AI in India: A Policy Agenda

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Background

Over the last few months, the Centre for Internet and Society has been engaged in the mapping of use and impact of artificial intelligence in health, banking, manufacturing, and governance sectors in India through the development of a case study compendium.[1] Alongside this research, we are examining the impact of Industry 4.0 on jobs and employment and questions related to the future of work in India. We have also been a part of several global conversations on artificial intelligence and autonomous systems. The Centre for Internet and Society is part of the Partnership on Artificial Intelligence, a consortium which has representation from some of most important companies and civil society organisations involved in developments and research on artificial intelligence. We have contributed to the The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, and are also a part of a Big Data for Development Global Network, where we are undertaking research towards evolving ethical principles for use of computational techniques. The following are a set of recommendations we have arrived out of our research into artificial intelligence, particularly the sectoral case studies focussed on the development and use of artificial intelligence in India.

National AI Strategies: A Brief Global Overview

Artificial Intelligence is emerging as a central policy issue in several countries. In October 2016, the Obama White House released a report titled, "Preparing for the Future of Artificial Intelligence"[2] delving into a range of issues including application for public goods, regulation, economic impact, global security and fairness issues. The White House also released a companion document called the "National Artificial Intelligence Research and Development Strategic Plan"[3] which laid out a strategic plan for Federally-funded research and development in AI. These were the first of a series of policy documents released by the US towards the role of AI. The United Kingdom announced its 2020 national development strategy and issued a government report to accelerate the application of AI by government agencies while in 2018 the Department for Business, Energy, and Industrial Strategy released the Policy Paper - AI Sector Deal.[4] The Japanese government released it paper on Artificial

[1] https://cis-india.org/internet-governance/blog/artificial-intelligence-in-india-a-compendium

[2] https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf

[3] https://www.nitrd.gov/PUBS/national_ai_rd_strategic_plan.pdf

[4] https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal

Intelligence Technology Strategy in 2017.[5] The European Union launched "SPARC," the world's largest civilian robotics R&D program, back in 2014.[6]

Over the last year and a half, Canada,[7] China,[8] the UAE,[9] Singapore,[10] South Korea[11], and France[12] have announced national AI strategy documents while 24 member States in the EU have committed to develop national AI policies that reflect a "European" approach to AI [13]. Other countries such as Mexico and Malaysia are in the process of evolving their national AI strategies. What this suggests is that AI is quickly emerging as central to national plans around the development of science and technology as well as economic and national security and development. There is also a focus on investments enabling AI innovation in critical national domains as a means of addressing key challenges facing nations. India has followed this trend and in 2018 the government published two AI roadmaps - the Report of Task Force on Artificial Intelligence by the AI Task Force constituted by the Ministry of Commerce and Industry[14] and the National Strategy for Artificial Intelligence by Niti Aayog.[15] Some of the key themes running across the National AI strategies globally are spelt out below.

Economic Impact of AI

A common thread that runs across the different national approaches to AI is the belief in the significant economic impact of AI, that it will likely increase productivity and create wealth. The British government estimated that AI could add $814 billion to the UK economy by 2035. The UAE report states that by 2031, AI will help boost the country's GDP by 35 per cent, reduce government costs by 50 per cent. Similarly, China estimates that the core AI market will be worth 150 billion RMB ($25bn) by 2020, 400 billion RMB ($65bn) and one trillion RMB ($160bn) by 2030. The impact of adoption of AI and automation of labour and employment is also a key theme touched upon across the strategies. For instance, the White

[5] http://www.nedo.go.jp/content/100865202.pdf
[6] https://www.eu-robotics.net/sparc/10-success-stories/european-robotics-creating-new-markets.html?changelang=2
[7] https://www.cifar.ca/ai/pan-canadian-artificial-intelligence-strategy
[8] https://www.newamerica.org/cybersecurity-initiative/blog/chinas-plan-lead-ai-purpose-prospects-and-problems/
[9] http://www.uaeai.ae/en/
[10] https://www.aisingapore.org/
[11] https://news.joins.com/article/22625271
[12] https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf
[13] https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe https://www.euractiv.com/section/digital/news/twenty-four-eu-countries-sign-artificial-intelligence-pact-in-bid-to-compete-with-us-china/
[14] https://www.aitf.org.in/
[15] http://www.niti.gov.in/writereaddata/files/document_publication/NationalStrategy-for-AI-Discussion-Paper.pdf

House Report of October 2016 states the US workforce is unprepared – and that a serious education programme, through online courses and in-house schemes, will be required.[16]

State Funding

Another key trend exhibited in all national strategies towards AI has been a commitment by the respective governments towards supporting research and development in AI. The French government has stated that it intends to invest €1.5 billion ($1.85 billion) in AI research in the period through to 2022. The British government's recommendations, in late 2017, were followed swiftly by a promise in the autumn budget of new funds, including at least £75 million for AI. Similarly, the the Canadian government put together a $125-million 'pan-Canadian AI strategy' last year.

AI for Public Good

The use of AI for Public Good is a significant focus of most AI policies. The biggest justification for AI innovation as a legitimate objective of public policy is its promised impact towards improvement of people's lives by helping to solve some of the world's greatest challenges and inefficiencies, and emerge as a transformative technology, much like mobile computing. These public good uses of AI are emerging across sectors such as transportation, migration, law enforcement and justice system, education, and agriculture..

National Institutions leading AI research

Another important trend which was key to the implementation of national AI strategies is the creation or development of well-funded centres of excellence which would serve as drivers of research and development and leverage synergies with the private sector. The French Institute for Research in Computer Science and Automation (INRIA) plans to create a national AI research program with five industrial partners. In UK, The Alan Turing Institute is likely to emerge as the national institute for data science, and an AI Council would be set up to manage inter-sector initiatives and training. In Canada, Canadian Institute for Advanced Research (CIFAR) has been tasked with implementing their AI strategy. Countries like Japan has a less centralised structure with the creation of strategic council for AI technology' to promote research and development in the field, and manage a number of key academic institutions, including NEDO and its national ICT (NICT) and science and tech (JST) agencies. These institutions are key to successful implementation of national agendas and policies around AI.

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https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf

AI, Ethics and Regulation

Across the AI strategies — ethical dimensions and regulation of AI were highlighted as concerns that needed to be addressed. Algorithmic transparency and explainability, clarity on liability, accountability and oversight, bias and discrimination, and privacy are ethical and regulatory questions that have been raised. Employment and the future of work is another area of focus that has been identified by countries. For example, the US 2016 Report reflected on if existing regulation is adequate to address risk or if adaption is needed by examining the use of AI in automated vehicles. In the policy paper - AI Sector Deal - the UK proposes four grand challenges: AI and Data Economy, Future Mobility, Clean Growth, and Ageing Society. The Pan Canadian Artificial Intelligence Strategy focuses on developing global thought leadership on the economic, ethical, policy, and legal implications of advances in artificial intelligence.[17]

The above are important factors and trends to take into account and to different extents have been reflected in the two national roadmaps for AI. Without adequate institutional planning, there is a risk of national strategies being too monolithic in nature. Without sufficient supporting mechanisms in the form of national institutions which would drive the AI research and innovation, capacity building and re-skilling of workforce to adapt to changing technological trends, building regulatory capacity to address new and emerging issues which may disrupt traditional forms of regulation and finally, creation of an environment of monetary support both from the public and private sector it becomes difficult to implement a national strategy and actualize the potentials of AI . As stated above, there is also a need for identification of key national policy problems which can be addressed by the use of AI, and the creation of a framework with institutional actors to articulate the appropriate plan of action to address the problems using AI. There are several ongoing global initiatives which are in the process of trying to articulate key principles for ethical AI. These discussions also feature in some of the national strategy documents.

Key considerations for AI policymaking in India

As mentioned above, India has published two national AI strategies. We have responded to both of these here[18] and here.[19] Beyond these two roadmaps, this policy brief reflects on a number of factors that need to come together for India to leverage and adopt AI across sectors, communities, and technologies successfully.

[17] https://www.cifar.ca/ai/pan-canadian-artificial-intelligence-strategy
[18] https://cis-india.org/internet-governance/blog/the-ai-task-force-report-the-first-steps-towards-indias-ai-framework
[19] https://cis-india.org/internet-governance/blog/niti-aayog-discussion-paper-an-aspirational-step-towards-india2019s-ai-policy

Resources, Infrastructure, Markets, and Funding

Ensure adequate government funding and investment in R&D

As mentioned above, a survey of all major national strategies on AI reveals a significant financial commitment from governments towards research and development surrounding AI. Most strategy documents speak of the need to safeguard national ambitions in the race for AI development. In order to do so it is imperative to have a national strategy for AI research and development, identification of nodal agencies to enable the process, and creation of institutional capacity to carry out cutting edge research.

Most jurisdictions such as Japan, UK and China have discussed collaborations between the industry and government to ensure greater investment into AI research and development. The European Union has spoken using the existing public-private partnerships, particularly in robotics and big data to boost investment by over one and half times.[20] To some extent, this step has been initiated by the Niti Aayog strategy paper. The paper lists out enabling factors for the widespread adoption of AI and maps out specific government agencies and ministries that could promote such growth. In February 2018, the Ministry of Electronics and IT also set up four committees to prepare a roadmap for a national AI programme. The four committees are presently studying AI in context of citizen centric services; data platforms; skilling, reskilling and R&D; and legal, regulatory and cybersecurity perspectives.[21]

Democratize AI technologies and data

Clean, accurate, and appropriately curated data is essential for training algorithms. Importantly, large quantities of data alone does not translate into better results. Accuracy and curation of data should be prerequisites to quantity of data. Frameworks to generate and access larger quantity of data should not hinge on models of centralized data stores. The government and the private sector are generally gatekeepers to vast amounts of data and technologies. Ryan Calo has called this an issue of data parity,[22] where only a few well established leaders in the field have the ability to acquire data and build datasets. Gaining access to data comes with its own questions of ownership, privacy, security, accuracy, and completeness. There are a number of different approaches and techniques that can be adopted to enable access to data.

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[20] https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe
[21] http://pib.nic.in/newsite/PrintRelease.aspx?relid=181007
[22] Ryan Calo, 2017 Artificial Intelligence Policy: A Primer and Roadmap. U.C. Davis L. Review, Vol. 51, pp. 398 - 435.

Open Government Data

Robust open data sets is one way in which access can be enabled. Open data is particularly important for small start-ups as they build prototypes. Even though India is a data dense country and has in place a National Data and Accessibility Policy India does not yet have robust and comprehensive open data sets across sectors and fields. Our research found that this is standing as an obstacle to innovation in the Indian context as startups often turn to open datasets in the US and Europe for developing prototypes. Yet, this is problematic because the demography represented in the data set is significantly different resulting in the development of solutions that are trained to a specific demographic, and thus need to be re-trained on Indian data. Although AI is technology agnostic, in the cases of different use cases of data analysis, demographically different training data is not ideal. This is particularly true for certain categories such as health, employment, and financial data.

The government can play a key role in providing access to datasets that will help the functioning and performance of AI technologies. The Indian government has already made a move towards accessible datasets through the Open Government Data Platform which provides access to a range of data collected by various ministries. Telangana has developed its own Open Data Policy which has stood out for its transparency and the quality of data collected and helps build AI based solutions.

In order to encourage and facilitate innovation, the central and state governments need to actively pursue and implement the National Data and Accessibility Policy.

Access to Private Sector Data

The private sector is the gatekeeper to large amounts of data. There is a need to explore different models of enabling access to private sector data while ensuring and protecting users rights and company IP. This data is often considered as a company asset and not shared with other stakeholders. Yet, this data is essential in enabling innovation in AI.

Amanda Levendowski states that ML practitioners have essentially three options in securing sufficient data— build the databases themselves, buy the data, or use data in the public domain. The first two alternatives are largely available to big firms or institutions. Smaller firms often end resorting to the third option but it carries greater risks of bias.

A solution could be federated access, with companies allowing access to researchers and developers to encrypted data without sharing the actual data. Another solution that has been proposed is ‘watermarking’ data sets.

Data sandboxes have been promoted as tools for enabling innovation while protecting privacy, security etc. Data sandboxes allow companies access to large anonymized

data sets under controlled circumstances. A regulatory sandbox is a controlled environment with relaxed regulations that allow the product to be tested thoroughly before it is launched to the public. By providing certification and safe spaces for testing, the government will encourage innovation in this sphere. This system has already been adopted in Japan where there are AI specific regulatory sandboxes to drive society 5.0.160 data sandboxes are tools that can be considered within specific sectors to enable innovation. A sector wide data sandbox was also contemplated by TRAI.[23] A sector specific governance structure can establish a system of ethical reviews of underlying data used to feed the AI technology along with data collected in order to ensure that this data is complete, accurate and has integrity. A similar system has been developed by Statistics Norway and the Norwegian Centre for Research Data.[24]

AI Marketplaces

The National Roadmap for Artificial Intelligence by NITI Aayog proposes the creation of a National AI marketplace that is comprised of a data marketplace, data annotation marketplace, and deployable model marketplace/solutions marketplace.[25] In particular, it is envisioned that the data marketplace would be based on blockchain technology and have the features of: traceability, access controls, compliance with local and international regulations, and robust price discovery mechanism for data. Other questions that will need to be answered center around pricing and ensuring equal access. It will also be interesting how the government incentivises the provision of data by private sector companies. Most data marketplaces that are emerging are initiated by the private sector.[26] A government initiated marketplace has the potential to bring parity to some of the questions raised above, but it should be strictly limited to private sector data in order to not replace open government data.

Open Source Technology

A number of companies are now offering open source AI technologies. For example, TensorFlow, Keras, Scikit-learn, Microsoft Cognitive Toolkit, Theano, Caffe, Torch, and Accord.NET.[27] The government should incentivise and promote open source AI technologies towards harnessing and accelerating research in AI.

[23] https://trai.gov.in/sites/default/files/CIS_07_11_2017.pdf
[24] https://www.datatilsynet.no/globalassets/global/english/ai-and-privacy.pdf
[25] http://www.niti.gov.in/writereaddata/files/document_publication/NationalStrategy-for-AI-Discussion-Paper.pdf
[26] https://martechtoday.com/bottos-launches-a-marketplace-for-data-to-train-ai-models-214265
[27] https://opensource.com/article/18/5/top-8-open-source-ai-technologies-machine-learning

Re-thinking Intellectual Property Regimes

Going forward it will be important for the government to develop an intellectual property framework that encourages innovation. AI systems are trained by reading, viewing, and listening to copies of human-created works. These resources such as books, articles, photographs, films, videos, and audio recordings are all key subjects of copyright protection. Copyright law grants exclusive rights to copyright owners, including the right to reproduce their works in copies, and one who violates one of those exclusive rights "is an infringer of copyright.[28]

The enterprise of AI is, to this extent, designed to conflict with tenets of copyright law, and after the attempted 'democratization' of copyrighted content by the advent of the Internet, AI poses the latest challenge to copyright law. At the centre of this challenge is the fact that it remains an open question whether a copy made to train AI is a "copy" under copyright law, and consequently whether such a copy is an infringement.[29] The fractured jurisprudence on copyright law is likely to pose interesting legal questions with newer use cases of AI. For instance, Google has developed a technique called federated learning, popularly referred to as on-device ML, in which training data is localised to the originating mobile device rather than copying data to a centralized server.[30] The key copyright questions here is whether decentralized training data stored in random access memory (RAM) would be considered as "copies".[31] There are also suggestions that copies made for the purpose of training of machine learning systems may be so trivial or de minimis that they may not qualify as infringement.[32] For any industry to flourish, there needs to be legal and regulatory clarity and it is imperative that these copyright questions emerging out of use of AI be addressed soon.

As noted in our response to the Niti Aayog national AI strategy "*The report also blames the current Indian Intellectual Property regime for being "unattractive" and averse to incentivising research and adoption of AI. Section 3(k) of Patents Act exempts algorithms from being patented, and the Computer Related Inventions (CRI) Guidelines have faced much controversy over the patentability of mere software without a novel hardware component. The paper provides no concrete answers to the question of whether it should be permissible to patent algorithms, and if yes, to to what extent. Furthermore, there needs to be a standard either in the CRI Guidelines or the*

[28] Amanda Levendowski, How Copyright Law Can Fix Artificial Intelligence's Implicit Bias Problem, 93 WASH. L. REV. (forthcoming 2018) (manuscript at 23, 27-32), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3024938.
[29] *Id*.
[30] H. Brendan McMahan, et al., Communication-Efficient Learning of Deep Networks from Decentralized Data, arXiv:1602.05629 (Feb. 17, 2016), https://arxiv.org/abs/1602.05629.
[31] *Id*.
[32] Pierre N. Leval, Nimmer Lecture: Fair Use Rescued, 44 UCLA L. REV. 1449, 1457 (1997).

Patent Act, that distinguishes between AI algorithms and non-AI algorithms. Additionally, given that there is no historical precedence on the requirement of patent rights to incentivise creation of AI, innovative investment protection mechanisms that have lesser negative externalities, such as compensatory liability regimes would be more desirable. The report further failed to look at the issue holistically and recognize that facilitating rampant patenting can form a barrier to smaller companies from using or developing AI. This is important to be cognizant of given the central role of startups to the AI ecosystem in India and because it can work against the larger goal of inclusion articulated by the report."[33]

National infrastructure to support domestic development

Building a robust national Artificial Intelligence solution requires establishing adequate indigenous infrastructural capacity for data storage and processing. While this should not necessarily extend to mandating data localisation as the draft privacy bill has done, capacity should be developed to store data sets generated by indigenous nodal points.

AI Data Storage

Capacity needs to increase as the volume of data that needs to be processed in India increases. This includes ensuring effective storage capacity, IOPS (Input/Output per second) and ability to process massive amounts of data.

AI Networking Infrastructure

Organizations will need to upgrade their networks in a bid to upgrade and optimize efficiencies of scale. Scalability must be undertaken on a high priority which will require a high-bandwidth, low latency and creative architecture, which requires appropriate last mile data curation enforcement.

Conceptualization and Implementation

Awareness, Education, and Reskilling

Encouraging AI research

This can be achieved by collaborations between the government and large companies to promote accessibility and encourage innovation through greater R&D spending. The Government of Karnataka, for instance, is collaborating with NASSCOM to set up a Centre of Excellence for Data Science and Artificial Intelligence (CoE-DS&AI)

[33] https://cis-india.org/internet-governance/blog/niti-aayog-discussion-paper-an-aspirational-step-towards-india2019s-ai-policy

on a public-private partnership model to "accelerate the ecosystem in Karnataka by providing the impetus for the development of data science and artificial intelligence across the country." Similar centres could be incubated in hospitals and medical colleges in India. Principles of public funded research such as FOSS, open standards, and open data should be core to government initiatives to encourage research. The Niti Aaayog report proposes a two tier integrated approach towards accelerating research, but is currently silent on these principles.[34]

Therefore,as suggested by the NITI AAYOG Report, the government needs to set up 'centres of excellence'. Building upon the stakeholders identified in the NITI AAYOG Report, the centers of excellence should involve a wide range of experts including lawyers, political philosophers, software developers, sociologists and gender studies from diverse organizations including government, civil society,the private sector and research institutions to ensure the fair and efficient roll out of the technology.[35] An example is the Leverhulme Centre for the Future of Intelligence set up by the Leverhulme Foundation at the University of Cambridge[36] and the AI Now Institute at New York University (NYU)[37] These research centres bring together a wide range of experts from all over the globe.[38]

Skill sets to successfully adopt AI

Educational institutions should provide opportunities for students to skill themselves to adapt to adoption of AI, and also push for academic programmes around AI. It is also important to introduce computing technologies such as AI in medical schools in order to equip doctors to adopt the technical skill sets and ethics required to use integrate AI in their practices. Similarly, IT institutes could include courses on ethics, privacy, accountability etc. to equip engineers and developers with an understanding of the questions surrounding the technology and services they are developing.

Societal Awareness Building

Much of the discussion around skilling for AI is in the context of the workplace, but there is a need for awareness to be developed across society for a broader adaptation to AI. The Niti Aayog report takes the first steps towards this - noting the importance of highlighting the benefits of AI to the public. The conversation needs to go beyond this towards enabling individuals to recognize and adapt to changes that might be brought about - directly and indirectly - by AI - inside and outside of the workplace.

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[34] https://cis-india.org/internet-governance/blog/niti-aayog-discussion-paper-an-aspirational-step-towards-india2019s-ai-policy

[35] Discussion Paper on National Strategy for Artificial Intelligence | NITI Aayog | National Institution for Transforming India. (n.d.) p. 54. Retrieved from http://niti.gov.in/content/national-strategy-ai-discussion-paper.

[36] Leverhulme Centre for the Future of Intelligence, http://lcfi.ac.uk/.

[37] AI Now, https://ainowinstitute.org/.

[38] https://cis-india.org/internet-governance/ai-and-governance-case-study-pdf

This could include catalyzing a shift in mindset to life long learning and discussion around potential implications of human-machine interactions.

Early Childhood Awareness and Education

It is important that awareness around AI begins in early childhood. This is in part because children already interact with AI and increasingly will do so and thus awareness is needed in how AI works and can be safely and ethically used. It is also important to start building the skills that will be necessary in an AI driven society from a young age.

Focus on marginalised groups

Awareness, skills, and education should be targeted at national minorities including rural communities, the disabled, and women. Further, there should be a concerted focus on communities that are under-represented in the tech sector-such as women and sexual minorities-to ensure that the algorithms themselves and the community working on AI driven solutions are holistic and cohesive. For example, Iridescent focuses on girls, children, and families to enable them to adapt to changes like artificial intelligence through promoting curiosity, creativity, and perseverance to become lifelong learners.[39] This will be important towards ensuring that AI does not deepen societal and global inequalities including digital divides. Widespread use of AI will undoubtedly require re-skilling various stakeholders in order to make them aware of the prospects of AI.[40] Artificial Intelligence itself can be used as a resource in the re-skilling process itself-as it would be used in the education sector to gauge people's comfort with the technology and plug necessary gaps.

Improved access to and awareness of Internet of Things

The development of smart content or Intelligent Tutoring Systems in the education can only be done on a large scale if both the teacher and the student has access to and feel comfortable with using basic IoT devices . A U.K. government report has suggested that any skilled workforce using AI should be a mix of those with a basic understanding responsible for implementation at the grassroots level , more informed users and specialists with advanced development and implementation skills.[41]The same logic applies to the agriculture sector, where the government is looking to develop smart weather-pattern tracking applications. A potential short-term solution may lie in ensuring that key actors have access to an IoT device so that he/she may access digital and then impart the benefits of access to proximate individuals. In the education sector, this would involve ensuring that all teachers have access to and are competent in using an IoT device. In the agricultural sector, this may involve

[39] http://iridescentlearning.org/
[40] https://cis-india.org/internet-governance/ai-and-governance-case-study-pdf
[41] Points, L., & Potton, E. (2017). Artificial intelligence and automation in the UK.

equipping each village with a set of IoT devices so that the information can be shared among concerned individuals. Such an approach recognizes that AI is not the only technology catalyzing change - for example industry 4.0 is understood as comprising of a suite of technologies including but not limited to AI.

Public Discourse

As solutions bring together and process vast amounts of granular data, this data can be from a variety of public and private sources - from third party sources or generated by the AI and its interaction with its environment. This means that very granular and non traditional data points are now going into decision making processes. Public discussion is needed to understand social and cultural norms and standards and how these might translate into acceptable use norms for data in various sectors.

Coordination and collaboration across stakeholders

Development of Contextually Nuanced and Appropriate AI Solutions

Towards ensuring effectiveness and accuracy it is important that solutions used in India are developed to account for cultural nuances and diversity. From our research this could be done in a number of ways ranging from: training AI solutions used in health on data from Indian patients to account for differences in demographics[42], focussing on natural language voice recognition to account for the diversity in languages and digital skills in the Indian context,[43] and developing and applying AI to reflect societal norms and understandings.[44]

Continuing, deepening, and expanding partnerships for innovation

Continued innovation while holistically accounting for the challenges that AI poses will be key for actors in the different sectors to remain competitive. As noted across case study reports partnerships is key in facilitating this innovation and filling capacity gaps. These partnerships can be across sectors, institutions, domains, geographies, and stakeholder groups. For example: finance/ telecom, public/private, national/international, ethics/software development/law, and academia/civil society/industry/government. We would emphasize collaboration between actors

[42] Paul, Y., Hickok, E., Sinha, A. and Tiwari, U., Artificial Intelligence in the Healthcare Industry in India, Centre for Internet and Society. Available at https://cis-india.org/internet-governance/files/ai-and-healtchare-report.
[43] Goudarzi, S., Hickok, E., and Sinha, A., AI in the Banking and Finance Industry in India, Centre for Internet and Society. Available at https://cis-india.org/internet-governance/blog/ai-in-banking-and-finance.
[44] Paul, Y., Hickok, E., Sinha, A. and Tiwari, U., Artificial Intelligence in the Healthcare Industry in India, Centre for Internet and Society. Available at https://cis-india.org/internet-governance/files/ai-and-healtchare-report.

across different domains and stakeholder groups as developing holistics AI solutions demands multiple understandings and perspectives.

Coordinated Implementation

Key sectors in India need to begin to take steps to consider sector wide coordination in implementing AI. Potential stress and system wide vulnerabilities would need to be considered when undertaking this. Sectoral regulators such as RBI, TRAI, and the Medical Council of India are ideally placed to lead this coordination.

Develop contextual standard benchmarks to assess quality of algorithms

In part because of the nacency of the development and implementation of AI, towards enabling effective assessments of algorithms to understand impact and informing selection by institutions adopting solutions, standard benchmarks can help in assessing quality and appropriateness of algorithms. It may be most effective to define such benchmarks at a sectoral level (finance etc.) or by technology and solution (facial recognition etc.). Ideally, these efforts would be led by the government in collaboration with multiple stakeholders.

Developing a framework for working with the private sector for use-cases by the government

There are various potential use cases the government could adopt in order to use AI as a tool for augmenting public service delivery in India by the government. However, given lack of capacity -both human resource and technological-means that entering into partnerships with the private sector may enable more fruitful harnessing of AI- as has been seen with existing MOUs in the agricultural[45] and healthcare sectors.[46] However, the partnership must be used as a means to build capacity within the various nodes in the set-up rather than relying only on the private sector partner to continue delivering sustainable solutions.

Particularly, in the case of use of AI for governance, there is a need to evolve a clear parameter to do impact assessment prior to the deployment of the technology that clearly tries to map estimated impact of the technology of clearly defined objectives, which must also include the due process, procedural fairness and human rights considerations . As per Article 12 of the Indian Constitution, whenever the government is exercising a public function, it is bound by the entire gamut of fundamental rights articulated in Part III of the Constitution. This is a crucial consideration the government will have to bear in mind whenever it uses AI- regardless of the sector. In all cases of public service delivery, primary accountability

[45] https://news.microsoft.com/en-in/government-karnataka-inks-mou-microsoft-use-ai-digital-agriculture/
[46] https://news.microsoft.com/en-in/government-telangana-adopts-microsoft-cloud-becomes-first-state-use-artificial-intelligence-eye-care-screening-children/

for the use of AI should lie with the government itself, which means that a cohesive and uniform framework which regulates these partnerships must be conceptualised. This framework should incorporate : (a) Uniformity in the wording and content of contracts that the government signs, (b) Imposition of obligations of transparency and accountability on the developer to ensure that the solutions developed are in conjunction with constitutional standards and (c) Continuous evaluation of private sector developers by the government and experts to ensure that they are complying with their obligations.

Defining Safety Critical AI

The implications of AI differs according to use. Some countries, such as the EU, are beginning to define sectors where AI should play the role of augmenting jobs as opposed to functioning autonomously. The Global Partnership on AI is has termed sectors where AI tools supplement or replace human decision making in areas such as health and transportation as 'safety critical AI' and is researching best practices for application of AI in these areas. India will need to think through if there is a threshold that needs to be set and more stringent regulation applied. In addition to uses in health and transportation, defense and law enforcement would be another sector where certain use would require more stringent regulation.

Appropriate certification mechanisms

Appropriate certificate mechanisms will be important in ensuring the quality of AI solutions. A significant barrier to the adoption of AI in some sectors in India is acceptability of results, which include direct results arrived at using AI technologies as well as opinions provided by practitioners that are influenced/aided by AI technologies. For instance, start-ups in the healthcare sectors often find that they are asked to show proof of a clinical trial when presenting their products to doctors and hospitals, yet clinical trials are expensive, time consuming and inappropriate forms of certification for medical devices and digital health platforms. Startups also face difficulty in conducting clinical trials as there is lack of a clear regulation to adhere to. They believe that while clinical trials are a necessity with respect to drugs, the process often results in obsolescence of the technology by the time it is approved in the context of AI. Yet, medical practitioners are less trusting towards startups who do not have approval from a national or international authority. A possible and partial solution suggested by these startups is to enable doctors to partner with them to conduct clinical trials together. However, such partnerships cannot be at the expense of rigour, and adequate protections need to be built in the enabling regulation.

Serving as a voice for emerging economies in the global debate on AI

While India should utilise Artificial Intelligence in the economy as a means of occupying a driving role in the global debate around AI, it must be cautious before

allowing the use of Indian territory and infrastructure as a test bed for other emerging economies without considering the ramifications that the utilisation of AI may have for Indian citizens. The NITI AAYOG Report envisions India as leverage AI as a 'garage' for emerging economies.[47] While there are certain positive connotations of this suggestion in so far as this propels India to occupy a leadership position-both technically and normatively in determining future use cases for AI in India,, in order to ensure that Indian citizens are not used as test subjects in this process, guiding principles could be developed such as requiring that projects have clear benefits for India.

Frameworks for Regulation

National legislation

Data Protection Law

India is a data-dense country, and the lack of a robust privacy regime, allows the public and private sector easier access to large amounts of data than might be found in other contexts with stringent privacy laws. India also lacks a formal regulatory regime around anonymization. In our research we found that this gap does not always translate into a gap in practice, as some start up companies have adopted self-regulatory practices towards protecting privacy such as of anonymising data they receive before using it further, but it does result in unclear and unharmonized practice..

In order to ensure rights and address emerging challenges to the same posed by artificial intelligence, India needs to enact a comprehensive privacy legislation applicable to the private and public sector to regulate the use of data, including use in artificial intelligence. A privacy legislation will also have to address more complicated questions such as the use of publicly available data for training algorithms, how traditional data categories (PI vs. SPDI - meta data vs. content data etc.) need to be revisited in light of AI, and how can a privacy legislation be applied to autonomous decision making. Similarly, surveillance laws may need to be revisited in light of AI driven technologies such as facial recognition, UAS, and self driving cars as they provide new means of surveillance to the state and have potential implications for other rights such as the right to freedom of expression and the right to assembly. Sectoral protections can compliment and build upon the baseline protections articulated in a national privacy legislation.[48] In August 2018 the Srikrishna Committee released a draft data protection bill for India. We have reflected on how the Bill addresses AI. Though the Bill brings under its scope companies

[47] NITI Aayog. (2018). Discussion Paper on National Strategy for Artificial Intelligence. Retrieved from http://niti.gov.in/content/national-strategy-ai-discussion-paper. 18

[48] https://edps.europa.eu/sites/edp/files/publication/16-10-19_marrakesh_ai_paper_en.pdf

deploying emerging technologies and subjects them to the principles of privacy by design and data impact assessments, the Bill is silent on key rights and responsibilities, namely the responsibility of the data controller to explain the logic and impact of automated decision making including profiling to data subjects and the right to opt out of automated decision making in defined circumstances.[49] Further, the development of technological solutions to address the dilemma between AI and the need for access to larger quantities of data for multiple purposes and privacy should be emphasized.

Discrimination Law

A growing area of research globally is the social consequences of AI with a particular focus on its tendency to replicate or amplify existing and structural inequalities. Problems such as data invisibility of certain excluded groups,[50] the myth of data objectivity and neutrality,[51] and data monopolization[52] contribute to the disparate impacts of big data and AI. So far much of the research on this subject has not moved beyond the exploratory phase as is reflected in the reports released by the White House[53] and Federal Trade Commission[54] in the United States. The biggest challenge in addressing discriminatory and disparate impacts of AI is ascertaining "where value-added personalization and segmentation ends and where harmful discrimination begins."[55]

Some prominent cases where AI can have discriminatory impact are denial of loans based on attributes such as neighbourhood of residence as a proxies which can be used to circumvent anti-discrimination laws which prevent adverse determination on the grounds of race, religion, caste or gender, or adverse findings by predictive policing against persons who are unfavorably represented in the structurally biased datasets used by the law enforcement agencies. There is a dire need for disparate impact regulation in sectors which see the emerging use of AI.

Similar to disparate impact regulation, developments in AI, and its utilisation, especially in credit rating, or risk assessment processes could create complex

[49] https://cis-india.org/internet-governance/blog/the-srikrishna-committee-data-protection-bill-and-artificial-intelligence-in-india
[50] J. Schradie, The Digital Production Gap: The Digital Divide and Web 2.0 Collide. Elsevier Poetics, 39 (1).
[51] D Lazer, et al., The Parable of Google Flu: Traps in Big Data Analysis. Science. 343 (1).
[52] Danah Boyd and Kate Crawford, Critical Questions for Big Data. Information, Communication & Society. 15 (5).
[53] John Podesta, (2014) Big Data: Seizing Opportunities, Preserving Values, available at http://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pdf
[54] E. Ramirez, (2014) FTC to Examine Effects of Big Data on Low Income and Underserved Consumers at September Workshop, available at http://www.ftc.gov/news-events/press-releases/2014/04/ftc-examine-effects-big-data-lowincome-underserved-consumers
[55] M. Schrage, Big Data's Dangerous New Era of Discrimination, available at http://blogs.hbr.org/2014/01/bigdatas-dangerous-new-era-of-discrimination/.

problems that cannot be solved only by the principle based regulation. Instead, regulation intended specifically to avoid outcomes that the regulators feel are completely against the consumer, could be an additional tool that increases the fairness, and effectiveness of the system.

Competition Law

The conversation of use of competition or antitrust laws to govern AI is still at an early stage. However, the emergence of numerous data driven mergers or acquisitions such as Yahoo-Verizon, Microsoft-LinkedIn and Facebook-WhatsApp have made it difficult to ignore the potential role of competition law in the governance of data collection and processing practices. It is important to note that the impact of Big Data goes far beyond digital markets and the mergers of companies such as Bayer, Climate Corp and Monsanto shows that data driven business models can also lead to the convergence of companies from completely different sectors as well. So far, courts in Europe have looked at questions such as the impact of combination of databases on competition[56] and have held that in the context of merger control, data can be a relevant question if an undertaking achieves a dominant position through a merger, making it capable of gaining further market power through increased amounts of customer data. The evaluation of the market advantages of specific datasets has already been done in the past, and factors which have been deemed to be relevant have included whether the dataset could be replicated under reasonable conditions by competitors and whether the use of the dataset was likely to result in a significant competitive advantage.[57] However, there are limited circumstances in which big data meets the four traditional criteria for being a barrier to entry or a source of sustainable competitive advantage — inimitability, rarity, value, and non-substitutability.[58]

Any use of competition law to curb data-exclusionary or data-exploitative practices will first have to meet the threshold of establishing capacity for a firm to derive market power from its ability to sustain datasets unavailable to its competitors. In this context the peculiar ways in which network effects, multi-homing practices and how dynamic the digital markets are, are all relevant factors which could have both positive and negative impacts on competition. There is a need for greater discussion on data as a sources of market power in both digital and non-digital markets, and how this legal position can used to curb data monopolies, especially in light of government backed monopolies for identity verification and payments in India.

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[56] Google/DoubleClick Merger case

[57] French Competition Authority, Opinion n°10-A-13 of 1406.2010, http://www.autoritedelaconcurrence.fr/pdf/avis/10a13.pdf. That opinion of the Authority aimed at giving general guidance on that subject. It did not focus on any particular market or industry although it described a possible application of its analysis to the telecom industry.

[58] http://www.analysisgroup.com/is-big-data-a-true-source-of-market-power/#sthash.5ZHmrD1m.dpuf

Consumer Protection Law

The Consumer Protection Bill, 2015, tabled in the Parliament towards the end of the monsoon session has introduced an expansive definition of the term "unfair trade practices." The definition as per the Bill includes the disclosure "to any other person any personal information given in confidence by the consumer." This clause excludes from the scope of unfair trade practices, disclosures under provisions of any law in force or in public interest. This provision could have significant impact on the personal data protection law in India. Alongside, there is also a need to ensure that principles such as safeguarding consumers personal information in order to ensure that the same is not used to their detriment are included within the definition of unfair trade practices. This would provide consumers an efficient and relatively speedy forum to contest adverse impacts on them of data driven decision-making.

Sectoral Regulation

Our research into sectoral case studies revealed that there are a number of existing sectoral laws and policies that are applicable to aspects of AI. For example, in the health sector there is the Medical Council Professional Conduct, Etiquette, and Ethics Regulations 2002, the Electronic Health Records Standards 2016, the draft Medical Devices Rules 2017, the draft Digital Information Security in Healthcare Act. In the finance sector there is the Credit Information Companies (Regulation) Act 2005 and 2006, the Securities and Exchange Board of India (Investment Advisers) Regulations, 2013, the Payment and Settlement Systems Act, 2007, the Banking Regulations Act 1949, SEBI guidelines on robo advisors etc. Before new regulations, guidelines etc are developed - a comprehensive exercise needs to be undertaken at a sectoral level to understand if 1. sectoral policy adequately addresses the changes being brought about by AI 2. If it does not - is an amendment possible and if not - what form of policy would fill the gap.

Principled approach

Transparency

Audits

Internal and external audits can be mechanisms towards creating transparency about the processes and results of AI solutions as they are implemented in a specific context. Audits can take place while a solution is still in 'pilot' mode and on a regular basis during implementation. For example, in the Payment Card Industry (PCI) tool, transparency is achieved through frequent audits, the results of which are simultaneously and instantly transmitted to the regulator and the developer. Ideally

parts of the results of the audit are also made available to the public, even if the entire results are not shared.

Tiered Levels of Transparency

There are different levels and forms of transparency as well as different ways of achieving the same. The type and form of transparency can be tiered and dependent on factors such as criticality of function, potential direct and indirect harm, sensitivity of data involved, actor using the solution . The audience can also be tiered and could range from an individual user to senior level positions, to oversight bodies.

Human Facing Transparency

It will be important for India to define standards around human-machine interaction including the level of transparency that will be required. Will chatbots need to disclose that they are chatbots? Will a notice need to be posted that facial recognition technology is used in a CCTV camera? Will a company need to disclose in terms of service and privacy policies that data is processed via an AI driven solution? Will there be a distinction if the AI takes the decision autonomously vs. if the AI played an augmenting role? Presently, the Niti Aayog paper has been silent on this question.

Explainability

An explanation is not equivalent to complete transparency. The obligation of providing an explanation does not mean that the developer should necessarily know the flow of bits through the AI system. Instead, the legal requirement of providing an explanation requires an ability to explain how certain parameters may be utilised to arrive at an outcome in a certain situation.
Doshi-Velez and Kortz have highlighted two technical ideas that may enhance a developer's ability to explain the functioning of AI systems:[59]
1) Differentiation and processing: AI systems are designed to have the inputs differentiated and processed through various forms of computation-in a reproducible and robust manner. Therefore, developers should be able to explain a particular decision by examining the inputs in an attempt to determine which of them have the greatest impact on the outcome.
2) Counterfactual faithfulness: The second property of counterfactual faithfulness enables the developer to consider which factors caused a difference in the outcomes.
Both these solutions can be deployed without necessarily knowing the contents of black boxes. As per Pasquale, ‘Explainability matters because the process of reason-

[59] Doshi-Velez, F., Kortz, M., Budish, R., Bavitz, C., Gershman, S., O'Brien, D., ... & Wood, A. (2017). Accountability of AI under the law: The role of explanation. arXiv preprint arXiv:1711.01134.

giving is intrinsic to juridical determinations – not simply one modular characteristic jettisoned as anachronistic once automated prediction is sufficiently advanced."[60]

Rules based system applied contextually

Oswald et al have suggested two proposals that might mitigate algorithmic opacity.by designing a broad rules-based system, whose implementation need to be applied in a context-specific manner which thoroughly evaluates the key enablers and challengers in each specific use case.[61]

1) Experimental proportionality was designed to enable the courts to make proportionality determinations of an algorithm at the experimental stage even before the impacts are fully realised in a manner that would enable them to ensure that appropriate metrics for performance evaluation and cohesive principles of design have been adopted. In such cases they recommend that the courts give the benefit of the doubt to the public sector body subject to another hearing within a stipulated period of time once data on the impacts of the algorithm become more readily available.
2) 'ALGO-CARE' calls for the design of a rules-based system which ensures that the algorithms[62] are:
   (1) Advisory: Algorithms must retain an advisory capacity that augments existing human capability rather than replacing human discretion outright;
   (2) Lawful: Algorithm's proposed function, application, individual effect and use of datasets should be considered in symbiosis with necessity, proportionality and data minimisation principles;
   (3) Granularity: Issues such as data analysis issues such as meaning of data, challenges stemming from disparate tracts of data, omitted data and inferences should be key points in the implementation process;
   (4) Ownership: Due regard should be given to intellectual property ownership but in the case of algorithms used for governance, it may be better to have open source algorithms at the default. Regardless of the sector,the developer must ensure that the algorithm works in a manner that enables a third party to investigate the workings of the algorithm in an adversarial judicial context.
   (5)Challengeable:The results of algorithmic analysis should be applied with regard to professional codes and regulations and be challengeable. In a report evaluating the NITI AAYOG Discussion Paper, CIS has argued that AI that is used for governance , must be made auditable in the public domain,if not

[60] Frank A. Pasquale 'Toward a Fourth Law of Robotics: Preserving Attribution, Responsibility, and Explainability in an Algorithmic Society' (July 14, 2017). Ohio State Law Journal, Vol. 78, 2017; U of Maryland Legal Studies Research Paper No. 2017-21, 7.
[61] Oswald, M., Grace, J., Urwin, S., & Barnes, G. C. (2018). Algorithmic risk assessment policing models: lessons from the Durham HART model and 'Experimental' proportionality. Information & Communications Technology Law, 27(2), 223-250.
[62] Ibid.

under Free and Open Source Software (FOSS)-particularly in the case of AI that has implications for fundamental rights.[63]
(6) Accuracy: The design of the algorithm should check for accuracy;
(7) Responsible: Should consider a wider set of ethical and moral principles and the foundations of human rights as a guarantor of human dignity at all levels and
(8) Explainable: Machine Learning should be interpretable and accountable.

A rules based system like ALGO-CARE can enable predictability in use frameworks for AI. Predictability compliments and strengthens transparency.

Accountability

Conduct Impact Assessment

There is a need to evolve Algorithmic Impact Assessment frameworks for the different sectors in India, which should address issues of bias, unfairness and other harmful impacts of use of automated decision making. AI is a nascent field and the impact of the technology on the economy, society, etc. is still yet to be fully understood. Impact assessment standards will be important in identifying and addressing potential or existing harms and could potentially be more important in sectors or uses where there is direct human interaction with AI or power dimensions - such as in healthcare or use by the government. A 2018 Report by the AI Now Institute lists methods that should be adopted by the government for conducting his holistic assessment[64]: These should include: (1) Self-assessment by the government department in charge of implementing the technology, (2)Development of meaningful inter-disciplinary external researcher review mechanisms, (3) Notice to the public regarding self-assessment and external review, (4)Soliciting of public comments for clarification or concerns, (5) Special regard to vulnerable communities who may not be able to exercise their voice in public proceedings. An adequate review mechanism which holistically evaluates the impact of AI would ideally include all five of these components in conjunction with each other.

Regulation of Algorithms

Experts have voiced concerns about AI mimicking human prejudices due to the biases present in the Machine Learning algorithms. Scientists have revealed through their

[63] Abraham S., Hickok E., Sinha A., Barooah S., Mohandas S., Bidare P. M., Dasgupta S., Ramachandran V., and Kumar S., NITI Aayog Discussion Paper: An aspirational step towards India's AI policy. Retrieved from https://cis-india.org/internet-governance/files/niti-aayog-discussion-paper.
[64] Reisman D., Schultz J., Crawford K., Whittaker M., (2018, April) Algorithmic Impact Assessments: A Practical Framework For Public Agency Accountability. Retrieved from https://ainowinstitute.org/aiareport2018.pdf.

research that machine learning algorithms can imbibe gender and racial prejudices which are ingrained in language patterns or data collection processes. Since AI and machine algorithms are data driven, they arrive at results and solutions based on available
and historical data. When this data itself is biased, the solutions presented by the AI will also be biased. While this is inherently discriminatory, scientists have provided solutions to rectify these biases which can occur at various stages by introducing a counter bias at another stage. It has also been suggested that data samples should be shaped in such a manner so as to minimise the chances of algorithmic bias. Ideally regulation of algorithms could be tailored - explainability, traceability, scrutability. We recommend that the national strategy on AI policy must take these factors into account and combination of a central agency driving the agenda, and sectoral actors framing regulations around specific uses of AI that are problematic and implementation is required.

As the government begins to adopt AI into governance - the extent to which and the circumstances autonomous decision making capabilities can be delegated to AI need to be questioned. Questions on whether AI should be autonomous, should always have a human in the loop, and should have a 'kill-switch' when used in such contexts also need to be answered. A framework or high level principles can help to guide these determinations. For example:

- Modeling Human Behaviour: An AI solution trying to model human behaviour, as in the case of judicial decision-making or predictive policing may need to be more regulated, adhere to stricter standards, and need more oversight than an algorithm that is trying to predict 'natural' phenomenon such as traffic congestion or weather patterns.
- Human Impact: An AI solution which could cause greater harm if applied erroneously-such as a robot soldier that mistakenly targets a civilian requires a different level and framework of regulation than an AI solution designed to create a learning path for a student in the education sector and errs in making an appropriate assessment..
- Primary User: AI solutions whose primary users are state agents attempting to discharge duties in the public interest such as policemen, should be approached with more caution than those used by individuals such as farmers getting weather alerts

Fairness

It is possible to incorporate broad definitions of fairness into a wide range of data analysis and classification systems.[65] While there can be no bright-line

[65] Sample I., (2017, November 5) Computer says no: why making AIs fair, accountable and transparent is crucial. Retrieved from https://www.theguardian.com/science/2017/nov/05/computer-says-no-why-making-ais-fair-accountable-and-transparent-is-crucial.

rules that will necessarily enable the operator or designer of a Machine Learning System to arrive at an ex ante determination of fairness, from a public policy perspective, there must be a set of rules or best practices that explain how notions of fairness should be utilised in the real world applications of AI-driven solutions.[66] While broad parameters should be encoded by the developer to ensure compliance with constitutional standards, it is also crucial that the functioning of the algorithm allows for an ex-post determination of fairness by an independent oversight body if the impact of the AI driven solution is challenged.

Further, while there is no precedent on this anywhere in the world, India could consider establishing a Committee entrusted with the specific task of continuously evaluating the operation of AI-driven algorithms. Questions that the government would need to answer with regard to this body include:

- What should the composition of the body be?
- What should be the procedural mechanisms that govern the operation of the body?
- When should the review committee step in? This is crucial because excessive review may re-entrench the bureaucracy that the AI driven solution was looking to eliminate.
- What information will be necessary for the review committee to carry out its determination? Will there be conflicts with IP, and if so how will these be resolved?
- To what degree will the findings of the committee be made public?
- What powers will the committee have? Beyond making determinations, how will these be enforced?

Market incentives

Standards as a means to address data issues

With digitisation of legacy records and the ability to capture more granular data digitally, one of the biggest challenges facing Big Data is a lack of standardised data and interoperability frameworks. This is particularly true in the healthcare and medicine sector where medical records do not follow a clear standard, which poses a challenge to their datafication and analysis. The presence of developed standards in data management and exchange, interoperable Distributed Application Platform and Services, Semantic related standards for markup, structure, query, semantics,

[66] Kroll, J. A., Barocas, S., Felten, E. W., Reidenberg, J. R., Robinson, D. G., & Yu, H. (2016). Accountable algorithms. U. Pa. L. Rev., 165, 633.

Information access and exchange have been spoken of as essential to address the issues of lack of standards in Big Data.[67]

Towards enabling usability of data, it is important that clear data standards are established. This has been recognized by Niti Aayog in its National Strategy for AI. On one hand, there can operational issues with allowing each organisation to choose their own specific standards to operate under, while on the other hand, non-uniform digitisation of data will also cause several practical problems, most primarily to do with interoperability of the individual services, as well as their usability. For instance, in the healthcare sector, though India has adopted an EHR policy, implementation of this policy is not yet harmonized - leading to different interpretations of 'digitizing records (i.e taking snapshots of doctor notes), retention methods and periods, and comprehensive implementation across all hospital data. Similarly, while independent banks and other financial organisations are already following, or in the process of developing internal practices,there exist no uniform standards for digitisation of financial data. As AI development, and application becomes more mainstream in the financial sector, the lack of a fixed standard could create significant problems.

Better Design Principles in Data Collection

An enduring criticism of the existing notice and consent framework has been that long, verbose and unintelligible privacy notices are not efficient in informing individuals and helping them make rational choices. While this problem predates Big Data, it has only become more pronounced in recent times, given the ubiquity of data collection and implicit ways in which data is being collected and harvested. Further, constrained interfaces on mobile devices, wearables, and smart home devices connected in an Internet of Things amplify the usability issues of the privacy notices. Some of the issues with privacy notices include Notice complexity, lack of real choices, notices decoupled from the system collecting data etc. An industry standard for a design approach to privacy notices which includes looking at factors such as the timing of the notice, the channels used for communicating the notices, the modality (written, audio, machine readable, visual) of the notice and whether the notice only provides information or also include choices within its framework, would be of great help. Further, use of privacy by design principles can be done not just at the level of privacy notices but at each step of the information flow, and the architecture of the system can be geared towards more privacy enhanced choices.

[67] http://www.iso.org/iso/big_data_report-jtc1.pdf