haran
- Narayanan Komerath
- Dileep Kumar
- C.M.A. Nayar
- Arjun Pandit
- Shri Rao

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Chapter 1

Introduction

1.1 Mandate of Working Group 4

Grand plans need careful implementation. As we develop a roadmap to facilitate massive distributed growth based on people moving out from cities to villages and pursuing a happy life, we must clear the obstacles that exist or may arise. Investment of life and capital requires a reasonable expectation that promised infrastructure materializes with good quality. People expect good healthcare, education, recreational facilities, peace, and the maintenance of law and order. Business investment requires a predictable, level playing field with sensible regulations, and swift, efficient justice. In short, things must work.

Large improvements can be made to the success of projects by bridging the gap between implementation and the available knowledge base and capabilities. Many research papers look in depth into problems, and propose innovative solutions. However, translating these into ground reality is hindered by many problems. Often the suggested remedies are drastic and punitive, without really getting to the root causes. Success stories abound, but their lessons may not be properly understood, assimilated and incorporated.

As with each of the other Working Groups, the activities of this Group are critical to success of the other groups. So we have started by collecting some widely-distributed literature to sample the research questions being pondered, invite discussions with various entities, and capture their opinions. Driving our interests are several projects that will tie into the other Working Group areas, all focused on the same objective of sustainable growth, rural self-reliance and reversing urban migration. Thus there is

primary linkage to Group 1 through energy and enterprise growth. There is primary linkage to Group 2 in several ways: enabling the reversal of pollution and the growth of greenery; implementing well-considered water conservation and resource linkage projects; implementing river and water body cleanup; building infrastructure to enable carefully-planned reverse migration and rural settlements. The primary linkage to Group 3 is because of the basic question asked of this Group: How to take the best of research ideas and innovative concepts, and turn them into successful grassroots implementation. Thus the advances along grand directions (such as reversing Climate Change, Artificial Intelligence and Thorium energy) as well as specific innovations (hydrogen village for instance) are of intense interest. The primary self-linkage to Group 4 is in applying research lessons on project administration around the world, as well as the growing technology of AI, to the Justice system and to the ability to model and predict floods and drought, and how to increase the resilience of communities to disasters, as well the efficiency of disaster response. The relevance to Group 5 is very strong: it is a central objective of good administration to bring swift, effective and affordable medical care of top quality to every resident.

The initial activities of this group include

1. Panel to discuss implementation hurdles and solutions.
2. NGO role in connecting to villagers.
3. Role and implications of Artificial Intelligence.

We are assembling a team of dedicated, experienced present and former IAS officers, who are determined to bridge the gap between implementation and capabilities. Research advances are often lost in implementation and likewise, the real issues in implementation often do not get communicated or recognized in the academic research environment. An illustrative example is a recent conference on disaster management and alleviation, where there were numerous research paper presentations, but no mechanism to listen and understand the difficulties faced by local administrators and villagers - until an impromptu gathering of attendees conducted such a discussion, late into the night. The above illustrates the critical importance of alliances with the NGOs to develop a resonant synergistic relationship with the villagers.

Beyond this, exciting possibilities are developing with the resurgence of Artificial Intelligence (AI) technology. Indian leaders see immense potential in software / Information Technology employment in India as this wave grows. However, our focus is on applications that start with a focus on India.

The Justice System in India is in need of good ideas. Basic Indian philosophy is to have a much lower ratio of Law Enforcement personnel to the population, than is

the norm in most Developed Nations. The resources available for the Justice system are also quite inadequate to deal with today's demands. AI could revolutionize this system, by first inducing digitization of the records into searchable databases, and then employing AI methods to recommend solutions and judgements solidly based on precedent as well as forward-looking wisdom. This should of course be as an aid to the human judge, whose time can be much better used, with far greater productivity.

A brief writeup from an experienced administrator follows.

1. Coordination and good interaction form the basis for good governance.
2. In actual fact one finds a number of existing gaps in thought processes, actions and priorities; some of the widest gaps are: between academicians and administrators; between social and natural scientists; between researchers and technologists.
3. These gaps lead to deep chasms between thought processes that nullify the results on the ground.
4. Take for example the research being done on protection of public lands and the need to use modern technology to do the same. Why are digitised cadastral maps still a dream in India and what is done is more to spend budgetary funds and not to provide relief to the people? The policy makers struggle to find the right solution, fighting their way through a maze of hardware-selling corporates, cagey software designers and omnipresent land mafia with close political and bureaucratic links.
5. Or take the case of the bridge schools meant to provide basic literacy to the school dropouts while providing them skill training. The schools have been hijacked by local bigwigs to provide quality education to their children.
6. And then there is the example of cleaning up of our water bodies: commercial houseboats and hotels release the night soil and pollutants into the Dal Lake with impunity in violation of all statutes and demand financial assistance for not doing so.
7. Academicians rue the fact that no administrator even cares to read and get acquainted with research dissertations, leave alone implement any of their suggestions. Administrators on their part struggle to find solutions to day-to-day issues and major administrative conundrums and draft major policy papers without having the benefit of the research base. Academicians and researchers struggle to find topics for research that would be relevant to society; while

administrators find most research repetitive and often irrelevant. What a loss it is for the entire community that the two never meet.

1.2 Solution Approach

1. If we are to take our country forward with better Human Development Index and reduced inequality we need to bridge these gaps. We need to:
2. Bring together administrators and research scholars to generate a core group of experts with robust academic base and practical field-experience;
3. Set up a network of such experts to enable them to learn from each other and to supplement each others knowledge and experience base;
4. Bring out occasional papers based on joint contributions and circulate these widely;
5. Hold workshops every year of select groups of scholars and administrators to expose them to innovative ideas in public service and to enable them to come up with innovative ideas on their own;
6. Develop this ever-enlarging group into a thinking and thought-provoking body led by a team of experts that would find novel ways to bring about interaction and cross-learning between administrators and academicians.

At this stage, this draft report starts by looking at some examples from around the world, and lays out a continuum of endeavor in India up to the present. It will be seen that in India, despite acerbic election campaigns highlighting differences between different political parties, there is a common thread of steady advancement. Successive governments have each built on their predecessor's work despite political differences. This is a very positive and uplifting observation, and it must be attributed to the dedication of the administrative services, as well as the basic goodness and dedication of political leaders.

Chapter 2

Governance and Justice

2.1 Prelude

In 1947 Independence followed World War II and was in turn accompanied by the horrors of Partition and then the Kashmir war of 1948. India was desperately poor. Unrecognized in the West is the fact that a very large part of the wealth and resources that the British Armed Forces consumed in World War II, not counting the massive loot of the 190 years preceding that, came from India. Famine in India was one of the costs of feeding the British war effort. With massive German bombing of the British Isles, and the Japanese invasion of British colonies in southeast Asia, India was the remaining strategic depth that enabled continous supply of supplies and armaments to British forces. Over 87,000 Indians died fighting for the British Empire, including the major battles in Egypt and Burma that stopped the advances of the Wehrmacht and the Imperial Japanese Army respectively: the cost to India was terrible.

The government of Independent India was faced with a near-hopeless task. An extremely diverse hodge-podge of over 600 city states and provinces, with 25 different official languages and at least 4 major religions had to be kept united and moving forward. Very few experts around the world expected the Indian experiment in free democracy and universal adult suffrage with Parliamentary democracy, to last. Indeed India is essentially alone in keeping such a system alive, much less thriving, in her neighborhood. The task of running the government and serving as the interface between government and the governed, fell to India's Administrative Service, one who to this day select officers based on merit and extremely competitive recruitment processes.

The political leadership, no doubt with guidance from the administrative service, set out to address priorities. Initially the government had to take over from the very top-down Colonial Imperial government that was fundamentally structured for the most efficient extraction of wealth from India for shipment to Britain, not to benefit Indians. To bring up basic standards, heavy industry, big dams and other power stations, and transport infrastructure all were needed, with a very low tax base or ability to collect taxes. Much of India was indeed at subsistence level or below. The initial governments swung increasingly towards the Socialist model of Five-year Plans and a very strong Public Sector to build up the industrial base. Industry located in the big cities, or big cities grew around industry as people migrated from the villages to the cities in search of employment. Many Indians, facing absence of opportunity in their homeland, went abroad in search of higher education and employment, and gradually the 'Non Resident Indian' and Indian diaspora populations became a primary source of scarce foreign exchange. The environment to start private enterprise in India remained quite negative, with a maze of licenses, rules and regulations. Regulations were poorly communicated, poorly enforced and often contradictory and conflicting. Economic growth stagnated, but in time, the specter of famine receded, and the democratic system remained free and served to unite the nation at least against external threats. While many modern Indians rue this focus on a Socialist model, one must pause to ponder what might have happened with alternative models, by looking at other nations that gained Independence around the same time as India.

By the 1980s this top-down structure had outlived its utility. As the Cold War ended and the western-dominated New World Order came into being, India was under severe pressure to 'liberalize' and open up her markets to foreign products and services. Starting with a severe economic crisis in 1991, India adopted liberalization, moving increasingly towards western capitalist and Free Market strategies. The success of the Indian Information Technology industry in delivering services worldwide, became a model for growth in India. However, with a huge population, based nearly 70 percent in the 600,00 villages of India, and most of India lacking basic energy access and other amenities, a sudden switch away from socialist policies would have been disastrous and again led to the situations seen in Africa and South/ Central Americas.

In 1992, India introduced the 73rd Constitutional Amendment (which requires a 67% vote in the Parliament, as well as endorsement by the States, thus indicating broad support). This was called Panchayati Raj. It was based on the recommendations of several study teams to decentralize administration. The term Panch-ayat means Rule By the Five, referring to the ancient system of five village elders making decisions in the village. The term Raj refers to Rule as by a government. The basic unit

of Panchayati Raj is the Gram Panchayat (village Panchayat), which consists of elected representatives, wise or otherwise, but local residents. The next higher level is the Mandal Parishad or Block Samiti or Panchayat Samiti. Above that is the Zila Parishad (the District level administrative unit). Today the Panchayati Raj system exists in all States except Nagaland, Meghalaya and Mizoram, and all Union Territories except Delhi. A centrally appointed IAS officer known as the District Collector wields some administrative power at the District level; however, note that law and order is in the hands of the State Police, who report to the Home Minister (often the Chief Minister) who is the political leader of the State.

Most projects were still top-down. Public-sector industrial policy tried to maximize employment rather than profits, in order to bring up the standard of living of people caught in very low economic strata. Government policy found itself driven increasingly to provide welfare schemes, often to distinct segments of society, to address perceived or real special ills and injustices.

Today, as we trace below, India stands on the threshold of fast growth in economic standards of the population. Buying power of the so-called middle class has sharply grown, and the bottom layer in the rural areas appears poised to ignite a boom.

2.2 Policy Evolution and Continuity

Much has changed in the nearly three decades as India's prowess in Information Technology and organizing massive complex enterprise software systems, started feeding into governance. The first revolution was of course the rapid scale-up of the Cellular wireless telephone network, which grew from the microwave wireless communication towers that were built along India's railway network. In turn, the decision to adopt wireless microwave was driven partly by the unaffordable cost of copper lines. The Mobile Phone network also brought the Internet to remote corners of India. In the 1990s the Chief Minister of Andhra Pradesh, then containing the technology center of Hyderabad, adopted e-governance in a big way in his State, perhaps the most visible political leader who carried a laptop compnter. *(Note that today Hyderabad is in the State of Telangana that was carved out of the former Andhra, with Amaravati, the new capital of Andhra, coming up).* Perhaps it was his way of trying to emulate and compete with the technology success story of Bengaluru (then called Bangalore), another Cantonment Town under the British, as a technology hub. People were amazed that in Andhra, one could accomplish over the Internet, what used to take a long trip to a government office and hours of waiting in line. At the

time, Internet access probably required going to an Internet Booth set up along with Long Distance Telephone access, but it was a huge revelation. Other states started emulating the Andhra example.

The National Democratic Alliance (NDA) government of 1998 to 2004 continued the prior government's efforts to liberalize. Public sector enterprises were divested to some extent. Despite the recession of 2003 in the Information Technology sector, the Indian IT industry continued to grow.

The United Progressive Alliance (UPA) governments of 2004-2014 brought in a welfare system that included legislation called Right To Work. This entailed a routine payments from the Treasury to every citizen below the poverty line (BPL) for subsistence. This was a massive step towards a societal safety net, but again, implementation wilted as much of the payments got stolen in one way or another by so-called 'middlepersons', dealing with poor and often illiterate end-recipients who survived strictly in a cash-based economy. The move was criticized as 'vote bank politics', with the incentive to work being taken away from many rural residents, and leading in some areas to a rise in alcoholism and associated societal fissures.

In 2009 the Central government opened the UIDAI, or Unique Identification Authority of India. They came out with the hugely ambitious Aadhar Card program, aiming to get every citizen a unique identity with biometric identification, as well as tax and financial data. The project, much watched around the world, achieved large success, but then started stalling as Opposition Parties and other interests, many of them well-meaning supporters of free democratic institutions, started raising concerns about possible negative implications. More importantly, many rural citizens were unable to see the point in giving the government any more information than they could avoid. Tax compliance was not very high in India, compounded by the natural concerns of free citizens about government and financial systems.

In 2014, the new National Democratic Alliance (NDA) government, elected with a massive majority, introduced several radical steps. To the casual observer these might have appeared to be scattered populist steps, but they in fact appeared to bear strong resemblance to a detailed 80-page manifesto developed ahead of the election (we will call it FGLI), with a detailed blueprint. The document contained sharp, concise essays from top-notch experts around the world, on what could be achieved, and the interlinkages between different problems and solutions. Let us briefly review, in a more or less informal manner informed only by news media articles, besides the FGLI document.

The first, announced on Independence Day (August 15, 2014) from the ramparts

of the Red Fort by the new Prime Minister Shri Narendra Modi, was the Swacch Bharat Abhiyan (Clean India Exercise). The PM announced that within a year, every school in India would have separated toilets for men and women. These were to be constructed through a public/private collaboration, with funding going to Non-Governmental Organizations (NGOs) who enjoyed the trust of villagers. The move had a massive implication besides obvious provision of basic sanitary facilities for a decent existence: it was seen as a way to stem the dropout rate of young women when they reached puberty. It was also a way to stem outdoor defecation, which contaminates the groundwater resources, besides posing all the health and safety and security risks of having to venture into wooded areas alone for basic needs. This reduction in outdoor defecation was adopted as a metric by the World Bank for many development projects in India, and hence NGOs got the word that unless there was a component of eliminating outdoor defecation one could not get funds from the WHO. For the Prime Minister of India to make such a declaration in his first public speech since being elected on a massive majority, and that from the ramparts of the legendary Red Fort, symbol of the might of a nation of 1.2 billion people, in an address heard, seen and translated throughout the world, was indeed a massive statement. Seen by many as a religious person, he had already shocked many of his own supporters before his election, by asking them to build toilets rather than temples. Independence Day activities are associated with massive pomp and ceremonial celebrations, with jet fighters roaring overhead, smart columns of military and paramilitary forces, floats from every state, troops of school children and distinguished guests seated in solemn splendour. The PM's humility and determination in his choice of opening remarks certainly gave pause, and got the attention of the audience for what followed.

Combined with the WHO's support, it became clear that this was a seriously thought-out step. By the next Independence Day, well over 100,000 schools had new toilets, many many more were under construction, and there was clear peer pressure if not other kinds of pressure, on localities where they were behind schedule. Sixty-six years after Independence, a massive step had been taken in Human Development, with what seemed like one speech. In 2019, the initiative continues, with new toilets continuing to be built and handed over to villagers with government funding to NGOs supplemented by Corporate Social Responsibility funds.

Next on the PM's list in his address from the Red Fort was another stunning declaration: The Jan Dhan Yojana (People's Wealth Plan) that every family would have a bank account, again in short order. Each account could be started with a zero balance. They could be operated using mobile phones, with the Aadhar card providing identification. Government payments, including the RTW payments, would

go directly into these accounts, completely bypassing the 'middlepersons'. *Suddenly, every citizen had a strong motive to get an Aadhar card*, it was much more than a symbol. Rumors hold that the PM also wanted to put some money in each account, but the banks advised strongly against that. Within a couple of years, the PM was proudly pointing to the fact that the empty bank accounts now held a massive total of cash: people were not simply spending the money, they were building assets. The government's faith was well-placed. Reports also say that the PM called the leaders of the bank employees' unions (which have a history of going on strike with fair frequency) and told them that the immense task of setting up 700 million new accounts was to be carried out with no fuss: he also promised that their salaries would receive a big boost. There was no strike. Mobile banking had become a nationwide reality in short order.

Next the government added another significant feature: Every family was provided with a significant amount of catastrophic insurance by the government, free of premium cost, again tied to the bank account and Aadhar. Now the citizenry had an unprecedented level of financial security, unimaginable before then.

More recently, the government has added medical insurance at a small premium, along with a massive chain of pharmacies selling generic as well as Ayurvedic (traditional) medicines at low cost. This scheme is called *Ayushman Bharat*, the term *Ayushman* referring to one who lives a long life. This has the added benefit of giving a government stamp of approval (and a mechanism for quality control and improvement) for the entire Ayurvedic line of healthcare. This aspect is discussed in our Working Group 5 deliberations.

In between, the government took the next big stride: Demonetization. Despite some evident glitches in implementation that got disproportionate negative publicity, the bold move served to bring e-commerce in a big way to the vast majority of Indians, and reduced the stranglehold of the cash-based economy. Grassroots sentiment was evident, when one of our Panel members who was visiting India at the time, spoke to shopkeepers, who must have felt the brunt as customers did not have cash, and the banks ran out of the cashless transaction machines: they emphasized hope for the future, as the government was finally showing a determination to level the playing field and remove the dominance of so-called Black Money! The declared objective of unearthing Black Money may or may not have worked well (opinions and experience vary widely) but the point had been made that the future held far higher risk for such enterprises. Electronic transactions based on debit Apps tied to (yes!) bank accounts and mobile phones, certainly took off. These days few Indians carry wallets stached with currency bills or plastic cards: everything is on their phones with perhaps one

identity card for backup.

Next came the General Services Tax (GST) a common tax structure that replaced a maze of taxes and fees that hindered commerce. Again, the real implication of GST was that it made possible a start-to-end near-real-time tracking of money through the chain of economic activity.

It was feared that these bold moves would reduce the popularity of the government enough to cause it to be defeated at the 2019 General election. The Opposition also came up with a last-minute initiative called NYAY (the acronym says 'Just' implying entitlement) which promised an annual payment of INR 72,000 per year to every citizen (nearly $1.5 trillion per year in direct disbursement from the Treasury!) This would have been a huge addition to the annual income of Indians with below average incomes. Consider that , per capita income in 2016 was around INR 120,000. The election result was opposite: the NDA has been returned to power with an even stronger majority and wider national reach, a ringing mandate for the policies enacted. Primises of handouts from the government no longer guarantee electoral popularity in India. Much more ambitious hope appears to have taken hold.

2.3 A Sampling of Governance Literature From Around The World

2.3.1 Electronic communications in Justice Administration: The Rwanda Example

Watson *et al* [**?**] describe an information systems approach to an integrated justice system. They use an electronic case management system for Ministry of Justice in Rwanda as a case study. Rwanda experienced the genocide of 1994, followed by overthrow of the government that presided over the genocide. The new government had the uphill task of rebuilding institutions, restoring justice and order and rebuilding the economy. They have made remarkable progress towards Sustainable Development Goals. Investment in information and communication technology was a key component of this recovery. The Justice Sector has become a focal point of this IT transformation. An Automated Case Management System has been developed. Five included institutions are the National Police, National Public Prosecution Authority, the Judiciary, Rwanda Correctional Services, and the Civil Litigation Service. The National Police are responsible for registering complaints, investigating crimes, and

gathering evidence. The National Public Prosecution Authority takes information gathered by the police and prosecutes cases within the Judiciary, which is responsible for hearings, settlements, and judgments. Once a judgment is rendered, convictions are handed over to Correctional Services for supervising sentence execution. These activities form one coherent and logical workflow process in which many actors representing many agencies must participate. Delays in case disposal, and perceived subjectivity and uncertainty around delays, were a root cause of critical problems such as prison overcrowding, high rates of recidivism, increased corruption, and loss of confidence in the justice system. Delays in case disposal were caused by increasing backlogs, poor case management, and poor communication between justice sector agencies. Collectively, these problems were hindering national development.

Inability to monitor court caseloads prevented quantifying case backlog or prioritizing cases. The Justice Sector was completely paper-based. A rudimentary e-filing system could not verify users or user accounts, and was limited in scope. Correctional Services had a basic prison management system, but it had to be installed separately at each prison. The Integrated Electronic Case Management System (IECMS) was government-driven and was fully implemented through Government of Rwanda institutions, with backing and support of development partner funding. The System Design Document, contained 500 pages of prototypes, workflows, and user roles and permissions, delivered in May 2015. A Training-of-Trainers approach enabled rapid expansion. The IECMS serves as the single point of entry for all Justice Sector institutions. The system records all information from the time a plaintiff files a civil case, or from the time of arrest through sentence execution, sharing that information among all relevant sector institutions. The case workflow automates the processing of cases from one agency to the next, so that there is a seamless integration of activities and communication. The system automatically sends in-system, email, and SMS notifications to users, and users can create, assign, and track tasks. Information is captured and passed on digitally, and data exchange is no longer fragmented. A detailed audit trail provides a record of all edits and status updates. Authorized users can see relevant case histories.

The IECMS also monitors and evaluates performance of sector institutions in the provision of justice. It has over 8,000 registered users, averaging 1,400 users per day. Effective case workflow monitoring guarantees compliance to the rules of procedure, which in turn guarantee and protect the rights of litigants, as any misuse of the required procedures is immediately evident. The IECMS speeds up proceedings, eliminates duplication of effort across agencies, and reduces the time required to transmit documents between institutions. It increases transparency, equality before

the law, and accountability. It enforces compliance with procedures across institutions, so that one cannot jump the queue, and permits easy access to precedent for judges to ensure quick, fair, and consistent decisions. Although the system was developed from the beginning, it was deployed from the end. This means that the Court application was rolled out first, which created a demand for data from the prosecution. When the prosecution began using the system, it placed a demand on the police to provide data. This strategy creates a demand for information which motivates the previous organization in the chain of information to provide good data. This pulling of data is more effective than attempting to push data from one entity to another that is not prepared for it. Lessons Learned include:

1. Addressing Capacity Constraints: Training public servants was key here.
2. Mailing list of every court enabling sharing of problems and solutions, easing load on system managers and enabling feedback monitoring.
3. Confronting Institutional Resistance to Change: regularly scheduled meetings of court leaders.
4. Promoting Public Awareness through radiom national TV and local newspapers to educate litigants.
5. Providing Access to eJustice: Youth facilitators were trained to enable the population to enable the system through the Internet, where only 20% of the population had Internet access. The facilitators were trained along with workers in cyber cafs, ICT telecenters, and smart villages, mobilizing the private sector to provide e-service kiosks throughout the country so that litigants could get the help they need. The more facilitators that were trained, the lower the cost became for citizens. Poor litigants who cannot afford these services are able to access support directly from MoJ employees, enabling them to file or follow-up on cases free of charge. In addition, since many Rwandans are not fluent in English, user manuals and tutorial videos on YouTube were distributed in both English and Kinyarwanda.
6. Adapting to Scale was done by sequencing rollout in different parts of the nation.
7. Minimizing change requests
8. Adapting Procedural Law: Procedural law must now be aligned with IECMS, eliminating outdated procedures.

2.3.2 Internet, Social Media and the Return of The Lynch Mob

Belkin [**?**] discusses how the Chinese Communist Party has been struggling with managing public opinion and the administration of criminal justice, in the Age of the Internet. They discuss eight high-profile cases, and also point to how the Chinese Communist Party's own policies have influenced public opinion in determining justice. The focus is on a practice where public outcry as perceived by reaction on the Internet has been used by judges and courts to determine or rationalize death sentences that are then carried out immediately. The larger relevance here is the danger that outsiders moving into rural areas, might face difficulties in receiving equal treatment before the law. The problem is aggravated rather than alleviated by the availability of the Internet and social media, as the magnitude of so-called 'public opinion' can be easily manipulated by those who have the resources to do so, with no relation to actual sentiment of the public. The effect on the Justice system can be devastating, being little different, or even worse than, rule by lynch mobs.

2.3.3 Social Inequalities

Schorr [**?**] discusses five causal mechanisms underlying the nexus of social inequalities affect sustainable development. She explores the inter-relationships between the Sustainable Development Goals and social inequalities. The causal mechanisms are:

1. Social inequalities enable powerful groups and individuals to impose their interests upon others and to behave in unsustainable ways.
2. Social inequalities weaken public institutions, damage democracy and reduce subnational state capacity.
3. Social inequalities exclude the poor and discriminated groups from human development including the political process and induce unsustainable behavior on part of resource weak groups;
4. Ultimately, social inequalities prevent social cooperation and promote conflict, street crime and violence.
5. In addition, global interdependent inequalities pose particular challenges to sustainable development since redressing them requires a significant political coordination among different actors on different levels with sometimes opposing interests and certainly varying degrees of power.

The five mechanisms intersect and often reinforce each other. For example, the influence of 'elites' can weaken democratic institutions and in the long- run, challenges the legitimacy of the political system. Excluded from participation in public and political processes, the poor may be induced to unsustainable behavior regarding natural resources, in turn subjecting them to unmediated exercises of government power. Lack of education and information may hinder social mobility and society's capacity to mobilize for social change, and in turn impact ecological sustainability. Institutional weakness causes distrust due to disorder and crime which reduces tax compliance, and in turn reduces national resources to invest in sustainability. Social inequalities form traps which the author defines as situations where the entire distribution is stable because the various dimensions of inequality (in wealth, power and social status) interact to protect the rich from downward mobility, and to prevent the poor from being upwardly mobile". Or, situations where the poor will stay poor because the rich are rich (IBID). Empirical research demonstrates that inequality provokes further inequality.

To achieve sustainable development a systemic perspective is mandatory. This implies government willingness to restrict extraordinary privileges by fostering democratic institutions, promoting institutional transparency and sanctioning rigorously all kinds of corruption as well as discrimination. Tax revenue must be seen to be invested in sustainable initiatives, so that the wealthy are motivated to participate. State and local governments must be empowered and required to dispose of sufficient resources to deliver public services. The five causal mechanisms.

Manhusha Nair (2016), reviewed by Arnab Roy Chowdhury, studied informal workers in economic organisations in the formal sector. It compares two mobilisations of labourers in the state of Chhattisgarh. The first was triggered in 1977 by apparent inequity in bonus payment between permanent workers hired by the Bhilai Stell Plant, a public sector undertaking, and informal workers hired through contractors, but working at the same plant. The major trade unions affiliated with national political parties, whose members were the permanent workers, showed little interest in the informal workers' interests, and so a movement started, that demanded inclusive and holistic rights, considering various other social groups, and demanded alternative forms of development. This movement per the author ultimately led to the formation of the State of Chattisgarh out of a much larger state, in 2000. On the other hand, a strike by workers following an agreement between a major trade union and the government to retrench some workers at the Associated Cement Company in 1990, did not succeed. The leader of the movement was assasinated. The author postulates that the former succeeded because it was seen as a demand for fundamental rights in

a post-colonial environment where socialists sentiment was on the rise, whereas the latter encountered a post-liberatlization environment where public sentiment favored 'market fundamentalism' (in the author's words).

2.3.4 The Governance Trap: The Mexico Example

Canez-Cota [**?**] discuss breaking out of the 'Governance Trap' in rural Mexico. A governance trap is defined as an inefficient yet stable pattern of behaviour that endures mainly through cultural inertia. They explain a Governance Trap that afflicts the water agencies of the municipalities in the Sonora State in Mexico. Many customers who are relatively well-off simply do not pay for the use of the water that they receive through the pipeline network. Officials are afraid to incur their wrath and hence keep on providing water without payment as long as their budget permits. State agencies attempt to extract payment using threats and demands. Thus bringing the governance of the water supply down to the local level, is not effective: it lacks the coercive effect needed to win payments from recalcitant customers. An alterative system is based on Federal or State-organized, large networks with more formal mechanisms for payment, or for cutting off water in case of non-payment.

The author sought to understand what governance mechanisms contribute to effectiveness of the human right to drinking water and sanitation. The study focused on the Tijuana - San Diego cross-border region, comparing two governance traditions in the same geographical context. Tijuana is in Mexico. San Diego is north of the border, in the United States of America. Tijuana is a bustling metropolis that is considered to be one of the most thriving in Mexico: it offers many assets to entities on both sides of the border. These included relatively inexpensive and well-qualified labor force, affordable housing and good medical care. There are several multinational/ binational corporations located there, as well as a strong tourism industry. Changes in river flow, and pollution in river basins, are severe problems that have been mostly addressed in a cooperative manner between the two nations.

Article 1.1 of the General Observation Number 15 of the UN Committee of Economic, Social and Cultural Rights set out in the year 2002, that the human right to water is indispensable for a decent human life. Resolution 64/292 set out in 2010 that "that clean drinking water and sanitation are essential for the fulfillment of all other Human Rights". In Mexico, the right to water is also defined as a guarantee that each of us will have access to sufficient water that is healthy, acceptable, physically accessible and affordable for personal and domestic use. Mexico's constitution recognizes the human right to drinking water and sanitation, however, guaranteeing that right is

a major challenge given shortages of water. The entire region is dry (though on the Pacific coast) and has demographic expansion. This poses a major challenge in ensuring fair distribution among users on both sides of the US-Mexico border. San Diego is considered to be one of the best places to live in the USA, given very moderate weather, excellent infrastructure, very strong educational, medical and corporate facilities, and one of the strongest Convention businesses in the world.

The authors concluded that governance mechanisms did indeed make a large difference. While 90% of Mexico's population has access to drinking water and sanitation, availability is inadequate in both quantity and quality. These lead to sanitary problems due to poor qater quality, excessive workloads on women as the parties 'responsible' for water supply at homes, being forced to buy water from tanker trucks, and untreated sewage downloads in the open. Paradoxically, in the congested urban areas where water is theoretically plentiful, the problems are much more severe, than in the arid and sparsely populated northern areas.

The governance plan has evolved from a centralized approach pushing for more supply sources, to a decentralized approach since 2000, focused on reducing water demand, to the present focus on hydraulic sustainability, focused on including economic, social and environmental impact. However, discourse at the central level does not necessarily feed into adoption at the ground level.

The author calls the prevailing model in Mexico a 'metallic effect', referring to the dominance of infrastructure development as the priority driving any improvement in water availability. In turn, departments are more or less static, and recuit people to help build infrastructure, not think ahead about effects. Governance is through networks. He says that this constrains more enlightened motivations for governing departments to ake action. On the other hand he says that on the US side there is a 'talent effect' where talent is valued as an asset in competing for resources and credibility. The competition between agencies serves to highlight long-term effects and costs between different approaches. On the other hand, the competition leads to lack of cooperation.

The lessons in governance are to professionalize, decentralize and counterbalance. Lessons of management are to diversify, recycle and sustain. It is the governance framework that sets the conditions to improve management and public policies. Under 'professionalize' the author recommends bringing career professionals to the water sector, from the local to the federal levels. Under 'diversify' he recommends diversification of water supply sources. Decentralization includes decision-making in local spheres, including all stakeholders. Recycling includes treated waters as a strategy for a new water culture. Redundant decision-making systems generate

debates. This raises awareness of the need for economic, social and environmental benefits.

2.3.5 Loss of Confidence in Governance: the Eastern Mediterranean Example

Pedersen [**?**] discusses the dilemna faced by youth in the Eastern Mediterranean, between informality and precariousness. This has some implications and lessons for rural India. The authors say that 34% of young Tunisians surveyed, were trying to move abroad for work in the next 5 years. Percentages in other nations such as Morocco, Palestime, Lebanon, Egypt and Turkey were lower but substantial, and were higher for men than for women. This numbers should also be viewed in context: A large percentage of Syrians, Iraquis and Libyans have been forced to move, whether they wanted to or not, just to stay alive. Reasons for wanting to move abroad were high unemployment (20% in Lebanon to 51 percent in Palestine and Tunisia). In addition, many homemakers and students would have entered the workforce if they could find part-time or full-time work with a decent salary. There is a new 'precariousness' even in the traditionally high-income societies of Europe where job and income security was high, accompanied with welfare state entitlements. In lower-income countries by contrast, labour markets are characterized by informal work with no legal protections or welfare benefits. Eastern Mediterranean nationsm which were middle income nations, shared both characteristics, but now new forms of precariousness have added to the informal sector - a 'double bind' . The authors conclude that as a result of this predicament, youth have little trust in their governments, political parties, parliaments, civil service or humanitarian organizations. Given this situation, the desire for migration is a logical response.

2.4 Literature

Urichhio [?] describes a fuzzy knowledge-based decision support system to evaulate groundwater pollution risk. Groundwater is a primary source of drinking water in most Mediterranean countries. Thus preserving the availaility and quality of groundwater is essential. Excessive groundwater withdrawal causes sea-water intrusion and salinity, as one of several risks to acquifers. Other hazards come from the use of pesticides on farms. Because environmental planners are often constrained by incomplete information, the decision support system incorporates uncertainty through algorithmic features and by calling on the assistance of expert judgement. The knowledge based decision support system applies experts heuristics to evaluate groundwater pollution risk due to the use of pesticides in agriculture. It accounts for uncertainty due to incomplete information. A ranking system evaluates the risk that a pollutant may leach along soil to reach the groundwater. The paper concludes that when investigating the risk of groundwater pollution due to the use of pesticides, the developed system could indicate areas where efforts should be concentrated to direct farmers towards more eco-compatible agricultural practices.

Prathana Majumdar and Sharmishtha Banerjee [?] describe challenges to sustainable growth of the microscale Kuhila craft industry of India. They point out that micro and small scale enterprises in handicrafts have fallen behind the national growth rate, post-liberalization. Competition from global multinational corporations (MNCs), withdrawal of government subsidies, and socio-cultural factors all detracted from the business. Gradual westernization of culture, rural education, urban migration, changing nature of gender and generational relations in rural North East India all contributed to this decine. Environmental changes also potentially threaten the Kuhila craft industry. The authors cite Craft production as a 'weapon of the weak' for people who are at the fringes of the economy. Kuhila craft has been used for centuries in making colorful masks, prayer mats, idols, decorative artifacts and toys. The material is lightweight and flammable, derived from the stems of two plants that grow in swampy areas. Cultivation is similar to that of rice, with manual harvesting, annually after the rainy season. While the cultivation and harvesting are typically done by migrant families, while the craft-making is done year-round by 4 or 5 artisan families.

The strongest factor in economic backwardness of the artisans is lack of education, and managerial skills. This lack hindered their use of new marketing, advertisement and global market reach channels. On the other hand, pride in their skill keeps the artisans from turning their unique craft into a mass-market commodity. Competition

from synthetic products is a major external factor. Prayer mats are replaced by PVC mats, Kuhila animal figures are replaced by plastic products, while Kuhila paper is replaced with A grade paper made from bamboo. Others are lack of access to capital, lack of access to markets with no online presence, and long supply chains (122km from the nearest city). Others are the ecology, with the dwindling of wetlands, social fragility and changes in cultural trends. The authors conclude that comprehensive planning is required to sustain such unique craft industries along with the ecological systems that are vital to their existence. Future work includes designing new products with higher commercial potential, and greater commercial use of such eco-materials and the new products.

Olowookere [**?**] discusses the relevance of pro-social behavior to rural entrepreneurship development in the context of Nigeria. Despite tremendous natural resources and potential, Nigeria continues to be a poor nation, with over 55% unemployment: only 1 in 10 graduates get a job. A major thrust to solve this problem is to encourage self-employment, creativity and resourcefulness. Entrepreneurship is seen as a major vehicle to sustain a healthy economy and environment. Positive behaviours and attitude that are essential for the development of rural entrepreneurship are called entrepreneurial prosocial behaviours (EPB). These include:

1. conscientiousness
2. courtesy
3. integrity
4. individual initiative
5. selfdevelopment
6. altruism
7. sportsmanship.

The relevance of these behaviors to entrepreneurship is

1. increased customer/client base
2. increased productivity
3. increased profit
4. increased customer satisfaction
5. increased expertise
6. higher self-esteem

The authors recommend infusing and reinforcing such behaviors and attributes

through active education and intervention.

Geraci [**?**] discusses religious rituals in a scientific space, focusing on festival participation and the integration of outsiders. Reyes [**?**] present a theoretical review on social inclusion and social leverage foundations. Four fundamental approaches are considered:

1. the theory of growing capacities and increasing opportunities as essential aspects of the theory of human development advanced by Nobel Laureate Amartya Sen.
2. the perspective and factors of the current process of globalization;
3. Douglass North's neoinstitutionalist approach to social and political conditions;
4. foundations of the legitimacy theory from Jrgen Habermas.

The study was part of an effort to assess the investment made by Latin American and Carribbean nations in their health care management systems. The conclusions are:

1. Increasing human capacities, and expanding opportunities for the people, are two central concepts in the theory of development mainly formulated by Amartya Sen.
2. Jurgen Habermas showed the relationship of these conceptual features in reference to social and political terms, with the theory of legitimacy.
3. Any society has groups that are fully integrated into the mechanisms of social living conditions, and are hence self-sufficient to maintain satisfactory standards of living.
4. There are also social groups that are marginally integrated into society and hence get excluded.
5. These excluded groups need support to transform into effective contributors to society.
6. Such support is the core of social leverage, derived from This support is the core element of social leverage as a vital mean of social inclusion, derived from inclusive institutional framework.
7. This characteristic rises in significant in the theory of legitimacy, but also- in a more operational sense- that support is related to the theory of neo-institutionalism.

Ward *et al* [**?**] discusses natural patterns and processes in river corridors to help restoration of rivers.

Stead *et al* [**?**] discussed how people make unethical decisions, and the social learning context leading up to such decisions. They investigated the relationship between unethical decision behavior, decision history (a social-learning variable) and various personality and demographic variables. They concluded that unethical decision behavior is significantly influenced by decision history. Personality and demographic variables were overshadowed by situational, social-learning variables. Decision history reflects the influence of past ethical choices on current decisions. This is a situational variable which is controlled by the subject. Decision history is an important social learning variable in explaining unethical decision behavior. They proposed that two social-learning variables, managerial philosophy and contigencies of reinforcement, significantly influence unethical decision behavior. Their study consisted of giving hypothetical business case histories to 338 undergraduate students and seeing the reasoning of their behavior.

Lauwerier [**?**] discusses a broader and consensual vision for education by the OECD, UNESCO and the World Bank in the context of Sustainable Development Goals.

Chapter 3

Agriculture

3.1 Introduction

Rural India feeds all of India, and exports food produce. Agriculture is at present the source of employment for nearly all rural residents: viable non-agricultural enterprise is a very small percentage. Obviously, any revolution in India must ensure that agriculture is helped, not hindered.

Back in the 1950s through 70s, the emphasis was on improving output of the available farm area. Irrigation, usage of fertilizer, improved species of grain, and multiple crops per year, enabled the Green Revolution that resulted in India transforming from a counry where famine stalked, into a net exporter of food.

Food production has stayed ahead of population growth. The population in India is expected to level off in the coming decades. The emphasis must slowly shift from increasing agricultural production, to conserving the environment, and increasing the quality of products, while improving stability and return on investment to the farmer.

Based on some of the literature cited below, it appears that the dependence on the timeliness, intensity and distribution of the Monsoons must be reduced, to increase stability and security for the farmer. On the other hand, with over 80 percent of India's freshwater usage being in agriculture, and a long coastline, there is huge scope for reducing water usage, recycling water, and enabling use of somewhat brackish water. Meanwhile there is a global urgency to pursue reforestation, as by far the best way to reverse atmospheric Carbon Dioxide, and control soil erosion.

The availability of energy and water with technology enables innovative solutions. One strategy is to actually reduce the cleared land being planted, and turn the difference back into forests and/or fruit orchards with large trees instead of fields. This will improve the environment. So far, foodgrains cannot be grown in vertical farming configurations, but vegetables can. Many vegetables can be grown efficiently in multi-level controlled environments, making them less susceptible to the vagaries of weather. Vertical farming enables villagers to grow valuable crops with very small footprint.

3.2 Dependence on Monsoons

Dhasma [**?**] reports in early september 2016 an example of how prices fluctuate based on the arrival time and intensity of the monsoon. In 2016, the area under Kharif pulses rose 33 percent to 14.2 million hectares as for a second year in succession the Monsoon was 'good'. The good monsoon would also raise productivity of the area under cultivation, the combination causes prices to slide. Sen [**?**] argues that with 80% of water consumption in India being for agriculture it is essential for such use to be regulated and made more efficient. He argues that farmers are a hallowed vote-bank, constraining legislation and regulations. He says that historically about one-third of irrigation projects in the past have started with much fanfare but not been completed. He argues for the adoptin of solutions from desert nations such as those in West Asia. Israel used recycled, slightly brackish water for irrigation. Today 80% of Israel's wastewater is recycled for irrigation. Israel changed from open water channels to piped drip irrigation. this is projected to save nearly 75% of water compared to open-channel irrigation.

3.3 Food Imports

Patil [**?**] reports that with pastures for cattle shrinking, fodder supply for India's 299 million cattle would run short, forcing the nation to import milk by 2021 as demand for milk rises by 36% to 210 million metric tons from 2016. One solution is given by Sharma [**?**], where the Central Government is collecting cereal cultivation waste from farms around the national capital region, and turning that into cattle fodder. This greatly helps cut down air pollution caused by burning the crop residue, the usual practice.

India's food import bill in 2015 was over $22B, including edible oils, nuts, fruits, dairy products and beverages [**?**]. Goswami argues that cheap imported oils such as safflower, palm oil, and genetically modified soybean oil, are crowding out domestic coconut oil, while hiding the extreme ecological cost of those cheap oils. There is also concern, per a commentor under his article, that many edible oils are sold with paraffin adulteration.

Chapter 4

Artificial Intelligence: Opportunities and Risks

NITI Aaayog, India's new public organization for strategic planning, released a document on Artificial Intelligence in June 2018. Per practitioners in the field, the term"AI" is too broad. AI does not fit the model of programming languages. AI includes Machine Learning (ML), Natural Language Understanding (NLU), Network Analysis (NL), Mining (Text), etc. ML pertains to systems which learn (supervised or otherwise) over a period of time and get better than humans. AI, on the other hand, is mimicking human intelligence and has a broader or esoteric goal. Both ML and AI attempt to mimic humans. ML (as the name implies) attempts to learn from examples, while other branches of AI need more intervention. The US entrepreneur Elon Musk has recently stated that his ML (using Neural Networks) actually comes up with new algorithms that humans cannot even think of.

There are many areas of interest. Of computer languages used in this field, Python is the most commonly used, R is not too far behind. Based on these two, one must specialize within those languages, in libraries that pertain to a specific field within "AI". Machine Learning uses Statistics a good deal. AI does have a fair amount of coding (Python, etc), but a lot of it is Math. Neural Networks is actually Linear Algebra. Fuzzy Logic is based on Set Theory.

The vast majority of all actually monetizable work is likely to be outsourced or distributed at fairly low level to people who can do some kind of data analysis/ testing. Reading about the problems encountered by the Boeing Corporation will give a different view of how the "Real World" at the Top does "testing". Another AI problem is predicting what sorts of disasters to test for, with nonlinear combinations

of many System of Systems factors acting on each other.

4.1 Legal System

AI can be the breakthrough technology that breaks through the convoluted mess of India's Legal System. Think of a case filed: The parties would have to use the AI app (on a serious computer) to describe their problem/case precisely, but also with the more subjective disputes described. AI digs out the relevant Precedents, laws etc in a flash. This will take time, as the Precedents are gradually entered into the System, but at the start at least a title search followed by text search is possible soon).

The bottom line is that the work of Law Clerks taking months is done by AI in seconds. Then the clerks can step in and clean up what AI cannot. Then the Judge is presented with the AI/clerk based summaries and references to data. The Judgement is most of the time written by AI, for the Judge to review and approve, with a probability-based Certainty Rating (CR) assigned for the Judge to decide how much time to spend. Where the CR is say, below 85%, the Judge has to spend more time reviewing, but the data collection is done very swiftly.

HP bought a (Britsh) company by the name of Autonomy that has an excellent record in this field. Autonomy was founded around 1995. The algorithm BTH, is based on Bayesian theorem. It is an excellent tool and very widely used in the legal community. It understands natural language usage, in multiple languages. AI solutions can and do indeed today deal with multiple Indian languages. This feature must not be lost. An example is if one were to scroll way down on bbc.com, one can see the number of regional languages with which BBC (British Broadcasting Corporation) deals with. All of that is Autonomy.

4.2 Medical delivery/ Telemedicine

For every 1,000 people, the number of physicians in India stands at 0.7 (less than 1), compared to the global average of 1.5 physicians per 1,000 people. There are only 0.7 beds per 1,000 people, compared to the World Health Organisations (WHO) recommendation of 3.5. The findings from the Deloitte and CII report titled Medical Technology, Shaping Healthcare For All In India highlights the grim reality of healthcare in the country. Indias healthcare space is expected to grow at 23 percent CAGR to a $280 billion market by 2020. And with the Digital India initiative, the

government has been bolstering all efforts towards bridging the gap in healthtech, an area where Indian startups already have a momentum. With cancer patients, early diagnosis or prognosis of the cancer type could prove to be critical. However, with only 500 pathologists specialising in cancer diagnosis according to a NITI Aayog report India faces a backlog, between the number of pathologists available and the number of samples collected.

Here AI has a number of roles to play, from communications to diagnosis. AI started in the medical field. But that AI was very different than what we have today. Unfortunately "diagnosis" is just too wide a term. TODAY AI (seems to) work very well in IDing cancer cells. But it fails when it is consulted for a common cold or fever. A lot of work needs to be done in this area. AI is being used, extensively, in Pharma - to come up with new concoctions.

One growing idea worldwide is the linkage of AI with medical diagnostics - using immense databases that far exceed any one human expert's experience base. For instance, a Pathologist could be empowered immensely by having an AI system work alongside them, usually confirming, but occasionally questioning, the human expert's own observations. Obviously this idea should find a place in Working Group 5, but here it could be applied to other fields as well. Artificial intelligence technology offers a way to break through the communication barriers between many languages of India, by enabling not just translation but understanding of deep meaning, history and context.

The area of "expert systems" is an old technology and is thoroughly neglected given the focus on Machine Learning. However it has a place in India, where there so much institutional knowledge. Generations have grown up never taking antibiotics, because what their parents learned from their parents taught them how to treat various common problems faced by small kids. Unless these are written down (not as an expert system) it will be lost. The present generation usually runs to get antibiotics.

There are innumerable other specific applications of course. A recent news article by Sutrishna Ghosh on 8th Apr 2019 summarizes Indian 5 startup companies that are monitoring Indias health with AI, machine learning, and smart apps. They work on cancer diagnosis, monitoring diabetes, and digitizing medical records for access. From medical tourism to telemedicine, Indias healthcare sector has been expanding at a healthy double-digit rate to include newer and better services powered by new-age technologies. The problem, however, is not availability, but access to these services. The company 'Onward Health' uses predictive analytics and machine learning. They are building a portfolio of diagnostic tools in the form of classifiers

and analytical tools. These tools help pathologists diagnose more cases every day by providing deeper, more accurate insights from available samples. In addition, Onward Health is leveraging computer vision techniques and ML algorithms to offer tools in computational pathology and mammography.

BeatO

The World Health Organization (WHO) predicts that 100 million Indians will be living with diabetes by 2030. Yash Sehgal and Gautam Chopra started BeatO in 2015. By 2019 their platform had expanded to serve around 50,000 patients across 1,500 cities. Their App comes with a glucometer which can be plugged in to a smartphone to take readings that are saved in the app and used for further guidance and emergency intervention. Fitness levels are tracked and diet is managed.

The Medical wearable startup ten3T makes medical grade wearable devices, and its breakthrough was Cicer, a palm-sized patch sticker with multiple embedded sensors. The IoT technology helps in the early detection and prevention of medical episodes in hospitals, during transport, and even at home.

Mumbai-based, Ayurveda-inspired AADAR monitors various health conditions to proactively heads off diseases. AADAR offers herb-based antidotes for lifestyle ailments like protein deficiencies, blood sugar, indigestion, cholesterol, and obesity. They plan to expand into the space of menstrual wellness, skincare products, and health supplements. The startup company DRiefcase focuses on medical records and record-keeping.

Medical diagnosis using x-rays, CT, MRI images via trained Neural Nets (CNN) are being attempted as well. Mostly in research labs. A phone picture based glaucoma or other retina anomaly detection etc have been attempted. Not commercial AFAIK. Given the sensitivity and compliance issues (such as HIPPA) real applications are hard to develop without training data at scale. Hospital Networks, Medical mfg, Pharma with big money are indeed working on these. Again, we should see scalable applications in 2-3 years.

4.3 Natural Language Processing

Text summarization (Legal or otherwise) is very much within the grasp of the current NLP. Text understanding(and Translation) is well understood but summary generation with content is still WIP for serious applications. However, there are serious, production-ready applications that are being worked upon by ML folks in

the industry. The scale of the application you are talking about is huge number of documents and text to be processed would be huge. Also, first they would have to be digitized (e.g. FIRs are still handwritten) and then read as text. As of today, no ML framework (TF, Azure, PyTorch) can scale to that level. However, they will be in 2-3 years. Scientists are working to create speech from brain signals. A prosthetic voice decodes what the brain intends to say.

4.4 Voting

AI technologies could be used to make voting much more efficient, and convenient. In particular, let us consider the option of electronic voting for all voters. In India a remarkably high percentage of voters cast their vote in the present sytem. Voting is above 75% over large areas, generally well above 60% in most areas in the 2019 election. The strict implementation of the "last kilometer" dream now mandates that no voter should have to travel more than 1.3 kilometers *of their registered voting location*to cast their vote: this also means that lines are short. Electronic voting machines (EVM) with a paper trail, mean that the official results can be announced within a day of starting the counting.

However, there are substantial hurdles remaining. People who must be out of their registered location must return home to vote: this disenfranchises many. Errors in the electoral rolls are discovered only when voters arrive to vote: in many cases they cannot be resolved on the spot, with the voter being disenfranchises. The emphasis there has to be on preventing impostors from voting. Most particularly, the vast diaspora of Non-Resident Indians (NRI's), among them some of India's most dedicated, well-informed and productive citizens, are disenfranchised, unless they happen to return home for the election (not feasible for most people given that they save every vacation hour, and their money, for that annual or biennial or even-less frequent trip home at special times. To make matters worse, if they do arrive, they find far too frequently that their names have been 'struck off the rolls' - or worse, than someone has already voted as them.

AI technology can address the security and privacy issues in enabling voters to vote from anywhere in the world (or from Space!), at times convenient to them, during the announced election season. Note that the 2019 election spanned a whole month, but Polling Days were very specific to each location. It is conceivable that people can be allowed to vote anytime during this month (or hopefully, shorter period in future) via electronic voting. On the other hand, the use of AI technology runs the extreme

risk that fraud can become extremely difficult to detect in time. This requires careful consideration, research, development and testing, with continuous updating.

In voting there are 5 issues:

1. Ensure that one votes IFF (If and only If) one is a registered voter. In the right constituency.
2. Ensure that no one can see who one votes for.
3. Ensure that the vote that one intended to cast is indeed the vote that was cast.
4. Ensure that the vote that one ended up casting is indeed the vote that ends up being counted.
5. Ensure that the actual vote count is what is announced.

The first item is easy. Aadhar only identifies one as a voter. Only 1 vote is allowed per Aadhar. Aadhar is supposed to be updated to remove dead people, foreigners etc. When an Aadhar vote is registered the owner is informed that s(he) has voted, just like credit card transactions today.

For the second item, there has to be some randomizer that then guards the entrance to the "polling booth" where one's vote is cast and no one can tell who is voting. This is not any worse than the security issues of BlockChain technology. So it possible to ensure that there is no trace from voting preference to voter. One is not seen going to the polling booth, and in whose car or bus. There is no "black mark" on one's finger that might identify one to the terrorists (a nagging problem in Jammu-Kashmir) as someone who did not boycott the election. Rain or shine, as long as there is electricity and Net connection one can vote.

The third item is the Miami Dade County 2000 election problem: the huge polling sheet was confusing enough that many people of limited attention span voted wrong.

The fourth item is Electronic Voting Machine (EVM) fraud. The fifth item is an Enforcement Directorate problem. India has surmounted that.

The randomizer can be infiltrated that is another BlockChain type problem. Verifying voter identify (item 3) is the credit card payment problem. If that is secure, why not voting? It is actually much better in the peace and security of one's own computer than on a strange screen in a polling booth. Verifying no. 4 may require innovation. How does one do that with no one seeing WHO cast the vote? What would be the "paper trail" that satisfies the voter, the different candidates and the ED that all is well?

4.5 Military / Security

The Indian Navy recently held a Conclave on AI opportunities. This paper talks about AI and ethics in naval operations. The Swarajyamag magazine recently published an article titled From War Games To War: It Is A Small Leap For AI, But A Giant Step For Mankind

Thus the Indian military for instance, has a window of opportunity to turn India's large numbers of IT-trained workers to gain an edge in the deployment of AI technology in military systems. Perhaps not as early mover/adaptor, but by becoming the biggest, and using that advantage in simulation, deployment and cost savings. Some applications (courtesy of postor Arjun Pandit at the Bharat Rakshak Forum). "The possibilities are endless, but require focussed outcome-oriented support from different organizations and academia.":

1. ISR missions, where the captured SAR Map can be segmented into different regions of interest like hangars, oil dumps, existing deployment of enemy
2. Disaster relief = All soldiers doing to avalanche-prone area to have transponder transmit their last location. Based on that, simulation models can be developed to find the estimated location of soldiers in case of avalanche has struck.
3. Use of AI to improve the automatic identification of mines etc.
4. Upcoming swarm technologies will involve agent-based modelling and AI to learn from past operations and improve deployment in future missions
5. Robotics in UGV, UAV, unmanned naval systems in patrolling etc.
6. AI can be used as an evaluation tool for different strategies during war gaming.
7. Cybersphere is a domain in itself. Where you will use methods to disable enemy infrastructure. Finding vulnerabilities in their infra and self-protection system involve use of AI. eg = NTRO related work might involve use of AI to cluster social media, finding terror related persons
8. Deep Learning is a subset of AI = where you simulate using a very large database of inputs. Primarily used in face recognition and other tasks. eg - face recognition and gait analysis from videos of stone pelters and indexing their profiles in the database.

On the other hand, AI is not doing so well yet in military systems. The reason is that humans do not trust AI yet. There are two newly minted areas of interest. The first is "Assured Autonomy", an area pursued by the US Defense Advanced Research

Projects Agency (DARPA), where the goal is to incrementally introduce "Automation" via AI (not robotics). What is the difference? While robotics is repetitive (humans see that repetition so often that they trust it), "Autonomy" is actually "decision making", which is why humans do not trust it. This leads to studies in the area of Human-Machine Interface (HMI). These two are closely related and in this step, the human has the option to press a button and take over the task from the machine's AI interface. The US has a great deal of data in this area, especially with respect to aircraft operation.

4.6 Disaster Alleviation

An article titled "How Google Is Using Machine Learning To Predict Floods In India" discusses that initiative. Sella Nevo, the software engineer heading the initiative, is cited as saying that about 20% of fatalities worldwide from flooding occur in India. Google chose Patna as an ideal location due to the incessant rainfall the city receives, and the number of embankments and other man-made structures. As the countrys most flood-prone state, "73% of Bihar's 94,163-sq.km land area gets flooded annually", per the International Water Management Institute (IWMI). The Government of India is providing Google with stream gauge measurements as well as forecasts based on their gauge-to-gauge forecasting system. With these and other inputs Google maps areas expected to be inundated. Google Machine Language expertise, computational power and other data resources could substantially improve flood forecasting systems. Satellite imagery is used to estimate the amount of water that has gone through a river, and Machine Language is used to integrate the data from the optical and infrared imagery, radar and microwave signal analysis. One concern expressed by some is that such data are being provided by the government to foreign-based entities. They wonder about the controls on such data, and the potential for their misuse by adversaries. There was some suspicion in 2018 that extreme flooding in Assom and other northeastern states might have been aggravated by anthropogenic means, and perhaps not all of it was unintentional.

The Indian government's Central Water Commission (CWC) estimates that rain and floods have killed 107,487 people and caused 365,860 Crore Indian Rupees of damage across India between 1953 and 2017. Most deaths resulted from the inability of drainage capacity, reservoir regulations and flood control structures to cope with intense rainfall. An example is the 2018 August flooding in Kerala with over 1000 deaths, destruction of 12,362 houses and a loss of INR 31,000 crores to the State.

4.7 Justice System

4.8 Education and Research

The People's Republic of China has invested significant resources in AI education, starting at the pre-schooler level. This site, written in Chinese is an example.

AI education initiative launched this July by the China Education Technology Association Smart Learning Committee and UNESCO. The aim is to democratize AI education in 100 Chinese schools, introduce pre-teens to the basics, strengthen teenagers capability for using intelligent and applied technologies, and help train hundreds of new AI teachers.

cloud-based AI e-learning platform that students can access via PC or WeChat. The platform supports major machine learning frameworks including TensorFlow, CNTK, and Caffe; programming environments Scratch 3.0 and Python Integrated Development Environment (IDE); and includes digital copies of the 33 AI textbooks and a broad scope of use cases. Platform development was reportedly led by Google AI experts in Beijing.

In April 40 high schools in Shanghai began using Fundamentals of Artificial Intelligence, a nine-chapter AI textbook compiled by SenseTime, the worlds most valuable AI startup. Two months later, Suzhou University published its Primary and Secondary School Artificial intelligence Series.

With the rise of automation, new skills are emerging as valuable in the age of AI and are often not the focus of K-12 education. These include problem finding, inquiry, flexibility, collaboration, creativity, systems thinking and technological literacy to name the basics, says Simsarian. AI changes what we teach the next generation starting in Kindergarten because the next generation will have jobs that do not exist yet.

Alibaba Open-Sources Mars to Complement NumPy Mars in distributed version is now available on Linux and Mac OS. Click this link for the Mars Github page.

According to The Hindu newspaper India ranks third in research on artificial intelligence, as gleaned from tracking papers in peer-reviewed journals. This is a long way behind China which leads, and the USA which is second. The application areas seen by present AI researchers in India included healthcare, financial services, monsoon forecasting, retail and education. They felt that the field was unlikely to lead to a destruction of jobs a key global concern regarding the field.

There is an initiative by a group of private universities to collect Artificial Intellgence resources.

One industry insider who works to help organizations in adapting data science/ML, gave his observations baed on many years of interaction with industry people in Bengaluru, Chennai, Hyderabad, Pune and Gurgaon:

1. Big IT companies (Infy/Wipro/HCL) seem to be finding it difficult to have a strategy to exploit ml/ai. The fast paced nature of most ML/Data Science projects is something that these companies aren't familiar/comfortable with.
2. Consultancies such as McKinsey/EY whose work force is less tech heavy (MBA types) are making it a point that people are able to write SQL queries+do some general python scripting. This seems to be true for teams which were purely into management consulting earlier were doing some sort of excel+vba reporting.
3. Some financial companies (foreign banks and market data providers) are focusing on automating some manual processes such as digitizing bank forms, getting relevant financial data from pdf (the ones which are scanned images) using image processing (yes this not purely AI but that's how AI is being used as a term)
4. Automation using RPA is catching up. One big foreign brewery company in bangalore, has made it a point to impart RPA+SQL training to people working in functional teams such as Accounts+Finance
5. Cool stuff is still being done by startups.
6. Good data culture is an issue with big companies, there are still a lot of tech silos.
7. I have met very few people who are making data-based products. Majority of the people I have interacted with are more focused on doing a consulting assignment.
8. I think running SQL queries+general scripting should be skills that every one should learn.

4.9 Steps to enhance the growth of AI in India

Postors commented on this aspect. In summary,

1. Emphasis on mathematics and science right from elementary education. Make it fun to learn mathematics.
2. Create two streams. Computer "Programming" and Computer "Science". Make people understand the distinction, and grow the "science" stream.
3. Discourage people who learn python and call themselves AI engineers. At the risk of sounding harsh - Put them in place.
4. Understand BI is not ML /AI. See many resumes that are able to write only SQL Queries and can mention few AI frameworks and call themselves AI engineers
5. RPA is not AI , and is largely an extension of Automated UI testing frameworks like Selenium
6. Know Machine learning is not writing SQLs.
7. IT organizations should not sell AI skills just to make money. If they want to really create a differentiator, they should stop masquerading SQL Writers as AI/ML Engineers. Tough call.
8. Educate our predominantly useless software workforce that does junk, low quality work. Ask them not to be ugly consumers. For a change, create value and original products.
9. Know your worth as Indian, and work with local problems. Scale is never an Issue in India. If you cant do real ML and AI here in India, where will you do ?

4.10 Concerns About Data Localization

One participant commented that about a year ago he tried to access data for health care (genetic data for autism research). In that case data were owned by NGOs financed by corporate firms like Google. It was huge disappointment. Even without that effort the data localization requirements from RBI are a good start. We will never have access to proprietary data in public domain. So let us get over that notion. He doubts that data will be publicly available that easily for this application. You neeed to get into the system for this. Google maps/earth data, resolution will have

resolution issues. But still there can be some information that can be scraped and figured out. Remember even in pvt set ups data is not readily available it has to be collated and processed and a lot of effort goes into. In his experience 80-90% effort is in getting the data in right shape and that's when you have the data to begin with. When he said that efforts can begin without data he meant that we will have to start coolligiree for the west (because they have the capital) and port some of the things to our set ups. One will have to be resourceful. regarding medical data. Google is trying many things. Google maps and other apps have got reams of data about us and so has the West because of their strangle hold over internet technologies and probably China because of hardware manufacturing and data hackings

4.11 Financial Systems

In financial systems, there has been some evolution/devolution of what is these days is called AI.

4.12 Rural Enterprise

A great many of the present workforce trained in India and abroad in Information Technologies, can be re-purposed into Artificial Intelligence system development with relative ease.

Startups in India throw in this fancy AI + ML in their pitch but when you look beneath the hood, There is very basic level AI stuff going on. We still are few years behind to do some cutting edge work in AI & ML. Most of the AI work revolves around chatbots and figuring out documentation. Big - 4 (TCS/INFY/WIPRO/HCL) of India are gearing up but to provide consultancy and offshore any AI+ML+NLP work that originates in developed world. Don't count upon them to come up with anything innovative.

Some observations are recorded below from another professional who has been working in the Machine Language / AI fields for several years consulting for, and training employees of organizations in adapting data science/ML. The observations are based on interactions with industry pesonnel in the Bangalore/Chennai/Hyderabad/Pune/Gurgaon circuit):

1. Big IT companies seem to be finding it difficult to have a strategy to exploit Machine Language / AI. These companies are not comfortable with the fast

pace of most ML/Data Science projects.

2. Consultancies (such as McKinsey/Erst and Young), whose workforce is less tech-heavy (they are MBA types) are making it a point that people are able to write SQL queries and do some general python scripting. This seems to be true for teams which were purely into management consulting earlier where they were doing some sort of MSExcel and Visual Basic reporting.
3. Some financial companies (foreign banks and market data providers) are focusing on automating some manual processes such as digitizing bank forms, getting relevant financial data from pdf (the ones which are scanned images) using image processing (this not purely AI but that is how AI is being used as a term.)
4. Automation using RPA is catching up. One big foreign brewery company in bangalore, has made it a point to impart RPA plus SQL training to people working in functional teams such as Accounts plus Finance.
5. Cool stuff is still being done by startups.
6. Good data culture is an issue with big companies, there are still a lot of tech silos.
7. I have met very few people who are making data-based products. Majority of the people with whom I have interacted are more focused on doing a consulting assignment.
8. I think that everyone should learn the skills needed to run SQL queries plus general scripting.

4.13 Overall Employment

Economic success of any nation will depend upon its capacity to create wealth and jobs for ensuring a decent life-style to the entire cross section of the population . While GDP is an indicator , it is not necessarily an indicator of the well-being of the people as a whole. A successful nation with respectable societal values considers that wealth creation will have to be associated with job creation. In a knowledge based economy where technology drives the main elements for competitiveness, the required skills undergo continuous transformation and an acceptable equilibrium between job requirement and skill-requirement is essential in order to provide adequate purchasing power for every citizen to have a reasonably comfortable life-style. It is well known

that automation will kill certain jobs while it creates certain other jobs of different skills. If such a change results in large scale unemployment/under employment , it gets translated into a serious societal problem. Several European countries are facing such a situation. We will examine these aspects in the Indian context and see how India can adopt a winning strategy for creation of both wealth and jobs in a competitive environment embracing the enormous potential of AI .

4.14 Impact of automation on industrial activities and service activities

Automation techniques were adopted in industrial activities in a big way since the 1970s with the introduction of Numerically controlled (NC) machines and later Computer Numerical Control machines (CNC). The author had the opportunity to witness all the stages of this transformation in a factory in Europe during the period 1970 to 2000. The primary objective of this transformation was to improve competitiveness through automated production lines and increased profitability through better exploitation of manufacturing facilities, so as to have lower direct labour cost. Such changes have resulted in considerable reduction of manpower in all the activities associated with manufacturing: machining, plate working, surface protection, assembly and material-handling. It is true that new jobs were created with other skills. Yet there was a net loss of jobs. No doubt, automation has helped countries with high person-hour cost, to optimize cost in order to be competitive in the global market. This is one of the principal reasons for a high level of unemployment/underemployment in several developed nations. The impact of unemployment in countries covered with a social security net is enormous. The whole system is under strain because the number of persons contributing to the Social security system has come down. In the 1980s, a question was raised by French politician Segolene Royal (Minister in the Mitterand administration) about the possibility of charging a tax on machines which kill jobs. Nothing concrete has been done so far. In the author's view, taxing robots which kill jobs will be inevitable in the near future in order to sustain the social security system.

The adoption of AI-aided CNC machines with auto-correction features will change the job-scenario completely. The political leadership all over the world will have to find solutions adapted to their countries in order to create an equilibrium between work and leisure at reasonable levels of wages, to ensure a decent life-style for all citizens. This is a big challenge.

4.15 AI and Indias challenges

Indias challenges in the job-market are quite different from those of the developed world. Hence it will be a mistake for India to follow the beaten track of the western world, or even China which has followed the West. Any discussion on the impact of AI on jobs in India based on what is happening in the organized sector could be misleading. Let us try to examine the job-scenario in India at present. As per the data published by World bank, Indias Labour Force Participation Rate (LFPR) is around 56 % in 2015. This corresponds to a working age population of around 830 million and a labour- force of around 460 million people. Considering the comparatively low median age in India, the LFPR should have been around 65 % (68 % in China, 62 % in USA and 60% in Germany). Out of the 460 million people in the labour force in India, only around 54 million people happen to be in the organized sector (32 million in industrial and service activities and 22 million in Govt service) leaving the vast majority of employees in India in the unorganized sector. By definition, the organized sector is one which is incorporated with appropriate authorities and which follows specific rules and regulations. Any future grand strategy of India for wealth-creation and associated job-creation will have to take into account the following points:

- Take full advantage of the technological evolution for creating wealth and jobs
- Bring the vast majority of the labour force in unorganized sector into organized sector with the required skill development / skill-migration
- Maintain the contribution of agriculture in GDP at the same percentage level as today when GDP gets multiplied by 10 .
- Make the rural India the centre of gravity of wealth-creation and job-creation

In this background , let us try to analyse a scenario on impact of AI on jobs:

AI will kill a considerable number of jobs of today in the organized sector (industrial and commercial activities) unless there is substantial expansion of activities in future. Adoption of AI could kill around two thirds of the present jobs in the organized sector (public and private enterprises) now, i.e. around 21 million jobs. The job-losses in Government service could be around 14 million. This transition will have to be manged very carefully. It India achieves a tenfold increase in GDP in 20 years, it may be possible to keep the number of employees the same as today (evidently with different skills). The Govternment services should be streamlined in such a way that around 8 million employees should be able to render the required services presently being rendered to the citizens. One has to acknowledge the fact that bulk of Govt services are being enjoyed by urban citizens. Rural India is very badly served by

Government services particularly in education, healthcare and administrative services. It will be reasonable to assume that all the six hundred thousand villages should be served by an average of 20 Govt servants each. This will work out to 12 million jobs created and paid by local bodies in the villages from taxes collected from wealth generated in the villages.

Political leadership and the bureaucratic leadership will have to accept the simple fact that the responsibility of the Govt is to create the ambience for wealth-creation and job-creation by entrepreneurs. This also would mean that the Govt will not create unwanted jobs simply for the purpose of providing employment. Our educational system should become completely job -oriented and should provide adequate skills for the type of jobs needed in the country. The purpose of university education should not be for manufacturing graduates with degrees/diplomas with no value in the job market. Sadly, that is the case now. In a recent request for applications for 2000 last grade jobs (sweepers) by the Government of Uttar Pradesh, there were around 300,000 applicants, mostly from graduates and some of them post graduates and even candidates with doctorates !!!. We have a problem and we have to recognize the existence of the problem if we are desirous of finding solutions.

In short, the impact of AI will cause a net reduction of jobs in the organized sector even in the best case scenario of job creation both in industrial/commercial activities and Govt services. How do we transform Indian villages with the help of AI?

1. Creating wealth and jobs in the rural India in the Agriculture sector with the adoption of AI will be one of the biggest challenges facing in India . The areas where AI could make substantial contributions are:
2. Weather prediction and farming advice based on data-based weather-analysis
3. Precision agriculture : choice of crops including crop rotation , identification of optimal mix of products , plant growth optimization , field management , application of genetics algorithms ,data based yield prediction ,geographical identification
4. Intelligent environment control (soil health evaluation and remedies, identification of field-characteristics, automated irrigation systems , crop health monitoring , protection of delicate items like fruits from change in environment , GPS based system for identifying and removing weeds, disease -detection and optimum use of pesticides/ herbicides, optimum use of fertilizers etc)
5. Driverless intelligent tractors , use of drones, proximity sensing and remote sensing devices , image based insight generation (3 D mapping and imaging spectroscopy) ,

6. Scientific live stock farming , health monitoring , productivity improvement , traceability and geographical identification .
7. Market analysis, direct market reach through e platforms , customer behavioural change , market influence (natural evolution and through promotion)
8. Optimum logistics- support (storage and transport) for preventing damage to farm products
9. Scientific management of fishing and fish-processing
10. Forestry management for increasing green cover
11. Extending areas for cultivation of commercial crops (cash crops and plantation crops) through data based analysis on soil condition, weather condition, market conditions.

4.16 Conclusions

1. AI will affect all the domains of activities and will kill jobs in a significant manner in almost all the known industrial and service activities. The enormous power of AI should be made use of for creating new activities in physical wealth-creation both in industrial and agricultural sector.
2. Fairness is an important issue to be dealt with in the adoption of AI . Extreme care will have to be taken while creating the algorithms for avoiding bias. This will also mean that certain adaptation will have to be made for adapting to the sensibilities countries/regions
3. Any national economy will have to depend primarily on physical wealth-creation and associated job-creations so as to give purchasing power to the people involved in such activities . Expansion of service activities will have be centred around the wealth-creation activities . Undue emphasis on services in the national GDP based on financial activities particularly on speculative activities is likely to lead to the collapse of the national economies. AI should be capable of forecasting such probable future collapse of the economy so as to trigger the security system for preventing such collapse .
4. Skill -development and skill -migration will have to be a continuous process and an individual may be called upon to undertake skill-migration three or four times during his professional career of around 40 years . A new equilibrium will have to be developed between work and leisure so that individuals will work

less number of hours with increased physical output and higher wages so that leisure activities will create more service-activities .

5. An emerging economy like India will have to use AI for creating new activities in the rural areas so that the centre of gravity of wealth-creation will shift to the rural India with associated increase in service-activities like education , health care and construction etc. The vast majority of jobs in India is under unorganized sector and it will be necessary to bring such jobs under organized sector through effective use of AI in agriculture (including forestry and fishing)
6. AI is the direct consequence of a technology-revolution. No one will be able to stop the adoption of AI in a big way in the wealth-creation process and delivery of services. The impact of this transformation will be considerable on the society. Nations will have to get used to a new way of doing things to take advantage of AI abandoning the attempts to maintain status quo .

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