Artificial Intelligence (AI) for Development Series

Module on Setting the Stage for AI Governance: Interfaces, Infrastructures, and Institutions for Policymakers and Regulators

July 2018

Work in progress, for discussion purposes
Comments are welcome!
Please send your comments on this paper at: gsr@itu.int by 30 July 2018

This module was prepared by Urs Gasser, Ryan Budish, Amar Ashar, members of the Ethics and Governance of AI initiative by the Berkman Klein Center for Internet & Society at Harvard University and the MIT Media Lab [1], under the direction of the ITU/BDT Regulatory and Market Environment Division, in collaboration with the ITU/BDT Telecommunication Division and under close coordination with the Chief of the ITU/BDT Infrastructure, Enabling Environment, and E-Applications Department. We would like to thank the ITU General Secretariat and the ITU Standardization Bureau for their contributions.

The authors would like to thank Wendy Chu, Elena Goldstein, Aida Joaquin Acosta, Levin Kim, Sean Rail, and Jenna Sherman for their research and writing assistance. Deep appreciation is also expressed to the many individuals who were gracious with their time through participation in the Berkman Klein Center's Global AI Dialogue Series and individual interviews, and whose inputs were incredibly influential to our thinking. In particular we thank Paul Nemitz (Principal Adviser, Directorate-General for Justice and Consumers, European Commission), Gabriele Mazzini (Policy Officer, European Commission), Danil Kerimi (Head of Information Technology and Electronics Industries, World Economic Forum), and Terah Lyons (Executive Director, Partnership on AI).

I. Introduction

This module is one part of a four-part series on AI for Development. The series covers a range of issues relevant to policymakers and regulators as they seek to understand and address the challenges and opportunities of AI technologies. The series covers AI, its potential societal impacts, governance questions, and cybersecurity and Internet of Things issues.

The other modules of the AI for development series make it clear that "AI" is not one thing—it refers to a range of different technologies and applications used in many different ways. The other briefing papers also highlight that we are at different places in our collective empirical and normative understanding of these technologies, their impact on humans and society, and the best ways to deal with the changes ahead. This state of uncertainty is mirrored in the contemporary debates about the governance and ethics of AI, where both public and private sector leaders and experts have many different ideas about how to best limit the risks of these innovative AI applications and help unlock their opportunities.[2] For example, some experts have called for the formation of new regulatory agencies that specialize in AI or robotics.[3] Governments and international organizations have started to create non-binding standards to govern the creation and use of AI.[4] Individual companies are releasing their own ethical guidelines constraining their own use of AI.[5] Multistakeholder partnerships are currently formulating their own best practices for the development and deployment of AI.[6] And academics have created frameworks to ensure that AI training data and outputs are used "for good."[7]

Although there are many proposals for addressing AI's challenges, these efforts do not represent a holistic governance framework ready for application in the real world. Instead, existing proposals are possible building blocks and elements towards a more comprehensive approach. That said, there have been efforts to sketch at a conceptual level what a holistic governance framework for AI might look like. For example, one of the authors of this paper has proposed a layered model for AI governance that describes three layers of different governance approaches: (1) the technical layer – focusing on technical standards

---

[2] Throughout this paper we collectively refer to these opportunities and risks as the "challenges" of AI.

[3] See Ryan Calo, "The Case for a Federal Robotics Commission," *Brookings Institution Center for Technology Innovation,* September 1, 2014, https://ssrn.com/abstract=2529151; Bruce Schenier, "Click Here to Kill Everyone," New York Magazine, January 27, 2017, https://www.schneier.com/essays/archives/2017/01/click_here_to_kill_e.html; European Parliament, "Motion for a European Parliament Resolution: Recommendations to the Commission on Civil Law Rules on Robotics," 2015/2103(INL), January 27, 2017, http://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&mode=XML&reference=A8-2017-0005&language=EN#title1.

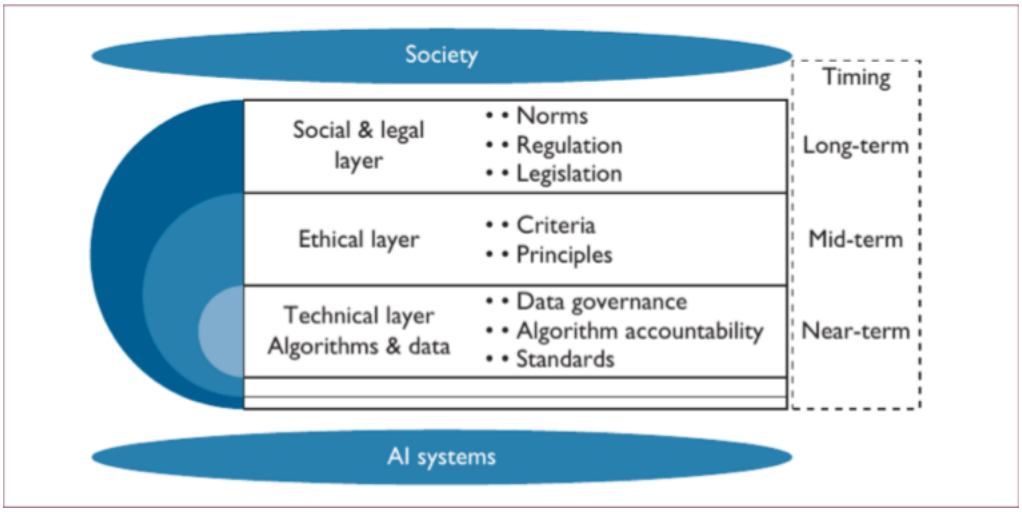
[4] See, for example, "Discussion Paper on Artificial Intelligence (AI) and Personal Data – Fostering Responsible Development and Adoption of AI," Personal Data Protection Commission: Singapore, June 5, 2018, https://www.pdpc.gov.sg/Resources/Discussion-Paper-on-AI-and-Personal-Data; Japan's Institute for Information and Communications Policy (IICP), the Ministry of Internal Affairs and Communications (MIC), "Draft AI R & D Guidelines," July 28, 2017, http://www.soumu.go.jp/main_content/000507517.pdf; IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, Ethically Aligned Design Version 2, 2017, http://standards.ieee.org/develop/indconn/ec/autonomous_systems.html.

[5] Sundar Pichai, "AI at Google: Our Principles," June 7, 2018, https://blog.google/topics/ai/ai-principles/.

[6] See Partnership on AI, https://www.partnershiponai.org.

[7] ITU News, "'Roadmap Zero' to AI and Data Commons," ITU News, May 25, 2018, http://news.itu.int/roadmap-zero-to-ai-and-data-commons/.

and constraints on the collection, use, and management of data by AI algorithms; (2) the ethical layer – focusing on ethical and human rights principles; and (3) the social and legal layer – focusing on creating institutions for regulating autonomous systems.[8]



Credit: Urs Gasser and Virgilio A.F. Almeida (2017)

From this model one can see how existing efforts like those described at the outset, such as Singapore's accountability-based framework, or the IEEE's Ethically Aligned Design Principles, can each play a role in a larger governance framework. However, the envisioned framework is like an evolving library; we know where the books would go, but many of the books are still being written. In addition, a series of structural challenges make it currently difficult (and in our view inadvisable) to build an all-encompassing single AI governance framework:

1. **Unknown societal impact:** Governance frameworks aim to address particular societal problems based on evidence, and yet for most aspects of AI we currently lack a solid empirical understanding of the short- and long-term consequences of the technologies. In many cases, reliable metrics to track societal impacts beyond unemployment and GDP are not readily available—a task that is particularly difficult given the dual-use nature of AI, with a variety of positive and negative impacts.
2. **Undefined questions:** In many areas of application, researchers are still defining some of the "right" questions to be asked. For example, when we look at issues like disinformation or hate speech online and how AI might be used to help counter those challenges, we do not yet even fully understand the scope of the problem. We struggle to answer many foundational questions, such as: How do we define harmful speech or "fake news"? What is the role of platforms in addressing these issues? What level of error are we willing to accept from automated systems that police content online? And what interventions—technological, legal, social, normative or otherwise—will help us address it?

[8] Urs Gasser and Virgilio A.F. Almeida, "A Layered Model for AI Governance," IEEE Internet Computing 21, November, 2017, http://nrs.harvard.edu/urn-3:HUL.InstRepos:34390353, 58-62.

3. **Diversity of frameworks:** AI is not emerging in a total vacuum and is shaped in important ways by existing norms and governance frameworks. For example, medicine, automobiles, and data collection are spaces with complex, local, national, and international governance structures in place that interact with the development and deployment of next generation technology. The EU's recently enacted GDPR, for instance, is not an AI-specific governance framework, but already constrains how data can be collected and used for machine learning.

Given these structural challenges, the quest for a comprehensive and detailed governance framework for AI seems unrealistic—at least for the time being. Instead, we believe that a more productive approach would be to focus on the development of governance elements and strategies and the interplay and interoperability between these building blocks in a layered model. It is in this spirit that this paper offers a set of approaches aimed at assisting policymakers and regulators in building capacity so that they can engage in the shaping and creation of the evolving governance frameworks for AI. This is no small task. For many policymakers and regulators, addressing the challenges of AI may seem daunting in large part because they are complex, fast-moving, and dynamic, and as a result a handful of broad areas of concerns have emerged. Based on formal and informal dialogues at international forums such as the ITU's AI for Good Summit, the Internet Governance Forum, and the Global Summit on AI & Inclusion, as well as the Berkman Klein Center's Global AI Dialogue Series[9], original interviews with leaders and experts in the field, and a review of AI policy materials, four broad areas of concern have crystallized:

1. Increasing information asymmetries: Knowledge about AI is increasingly held within a handful of companies within the private sector, creating knowledge gaps and information asymmetries that challenge policymakers and regulators, who often struggle to keep pace with the latest societal developments and their societal implications, and lack the technological depth to understand the full range of possible approaches and the tradeoffs that they might entail.
2. Inadequacy of unilateral public-sector action: Just as most of the knowledge about AI is held within the private sector, so too is much of the control of the technical development of AI technologies. Even if information asymmetries can be fully bridged, many of the most effective approaches may require private sector participation and support.
3. Exacerbating the digital divide: The digital divide has long been a concern for decisionmakers, and AI is making these concerns ever more pressing, both from an impact and development perspective. From an

Global AI Dialogue Series

Over the last year, the Berkman Klein Center for Internet & Society has convened several workshops with policymakers and a diverse range of stakeholders from around the world as part of the Global AI Dialogue Series. The inclusive series is aimed at identifying opportunities as well as challenges related to AI that need to be addressed from an international perspective through evidence-based dialogue. The Series works to build an institutional knowledge base, foster human capacity, and strengthen interfaces with industry and policy-makers at an international scale. Initial meetings have taken place in the US, Seoul, China, Hong Kong, Switzerland, and Italy, with projected meetings set at this stage for Singapore and Thailand.

[9] See sidebar and Berkman Klein Center for Internet & Society, "Ethics and Governance of Artificial Intelligence Initiative: Research Sprints and Pilots," cyber.harvard.edu, https://cyber.harvard.edu/research/ai/research (accessed May 2, 2018)

impact perspective, AI technologies often require substantial digital infrastructure and data to be effective. This means that areas with the most data and the most robust digital infrastructure will be the first to reap the benefits of these technologies, leaving underresouced, less connected communities even further behind than they are now. And from a development perspective, areas without strong technical capacities (both human and digital) may find it challenging to participate in the global governance dialogue, and to compete with more established market competitors from places like Silicon Valley and China.

4. Creating and maintaining a competitive environment: Because AI is so dependent on data, existing privacy and intellectual property regulations, as well as legal interoperability across jurisdictions, can have outsized impacts on the development of AI technologies. Moreover, existing market incumbents with large amounts of data can leverage those datasets to create lock-in and network effects. The sum effect is that decision makers may struggle to support local entrepreneurial efforts in AI technologies.

These concerns are important and real. Some of these concerns are familiar issues that are exacerbated by new AI technologies, and others are novel concerns emerging from new applications. Either way, there are tools that policymakers and regulators can deploy to address these concerns and ensure fair, accountable, and transparent outcomes.[10] In the remainder of this paper, we go through each of these four areas of concerns and identify some of the many approaches and tools[11] that policymakers and regulators can and should experiment with. This "toolbox" builds upon previous experiences when dealing with disruptive technologies, including the Internet, and the governance challenges those technologies have created.[12] In particular, we offer tools that address each of the following challenges that policymakers and regulators face when addressing AI governance issues:

1. Addressing Information Asymmetries
2. Building Public-Private Partnerships
3. Bridging the Digital Divide
4. Sustaining a Competitive Environment

---

[10] "Discussion Paper on Artificial Intelligence (AI) and Personal Data – Fostering Responsible Development and Adoption of AI," Personal Data Protection Commission: Singapore, June 5, 2018, https://www.pdpc.gov.sg/Resources/Discussion-Paper-on-AI-and-Personal-Data, 5.

[11] Throughout this paper we refer to these as "tools." We recognize, however, that much of what we describe are governance approaches. Many of AIs challenges that policymakers seek to address are closely connected to, or are proxies for, difficult social, economic, and political challenges. As such, there are neither simple fixes nor external solutions that can simply be dropped in.

[12] To be clear, we do not suggest that AI governance will look like Internet governance, but we recognize that because this space is still in flux and because not everything is new, Internet governance and other areas of governance can serve as a source of inspiration when exploring how different tools might be used to address certain challenges.

II. Tools for Addressing Information Asymmetries

Emerging technologies such as AI has the potential for tremendous societal benefits, so long as risks can be managed and mitigated through informed, evidence-based decision making. However, the more complex the technology, the harder it can be for regulators and policymakers to understand the potential impacts of the technology and the potential ramifications (both intended and not) of any proposed policy intervention. This is particularly true with AI, where even technical experts struggle to fully explain the inner workings of their systems.[13] [14] Moreover, much of the expertise that exists about AI has been consolidated into the hands of a small group of companies, further exacerbating the difficulty that policymakers face when trying to craft informed policies. This challenge is one of information asymmetries -- a growing imbalance of foundational knowledge between the private and public sectors that is particularly acute for AI technologies.

Although information asymmetries are stark with respect to AI, such asymmetries are a fundamental challenge for regulators and policymakers seeking to address the challenges of any complex technology. For example, policymakers have frequently struggled to overcome information asymmetries regarding cybersecurity and encryption. Cryptography is a complex mathematical field, and encryption is increasingly important in a range of technologies.[15] For that reason, even well-informed policy makers can struggle to predict the impacts of encryption policies.[16] For example, two months after the 2016 San Bernardino shooting, two US Senators proposed legislation that would have effectively banned the distribution of secure web browsers.[17]

Just as policymakers must address information asymmetries to craft effective encryption policies, so too must they bridge information asymmetries in order to craft effective artificial intelligence policies. For example, policymakers with a limited understanding of how machine learning applications can reinforce existing societal biases may disproportionately rely on AI to solve difficult societal issues, such as the

---

[13] Will Knight, "The Dark Secret at the Heart of AI," *MIT Technology Review*, April 11, 2017, https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/.
[14] David Weinberger, "Our Machines Now Have Knowledge We'll Never Understand," *Wired Magazine,* April 18, 2017, https://www.wired.com/story/our-machines-now-have-knowledge-well-never-understand/.
[15] OECD, "OECD Guidelines for Cryptography Policy," OECD.com, https://www.oecd.org/sti/ieconomy/guidelinesforcryptographypolicy.htm (Accessed May 2, 2018)
[16] Ryan Budish, Herbert Burkert , Urs Gasser, "Encryption Policy And Its International Impacts: A Framework For Understanding Extraterritorial Ripple Effects," Hoover Institution, March 2, 2018, https://www.hoover.org/research/encryption-policy-and-its-international-impacts.
[17] Andy Greenburg, "The Senate's Draft Encryption Bill Is 'Ludicrous, Dangerous, Technically Illiterate,"' *Wired Magazine*, April 8, 2016, https://www.wired.com/2016/04/senates-draft-encryption-bill-privacy-nightmare/.

prevalence of pre-trial detention in the criminal justice system,[18] [19] and unintentionally make things worse, not better.

Guiding Principles

Policymakers and regulators need not become technical experts in AI, but it is important to work to reduce information asymmetries. In that process there are a few high level principles that can guide policymakers and regulators:

- **Create compelling opportunities for experts to join government.** AI expertise is incredibly valuable within the private sector, making it cost prohibitive for governments to compete outright for hiring such experts. Governments are unable to compete with the salaries or earning potential available from large technology companies or innovative startups. However, policymakers and regulators can offer short-term appointments or "tours of duty" that appeal to civic responsibility, rather than competing outright with the private sector.
- **Reduce participatory friction for experts.** Technical experts are often unfamiliar with bureaucratic and government processes, and short-term appointments do not afford the opportunity to learn how to effectively advocate within these systems. Instead of asking AI experts to operate within existing, complex bureaucratic structures, policymakers and regulators can create positions that operate outside of traditional bureaucratic structures, such as Chief Innovation Officer roles that report directly to the agency heads, so that technical experts can influence AI governance without needing to first learn how to navigate governmental institutions.
- **Obtain hands-on experiences with AI technologies.** There is no substitute for hands-on experience. Through building AI technologies in-house, visiting AI labs and businesses (both local and in other countries), and testing products, policymakers and regulators will learn about the way AI technologies are being developed and applied, and how they might evolve in the future.

In putting these principles into action, there are a range of tools that policymakers and regulators can deploy to narrow the information gap--some more general to emerging technologies,[20] and some specific to AI.[21] In particular, policymakers and regulators can bridge the knowledge gaps between governments and the private sector by (1) building internal capacity and (2) developing knowledge exchange interfaces between regulators and experts. Below, we explore some specific approaches for both.

(1) Building Internal Capacity

---

[18] Julia Angwin, Jeff Larson, Surya Mattu and Lauren Kirchner, "Machine Bias," *ProPublica*, May 23, 2016, https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing.

[19] Megan Stevenson, Assessing Risk Assessment in Action, George Mason Law & Econ. Research Paper №17–36, 2017, https://ssrn.com/abstract=3016088.

[20] For example, given the close relationship between cloud computing and big data, on the one hand, and AI on the other, some of the same approaches that policymakers have used to close the information gaps with respect to big data and cloud computing are equally applicable for AI. See Urs Gasser and David O'Brien, "Governments and Cloud Computing: Roles, Approaches, and Policy Considerations," Berkman Klein Center for Internet & Society, March 17, 2014, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2410270.

[21] For example, the challenges of AI interpretability may necessitate some new approaches to bridging information asymmetries. See Finale Doshi-Velez, Mason Kortz, etc, "Accountability of AI Under the Law: The Role of Explanation," Berkman Klein Center for Internet & Society, April 13, 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3064761.

One way for policymakers and regulators to bridge information gaps is to bolster the technical expertise within government. This brings technical expertise in-house to policymakers and regulators to work side-by-side with policymakers and regulators in crafting policies and interventions, and can help reduce bureaucratic frictions. This kind of capacity development can occur at the individual layer, through special hiring and recruitment processes, or at the institutional layer, through creating and utilizing expertise across government agencies and departments.

(a) **Recruiting Individual Expertise**. At the individual layer, policymakers and regulators can attract AI experts to government by creating and funding more job positions, supporting residency programs that temporarily place technical experts within the government[22], and partnering with universities to create public sector employment pipelines for aspiring experts.[23] It is difficult to compete with the private sector, given the high salaries that AI experts can expect, but creating special temporary positions can appeal to policy-minded technical experts. For example, several United States regulatory agencies have experimented with creating positions like "Chief Technology Officer"[24] or "Chief Innovation Officer"[25] in order to attract experts with diverse backgrounds in security, telecommunications, privacy, and Internet governance. And programs like the Presidential Innovation Fellows Program and the U.S. Digital Service are designed to attract software engineers, designers, and product managers to perform "tours of duty" within government agencies.[26]

In some cases individual expertise may already exist internally, and simply needs to be activated through the creation of systems that identify employees with relevant technical skills and empower them to more fully engage in the governance process. For example, the World Bank created the SkillFinder network to help employees find technical and other experts from within its 27,000 employees, consultants, and alumni.[27] The United States Department of Health and Human Services took a similar approach in order to better utilize employees' technical expertise for medical device safety review panels in order to speed up approval processes.[28]

(b) **Building Institutional Expertise.** At the institutional level, capacity building can involve better connecting policymakers and regulators with the expertise and knowledge that exists in silos

---

[22] Examples include the Presidential Innovation Fellows Program, etc., see IEEE, "Artificial Intelligence Research,Development and Regulation", IEEEUSA.org, https://ieeeusa.org/wp-content/uploads/2017/10/AI0217.pdf, p. 5 (Accessed May 2, 2018)

[23] Examples include the Data Science for Good Program at the University of Chicago.

[24] See Neil Chilson's biography, Lorrie Faith Cranor's biography, and Latanya Sweeny's biography.

[25] US Commodity Futures Trading Commission, "The CFTC Announces Appointment of John Rogers as Chief Information Officer," CFTC.gov, September 6, 2011, https://www.cftc.gov/PressRoom/PressReleases/pr6106-11 and U.S. Department of Transportation. "J. Christian Gerdes biography," Volpe.dot.gov, https://www.volpe.dot.gov/events/chris-gerdes-biography (Accessed May 2, 2018).

[26] Presidential Innovation Fellows, "About," Presidential Innovation Fellows, https://presidentialinnovationfellows.gov/about/ (Accessed May 2, 2018); U.S. Digital Service, "Join," USDS.gov, https://www.usds.gov/join#who (Accessed May 2, 2018).

[27] GovLab, "Smarter State Case Studies: The World Bank: Skillfinder," thegovlab.org, February 10, 2016, http://www.thegovlab.org/static/files/smarterstate/skillfinder.pdf.

[28] GovLab, "Health And Human Services: HHS Profiles," thegovlab.org, February 10, 2016, http://www.thegovlab.org/static/files/smarterstate/HHS.pdf.

within other parts of government. For example, the United Kingdom Cabinet Office created open standard principles for common and secure information technology infrastructure[29] in order to promote data standardization practices to make data transfers more efficient and useful, enabling policymakers and regulators to take advantage of knowledge from across government and reducing frictions for data exchange.[30] Institutional expertise can also exist in peer agencies in other countries. For example, the International Development Research Centre recently held a research capacity mentorship and workshop program to facilitate ICT scholarship in the Global South.[31]

In some cases the demand for expertise may be so great that policymakers and regulators need to pool together expertise through establishing institutions to house specialized professionals. This can counter the fragmentation that can occur with overlapping agency jurisdiction, preempt political battles for turf, and attract new specialized talent.[32] For example, the European Data Protection Supervisor is an independent supervisory authority bringing together lawyers, IT specialists and administrators to advance privacy and data protection in the EU.[33]

(2) Developing Knowledge Exchange Interfaces With Experts

Policymakers and regulators can also address information asymmetries by establishing ongoing interfaces with experts, which can supplement or replace the need to hire experts. By engaging academic and industry experts, policymakers and regulators can leverage external expertise and gain increased experience with AI technologies.

(a) Leveraging academic expertise. Through the support of academic research centers and research projects, policymakers and regulators can address specific knowledge gaps while building a pipeline of expertise. For example, the April 25, 2018 Communication on Artificial Intelligence, the EU announced a EUR 2.7 billion investment in "market-creating innovation such as AI"

---

[29] See UK Government, "UK open standard principles," UK.gov, April 5, 2018 https://www.gov.uk/government/publications/open-standards-principles.

[30] Interagency data-sharing allows employees with different subject-matter expertise to collaborate on overlapping jurisdictions. In order to facilitate these partnerships, governments should develop a mechanism for agencies to dictate the reach and limits of their partnerships. For example, data-sharing can be facilitated by Memoranda of Understanding; the FTC and the Federal Communications Commission used a Memorandum of Understanding to share Internet Freedom consumer complaints subject to the agencies' confidentiality policies. See FTC, "FTC, FCC Outline Agreement to Coordinate Online Consumer Protection Efforts Following Adoption of The Restoring Internet Freedom Order," FTC.gov, December 11, 2017, https://www.ftc.gov/news-events/press-releases/2017/12/ftc-fcc-outline-agreement-coordinate-online-consumer-protection.

[31] International Development Research Centre, "Research Capacity Peer Mentorship Program: Case Study on the ICT and Development Conference," IDRC.ca, https://www.idrc.ca/en/project/research-capacity-peer-mentorship-program-case-study-ict-and-development-conference (Accessed May 2, 2018).

[32] Because of the effect of AI on a myriad fields, there is more potential for fragmented jurisdiction. In the United States, for example; at least sixteen federal agencies govern sectors related to AI.

[33] EU, "About: European Data Protection Supervisor," Europa.eu, https://edps.europa.eu/about-edps_en (Accessed May 2, 2018). In a similar manner, the Brookings Institute has called for a U.S. Federal Robotics Commission to combine the efforts of the National Highway Traffic Safety Administration, the National Aeronautics and Space Administration, the Food and Drug Administration, and various other bodies. See Ryan Calo, "The case for a federal robotics commission," Brookings Institute, September 15, 2014, https://www.brookings.edu/research/the-case-for-a-federal-robotics-commission/.

through the European Innovation Council.[34] Similarly, the EU is supporting AI excellence centers to facilitate academic collaboration on AI. In the cybersecurity space, the US has leveraged academic expertise through national security-focused university research projects like START and CERT,[35] which have advanced research in the areas of cybersecurity and terrorism while creating "a pipeline of approximately 30,000 data experts."[36]

(b) Activating stakeholder expertise. Expertise may also exist outside of academia, in civil society organizations, the private sector and others. Through both on-going and more time-limited engagements, policymakers and regulators can also leverage the expertise throughout these other organizations. For example, the European Parliament launched a three-month public consultation process about the future of robotics and artificial intelligence; 298 individuals, organizations, and corporations answered general[37] and specialized[38] questionnaires about rules on ethics, liability rules, safety and security, and institutional coordination and oversight.[39] Similarly, the White House AI Workshop Series invited experts to contemplate safety and control, legal issues, and social good in events all over the United States. The series informed the preparation of the National Science and Technology Council's report on the future of AI.[40]

Ongoing collaborations between policymakers and external experts are also possible; although they require greater commitments from the participants, they reservoir of trust established over time can help address more complex questions. For example, from 2010 to 2013 Germany formed an Enquete Commission, consisting of politicians and technical experts to inform its Internet policy decisions.[41] Similarly, the European Commission's GEAR 2030 high-level group convened member states, industry groups, civil society organizations, and various observers to set

---

[34] "Artificial intelligence: Commission outlines a European approach to boost investment and set ethical guidelines," European Commission, April 25, 2018, http://europa.eu/rapid/press-release_IP-18-3362_en.htm.
[35] National Consortium for the Study of Terrorism and Responses to Terrorism, "START," University of Maryland, http://www.start.umd.edu/about/about-start; "The CERT Division," Carnegie Mellon University, https://www.sei.cmu.edu/about/divisions/cert/index.cfm.
[36] Joel Tito, "Destination unknown:Exploring the impact of Artificial Intelligence on Government," Center for Public Impact, September 2017, https://publicimpact.blob.core.windows.net/production/2017/09/Destination-Unknown-AI-and-government.pdf, p.58.
[37] See example of a general questionnaire: European Parliamentary Research Service, European Added Value Unit, "General Questionnaire Civil Law: Rules on Robotics," Committee on Legal Affairs of the European Parliament, April 2017, http://www.europarl.europa.eu/cmsdata/committees/juri-public-consultation/civil-law-rules-on-robotics/general_questionnaire.pdf.
[38] See example of specialized questionnaire: European Parliamentary Research Service, European Added Value Unit, "General Questionnaire Civil Law Rules on Robotics," Committee on Legal Affairs of the European Parliament, April 2017, http://www.europarl.europa.eu/cmsdata/committees/juri-public-consultation/civil-law-rules-on-robotics/specialised_questionnaire.pdf.
[39] "Public consultation – Future of Robotics and Artificial Intelligence," European Parliament Committees, March 22, 2017, http://www.europarl.europa.eu/committees/en/juri/robotics.html?tab=Introduction.
[40] Ed Felton, "Preparing for the Future of Artificial Intelligence," Obama White House Archives, May 3, 2016, https://obamawhitehouse.archives.gov/blog/2016/05/03/preparing-future-artificial-intelligence.
[41] Urs Gasser, Ryan Budish, and Sarah Myers West, "Multistakeholder as Governance Groups: Observations from Case Studies," Berkman Klein Center for Internet & Society, January 15, 2015, https://cyber.harvard.edu/publications/2014/internet_governance.

objectives, specify milestones, and assign responsibilities to "reinforce the competitiveness of the European automotive value chain."[42]

1. Addressing Information Asymmetries
2. **Building Public-Private Partnerships**
3. Bridging the Digital Divide
4. Sustaining a Competitive Environment

III. Tools for Building Public-Private Partnerships

Even where policymakers and regulators can bridge information asymmetries, developing effective governance approaches for AI's challenges will often require private sector and civil society participation and support. AI technologies are increasingly embedded within many sectors of society, and its impacts are widespread and deep, posing difficulties for policymakers and regulators seeking to intervene. Consider for example, autonomous vehicles. The potential impacts of autonomous vehicles include: passenger safety, public safety, traffic, automobile manufacture and sales, the environment, labor markets, and more. The sheer variety of AI's potential impacts require solutions that include span a variety of perspectives and expertise: technical, social, political, and economic, among others. Moreover, even if policymakers and regulators could navigate these diverse perspectives, addressing some of these impacts may be most effectively addressed by the private sector or others outside of government.

Building effective multistakeholder governance groups is not easy. Bringing together these diverse perspectives is important, but utilizing these perspectives to create effective governance strategies requires more than just placing people into a room. Bridging the gap between different sectors, experiences, norms, and cultures is complex because stakeholders may come to the table without a shared, common language about AI technologies or governance, with different levels of comfort with AI technologies, with different levels of resources available to invest in governance processes, or with a lack of trust.

The design of effective multistakeholder systems is challenging and is a rich and deep field of study.[43] AI is particularly challenging, because as an academic field AI has existed for over 50 years, which can make it difficult to bring new perspectives and disciplines to the AI conversation, because trust and intellectual depth may be missing. That said, there a variety of tools that policymakers can use to strengthen the connections between the public and private sectors.

Guiding Principles

- **Develop a terminology, shared across all stakeholders.** A major challenge for both describing the challenges of AI and for developing shared solutions is that there's no common language across stakeholders. World like "Rules" and "function," for example, mean very different things

[42] "Policy and strategy: High Level Group on Automotive Industry 'GEAR 2030,'" European Commission, February 5, 2019, https://ec.europa.eu/growth/sectors/automotive/policy-strategy_de.
[43] See, e.g., Urs Gasser, *et al,* "Multistakeholder as Governance Groups."

to a computer scientist than to a regulator. Fundamental assumptions about meaning must be scrutinized and challenged until all stakeholders can participate equally in discussing the challenges and developing solutions.

- **Take advantage of being a second (or third, or fourth, or…) mover.** AI is operating at different timescales around the world. This means that the pressing issues facing some regulators and policymakers today may seem like distant science fiction to others. This can be a distinct advantage for those who need not act immediately; as AI becomes more prevalent, such policymakers and regulators should actively learn from the experiences of both the public and private sector actors who have faced similar challenges previously. What worked in one country or region is unlikely to play out in the exact same way in another, but important lessons can still be learned through ongoing dialogue with businesses and policymakers who have grappled with similar challenges.
- **Keep an open door and an open mind.** When it comes to AI, no one understands all of the problems, let alone all of the solutions. Hearing from as many perspectives as possible will expose policymakers and regulators to issues that may not have been on their radar and creative solutions they may not have tried otherwise. And some of these solutions may not require law or regulation.

In putting these principles into action, there are a range of tools that policymakers and regulators can deploy to engage with diverse stakeholders in advancing AI governance. For example, policymakers and regulators can (1) incubate and engage in multistakeholder systems, (2) solicit public feedback on policies, and (3) utilize diverse forums as platforms for information exchange.

(1) Incubate and engage in multistakeholder systems

One way for policymakers and regulators to engage stakeholders is through either creating or engaging in multistakeholder systems. These can be either AI specific or based on a broader set of topics that encompass AI. In either case, these systems provide opportunities for policymakers, regulators, the private sector, and civil society to share and learn about emerging technologies, develop a common language, and build trust. AI-specific systems in particular can be effective in helping educate stakeholders, including policymakers and regulators about the current state of AI technologies, can help to articulate solutions to complex problems, and can help to develop synergies among different initiatives that aim at solving related issues.

(a) AI-specific Multistakeholder Systems. Participation in multistakeholder systems can be an effective way for policymakers and regulators to stay abreast of state-of-art AI issues.[44] Through sustained dialogue with the private sector, policymakers and regulators can learn about emerging AI applications. And through sustained dialogue with civil society and academics, policymakers and regulators can hear about societally beneficial AI applications, as well as emerging concerns.

[44] See National Science and Technology Council, Committee on Technology, "Preparing for the Future of Artificial Intelligence," Executive Office of the President, October 2016, https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf. The White House recommended that industry work with government to keep it updated on the general progress of AI.

For example, the Partnership on AI, originally formed by several technology companies, now includes academics and civil society organizations such as Human Rights Watch.[45] The Partnership serves as an open platform to educate its partners and advance the public understanding of AI, while supporting research, testing on AI tech, addressing privacy, transparency, security, and ethics concerns. Similarly, the World Economic Forum's Artificial Intelligence and Machine Learning Project, seeks to support governments, industry, and academia in co-developing policy frameworks to govern AI, that will help to test theories, extract lessons and scale their adoption globally.[46]

Multistakeholder systems can also help policymakers and regulators avoid duplicating existing efforts by coordinating across the myriad of AI-specific initiatives that have emerged over recent years. A recent example of this is the European AI-on-demand-platform[47] which aims to enhance the economic and social potential of AI by building synergies among the existing AI initiatives in the EU. The European AI-on-demand-platform aims at activating the AI community in Europe, serving as a hub of AI-related knowledge and tools, promote the integration of AI into applications, and facilitate access to data needed by AI algorithms.[48]

(b) Broad-Based Multistakeholder Systems. Because the impacts of AI are so widespread and diffuse, participation in more general multistakeholder systems can also help policymakers and regulators explore and respond to AI technologies' impacts.[49] For example, the Missing Maps project[50] of the Multi-stakeholder Forum on Science, Technology, and Innovation (STI) for the Sustainable Development Goals[51] at the United Nations, uses crowdsourcing to add missing areas

---

[45] See "Thematic Pillars," Partnership on AI, https://www.partnershiponai.org/thematic-pillars/. The Partnership was founded by major tech companies (Amazon, Apple, DeepMind, Google, IBM, Facebook, and Microsoft) and includes public and private partners, such as AI Now, ACLU, Amnesty International, Center for Democracy and Technology, Universities of Princeton University, University of Washington, Tufts University, UNICEF, Data and Society, Upturn, Open AI, and Humans Right Watch. The list of the initiatives the Partnership wants to address includes safety-critical AI; Fair, Transparent, and Accountable AI; and collaborations between people and AI systems.

[46] "Center for the Fourth Industrial Revolution: Projects," World Economic Forum, https://www.weforum.org/center-for-the-fourth-industrial-revolution/areas-of-focus.

[47] "Horizon 2020 - Work Programme 2018-2020 Information and Communication Technologies," European Commission, January 31, 2018, http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-leit-ict_en.pdf,. 55-56.

[48] "The European Artificial Intelligence-on-demand-platform - Information day and brokerage event," European Commission, December 5, 2017, https://ec.europa.eu/digital-single-market/en/news/european-artificial-intelligence-demand-platform-information-day-and-brokerage-event.

[49] For more on the widespread impacts of AI technologies, see "Artificial Intelligence & Inclusion," ITS Rio, *et al*, https://aiandinclusion.org (last accessed May 2, 2018).

[50] "Missing Maps: crowdsourcing digital map creation," Global Innovation Exchange in collaboration with the United Nations, http://stisolutions4sdgs.globalinnovationexchange.org/innovations/missing-maps-crowdsourcing-digital-map-creation

[51] See "Multi-stakeholder Forum on Science, Technology and Innovation for the SDGs (STI Forum), 2017," STI Forum, https://sustainabledevelopment.un.org/TFM/STIForum2017. The STI Forum's objective is to facilitate discussions and multistakeholder partnerships to identify technology needs and to help transferring relevant technology for the Sustainable Development Goals. This platform is open to member states, UN organizations, civil society, academia, industry and private sector. The UN Inter-Agency Task Team on STI for SDGs (IATT) prepares

to maps so that governments and humanitarian organizations have accurate data during natural disasters or epidemics. Although not explicitly an AI issue, map data is critical to many AI technologies.[52]

Additionally, because many AI challenges will require solutions that span sectors and fields, broad-based multistakeholder systems can help ensure that the comprehensive solutions can be both developed and implemented with the support of all stakeholders. For example, the National Telecommunications and Information Administration (NTIA) has led several multistakeholder processes to help with a variety of complex challenges spanning cybersecurity,[53] unmanned aircraft systems,[54] Internet of Things,[55] and facial recognition technologies,[56] with the objective of developing best practices around those challenges.

(2) Soliciting Public Feedback on AI Policies

Another way that policymakers and regulators can engage diverse stakeholders on AI policies is through open calls for public feedback and dialogue about specific policy proposals. Such an approach can be particularly helpful in building trust between stakeholders and establishing legitimacy around proposed solutions. For example, when Brazil was considering the Marco Civil, an Internet civil rights frameworks, they used a variety of online tools between October 2009 to May 2010 to create a space for public consultation. Politicians, academics, artists, NGOs, private sector companies, individuals, and other stakeholders used online tools to blog, comment on, and debate the proposed legislative text.[57] Because of the openness of the process and the impact that stakeholder impacts had on the final text of the legislation "most stakeholders saw it as a uniquely legitimate piece of law."[58]

---

the work of the STI Forum by working with representatives from civil society, private sector and scientific community.

[52] Mimi Onouha, "Side-by-side images expose a glitch in Google's maps," Medum, June 6, 2017, https://qz.com/982709/google-maps-is-making-entire-communities-invisible-the-consequences-are-worrying.

[53] "Multistakeholder Process: Cybersecurity Vulnerabilities," National Telecommunications and Information Administration, December 15, 2016, https://www.ntia.doc.gov/other-publication/2016/multistakeholder-process-cybersecurity-vulnerabilities.

[54] "Multistakeholder Process: Unmanned Aircraft Systems," National Telecommunications and Information Administration, June 21, 2016, https://www.ntia.doc.gov/other-publication/2016/multistakeholder-process-unmanned-aircraft-systems.

[55] "Multistakeholder Process; Internet of Things (IoT) Security Upgradability and Patching," National Telecommunications and Information Administration, November 7, 2017, https://www.ntia.doc.gov/other-publication/2016/multistakeholder-process-iot-security.

[56] "Privacy Multistakeholder Process: Facial Recognition Technology," National Telecommunications and Information Administration, June 17, 2016, https://www.ntia.doc.gov/other-publication/2016/privacy-multistakeholder-process-facial-recognition-technology.

[57] See, e.g., Urs Gasser, *et al*, "Multistakeholder as Governance Groups."

[58] Carolina Rossini, Francisco Brito Cruz and Danilo Doneda, "The Strengths and Weaknesses of the Brazilian Internet Bill of Rights: Examining a Human Rights Framework for the Internet," Centre for International Governance Innovation and the Royal Institute of International Affairs, September 2015, https://www.cigionline.org/sites/default/files/no19_0.pdf, 7.

(3) Utilizing Diverse Forums for Information Exchange

Finally, there are numerous international forums that policymakers and regulators can utilize in order to learn from the experiences of peers who are struggling to address many of the same challenges. Policymakers and regulators can use these venues to learn from others' best practices around AI governance and identify areas where additional research or dialogue is needed. For example, the ITU's Global Symposium for Regulators (GSR) brings together the leaders of national telecommunication and information communications technologies regulatory authorities in order to share experiences and best practices regarding key regulatory challenges.[59] The World Summit on the Information Society is a multistakeholder platform for discussing ICT development.[60] And the Internet Governance Forum (IGF) is a UN-organized event that fosters dialogue around a variety of policy issues relating to Internet governance. These events are designed to foster dialogue, not implement solutions. While the IGF in particular has been criticized for being nothing more than a "talk shop," such information exchanges can be invaluable opportunities to learn from peers, particularly on emerging and complex technical issues.[61]

IV. Tools for Bridging the Digital Divide

Despite the opportunities AI technologies may offer, there is a real risk that—without thoughtful intervention—they may in fact exacerbate structural, economic, social, and political imbalances, and further reinforce entrenched inequalities. For regulators and policymakers around the world, uneven access to technology remains a major concern because of its potential impacts on social and economic inequality.[62] Although AI technologies can have global impacts, development has often been limited both geographically and sectorally, with a small number of companies driving forward these technologies with little input from different industries, disciplines, social classes, cultures, and countries. For that reason, there is a risk that increased reliance on AI may have unintended consequences that aggravate current disparities, particularly in countries that rely on industries at risk of being automated.[63] However, with

[59] "Global Symposium for Regulators," International Telecommunications Union, https://www.itu.int/en/ITU-D/Conferences/GSR/Pages/GSR.aspx.
[60] WSIS Forum 2018 (last visited June 15, 2018), https://www.itu.int/net4/wsis/forum/2018/.
[61] See, e.g., "Center for Democracy & Technology comments on IGF Istanbul and the future of the IGF," Center for Democracy & Technology, https://cdt.org/files/2014/10/CDT-comments-on-IGF-Istanbul-and-future-of-the-IGF.pdf.
[62] "ITU releases 2017 global information and communication technology facts and figures," ITU News, July 31, 2017, http://news.itu.int/itu-releases-2017-global-information-and-communication-technology-facts-and-figures/.
[63] Florence Jaumotte, Subir Lall, and Chris Papageorgiou, "Rising Income Inequality: Technology, or Trade and Financial Globalization?" International Monetary Fund, July 2008, https://www.imf.org/external/pubs/ft/wp/2008/wp08185.pdf, 16 ("[F]or economies that rely on low-skilled labour, automation could challenge their competitive advantage in the global labour market and exacerbate local unemployment challenges, impacting economic development.").

the help of strategic policies, AI technologies might be harnessed to overcome the persistent challenges posed by unequal access.

The use of AI to develop solutions to address inequalities is promising but also raises novel challenges for policymakers and regulators. For example, many companies are working to use AI and machine learning to provide alternative credit scoring to the unbanked in developing countries, using data gathered from cell phone usage to assess credit-worthiness.[64] While this has the potential to facilitate access to credit for many individuals, the quality of the input data depends on existing infrastructure, digital literacy, and cultural practices underlying cell phone usage. Innovative applications of AI technologies, such as alternative credit scoring, will inherit both the old challenges of the digital divide, such as disparities in digital infrastructure and technological literacy,[65] and face AI-specific challenges, such as a lack of representative data sets.[66]

Guiding Principles

Bridging the digital divide is not a new challenge for policymakers and regulators, but increased reliance on AI creates a greater sense of urgency. In prioritizing areas of focus, there are a few high-level principles that can guide policymakers and regulators:

- **Do not simply accept the status quo.** AI technologies may offer tremendous economic opportunities to entrenched, incumbent companies, just as they might reinforce existing biases and power relationships. But in this period of technological disruption, policymakers and regulators do not need to accept the status quo. Regulators and policymakers are in a privileged position to nudge how the power and economic gains of AI are shared.
- **Prioritize broad-based access to technology.** AI technologies are exacerbating existing needs for computers, broadband Internet, and data. In addressing these needs, policymakers and regulators should take an inclusive approach. For example, AI may have important implications for crop yields and resiliency, so policies that work to foster entrepreneurial ecosystems, such as funding for incubators, should consider regions beyond urban centers. Equity should be considered at every step: ICT regulators can work to close the digital divide by prioritizing equal access to a broad set of technologies with every policy decision.
- **Focus on entrepreneurship and innovation, not AI.** AI is simply one tool--one of many--that innovative companies will apply to build the next generation of new industries and jobs. Everything from intellectual property laws, the legality of non-compete agreements, educational

---

[64] Catherine Cheney, "How alternative credit scoring is transforming lending in the developing world," Devex, September 8, 2016, https://www.devex.com/news/how-alternative-credit-scoring-is-transforming-lending-in-the-developing-world-88487.

[65] Ben Shenglin, Felice Simonelli, Romain Bosc, Ruidong Zhang, and Wenwei Li, "Digital infrastructure: Overcoming Digital Divide in Emerging Economies," G20 Insights by Kiel Institute for the World Economy, January 15, 2018, http://www.g20-insights.org/policy_briefs/digital-infrastructure-overcoming-digital-divide-emerging-economies/. "[W]ithout proper education and skill training, the potential of digital technology cannot be fully tapped."

[66] See Emmanuel Letouzé, "Big Data for Development: Challenges & Opportunities," UN Global Pulse, Executive Office of the Secretary-General United Nations, May 2012, http://www.unglobalpulse.org/sites/default/files/BigDataforDevelopment-UNGlobalPulseJune2012.pdf, 42 (highlighting the challenges of using big data for development); Algorithmic Justice League, "Algorithmic Justice League," Algorithmic Justice League, https://www.ajlunited.org (highlighting bias in ML data sets).

opportunities, broadband access and more can affect innovation and entrepreneurship. The challenge for policymakers and regulators is that some of these factors may not be within their jurisdiction, and others may require significant financial investments, so cooperation and partnerships will be key.

In order to apply these principles into everyday practice, policymakers can work to close the digital divide by (1) supporting buildout of physical infrastructure, (2) supporting local ecosystems of entrepreneurship and start-ups, and (3) supporting capacity development at universities and through other training systems.

(1) Supporting Buildout of Physical Infrastructure

Disparities in the physical access to Internet infrastructure are a central source of the digital divide.[67] Because of the amount of data that many AI technologies require, the quality of digital infrastructure may impact the speed at which AI technologies can be deployed. For example, because a single autonomous vehicle will produce an estimated 4 terabytes of data every 90 minutes, AV systems rely on robust broadband Internet infrastructure.[68] Beyond broadband infrastructure, AI will also demand robust cloud capacity, electricity, and more. Creating this infrastructure will place significant demands on both private industry and the public sector. In working toward this infrastructure, policymakers and regulators will need to consider both funding and security:

V. **Infrastructure funding**. Direct investment can take several forms. One way is for the public sector to bear the brunt of the costs. Although it can be a risky and capital-intensive approach, because decisions are not driven by profit motives, policymakers and regulators can ensure that infrastructure is deployed in a manner that benefits all citizens, and can yield cheaper, higher-quality service than is available from the private sector. For example, when major telecommunications companies refused to provide broadband service to the town of Concord, Massachusetts, the town developed its own service at a cost of USD $3.9 million, which has begun to generate revenue for the town.[69] Such investments can be made easier when combined with other government infrastructure projects such as roads and electric improvement.[70] The other extreme is that the private sector can bear the brunt of costs, which

[67] See ITU, "Final Report: World Telecommunications Development Conference (WTDC-17)," 2018, https://www.itu.int/en/ITU-D/Conferences/WTDC/WTDC17/Documents/WTDC17_final_report_en.pdf; Calestous Juma, "How Can Africa Master the Digital Revolution?" Belfer Center for Science and International Affairs/World Economic Forum, April 1, 2016, https://www.belfercenter.org/publication/how-can-africa-master-digital-revolution. "Africa lags behind other regions in its use of core digital platforms such as the internet," partly due to the high prices for broadband resulting from undeveloped digital infrastructure." See also "2016 Broadband Progress Report," Federal Communications Commission, January 29, 2016, https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report. More than 34 million American still lack access to high-speed internet connectivity, 23 million of which are in rural areas.

[68] Kathy Winter, "For Self-Driving Cars, There's Big Meaning Behind One Big Number: 4 Terabytes," Intel Newsroom, April 14, 2017, https://newsroom.intel.com/editorials/self-driving-cars-big-meaning-behind-one-number-4-terabytes.

[69] David Talbot, Waide Warner, Susan Crawford, Jacob White, "Citizens Take Charge: Concord, Massachusetts, Builds a Fiber Network," Municipal Fiber Project, February 2017, https://dash.harvard.edu/bitstream/handle/1/30201055/2017-01_broadband.pdf?sequence=5.

[70] See UNESCAP, "A Study on Cost-Benefit Analysis of Fibre-Optic Co-Deployment with the Asian Highway Connectivity," Asia Pacific Information Superhighway (AP-IS) Working Paper Series, April 2018,

limits the ability of regulators and policymakers to exert influence over the way infrastructure is distributed. That said, policymakers and regulators do have some levers of influence, in particular when they can attach conditions through competitive bidding processes. For example, when Brazil auctioned off high-value LTE spectrum assignments in 2012, it tied ownership rights to rural coverage obligations.[71] Such conditions, however, must be carefully balanced so as not to deter the investments in the first place. For example, after a history of successful spectrum auctions, India had challenges selling off spectrum allocated for auction due to setting auction prices above well above market values in 2016.[72]

In between those extremes is the use of public-private partnerships (PPPs) to share both the burdens and benefits of digital infrastructure investments. Mats Granryd, Director General of the GSMA has stressed the important of PPPs for bridging the digital divide, noting that "it is more important than ever that governments and industry work together to ensure that all citizens benefit from this new era of hyper-connectivity."[73] Facilitating these partnerships sometimes requires legal and policy changes. For example, in 2005 Nigeria passed the Infrastructure Concession Regulatory Commission (ICRC) Act, and in 2009 approved the National Policy on PPPs, which together set clear guidelines for "project identification, evaluation, and selection," as well as "procurement, operation, maintenance, and performance monitoring."[74] While adopting of PPPs was slow in Nigeria,[75] this legislation has led to a rise in ICT PPPs in Nigeria over time.[76] Similarly, the World Economic Forum has launched the Internet for All initiative, aiming to bring Internet connectivity to 75 million people in Africa's Northern Corridor, and represents a collaboration between industry and the countries of Ethiopia, Kenya, Rwanda, South Sudan, and Uganda.[77]

---

http://www.unescap.org/sites/default/files/Cost-benefit%20analysis%20of%20fOC%20with%20Asian%20Highway.pdf, 10.

[71] "Delivering Digital Infrastructure Advancing the Internet Economy," World Economic Forum and Boston Consulting Group, April 2014, http://www3.weforum.org/docs/WEF_TC_DeliveringDigitalInfrastructure_InternetEconomy_Report_2014.pdf, 42.

[72] Salman SH, "2016 Spectrum Auction ends: Rs 65,789 Cr in bids, only 40% of spectrum sold," Medianama, October 7, 2016, https://www.medianama.com/2016/10/223-2016-spectrum-auctions-ends.

[73] "UN Broadband Commission Meets in Rwanda to Tackle Digital Divide," ITU News, May 8, 2018, http://news.itu.int/un-broadband-commission-brings-solutions-broadband-digital-connectivity-all/.

[74] Chidi Izuwah, "Nigeria blazes the trail for PPP disclosures with new web portal," World Bank Group Infrastructure and Public-Private Partnerships Blog, September 21, 2017, http://blogs.worldbank.org/ppps/nigeria-blazes-trail-ppp-disclosures-new-web-portal.

[75] Abdul Ganiyu Otairu, Abdullah A.Umar, Noor Amila Wan Abdullah Zawawi, Mahmoud Sodangi, and Dabo B.Hammad, "Slow Adoption of PPPs in Developing Countries: Survey of Nigerian Construction Professionals," Procedia Engineering, Volume 77, 2014, https://www.sciencedirect.com/science/article/pii/S1877705814009916, 194.

[76] "Sub-Saharan Africa Private Participation in Infrastructure Database Regional Snapshot," the World Bank, https://ppi.worldbank.org/snapshots/region/sub-saharan-africa.

[77] "Internet for All: A Key Initiative for Africa's Digital Transformation," press release, World Economic Forum, May 10, 2016, https://www.weforum.org/press/2016/05/internet-for-all-a-key-initiative-for-africa-s-digital-transformation/.

VI. **Cybersecurity**. Cybersecurity is a threat around the world,[78] but especially in developing countries experiencing rapid growth in digital infrastructure.[79] Because of the importance and sensitivity of data used in AI systems, these vulnerabilities will only be amplified with new AI technologies.[80] For that reason, policymakers should consider cybersecurity as a key component of all digital infrastructure projects. Fundamentally, this will require the establishment of legal frameworks protect privacy and allow for the redress of harm.[81] While regional entities, such as the African Union, have taken steps to establish such frameworks,[82] policymakers should also support legislation domestically.

(2) Supporting Local Ecosystems of Entrepreneurship and Startups

An important way for policymakers and regulators to address the digital divide is to promote entrepreneurship at home.[83] The entrepreneurial ecosystem concept is helpful for understanding conditions that are conducive to a vibrant market for innovation. The mass of perspectives and ideas that grow out of a successful entrepreneurial ecosystem will be crucial for the development of AI technologies in emerging markets. There are several approaches policymakers and regulators can try in order to entrepreneurial ecosystems that will enable AI development:

(a) **Government programs**. Government initiatives have shown promise in facilitating the growth of entrepreneurial ecosystems. For example, the Singapore government has a series of direct investment initiatives,[84] as well as the Startup SG program, which combines government investment with private equity. Similar efforts have occurred in the developing world. For example, the Botswana government established the Botswana Innovation Hub in 2012, which includes a campus to house companies that can benefit from seed funding provided by the Botswana Innovation Fund. The institutional structure provided by the Botswana Innovation Hub

[78] "Significant Cyber Incidents," Center for Strategic & International Studies, https://www.csis.org/programs/cybersecurity-and-governance/technology-policy-program/other-projects-cybersecurity.
[79] Mirko Hohmann, Alexander Pirang, and Thorsten Benner, "Advancing Cybersecurity Capacity Building: Implementing a Principle-Based Approach," Global Public Policy Institute, March 2017, http://www.gppi.net/fileadmin/user_upload/media/pub/2017/Hohmann__Pirang__Benner__2017__Advancing_Cybersecurity_Capacity_Building.pdf, 8-9.
[80] Barry Carin, "G20 safeguards vulnerabilities of digital economy, with financial sector focus," G20 Insights by Kiel Institute for the World Economy, November 20, 2017, http://www.g20-insights.org/policy_briefs/g20-safeguards-vulnerabilities-digital-economy-financial-sector-focus.
[81] Lilly Pijnenburg Muller, "Cyber Security Capacity Building in Developing Countries: Challenges and Opportunities," Norwegian Institute of International Affairs, 2015, https://brage.bibsys.no/xmlui/bitstream/id/331398/NUPI+Report+03-15-Muller.pdf, 9.
[82] "African Union Convention on Cyber Security and Personal Data Protection," African Union, June 27, 2014, https://au.int/en/treaties/african-union-convention-cyber-security-and-personal-data-protection.
[83] "Digital Policy Playbook 2017: Approaches to National Digital Governance," World Economic Forum, September 2017, http://www3.weforum.org/docs/White_Paper_Digital_Policy_Playbook_Approaches_National_Digital_Governance_report_2017.pdf, 35.
[84] *See* "Grants," SME Portal, https://www.smeportal.sg/content/smeportal/en/moneymatters/grants.html.

has also attracted outside investment.[85]

(b) **Technology business incubators**. Business incubators are spaces that provide needed services to entrepreneurs, such as access to technology and marketing assistance, and are usually run for profit or as part of a university program. Incubators have served as important catalysts for entrepreneurial ecosystems, such as that in Bangalore, India.[86] One example of a successful incubator is SmartXChange in Durban, South Africa, having created over 3,000 jobs since its founding in 2004 and generating and average of six startups each year.[87]

(c) **Commercial transfer of research**. A symbiotic relationship between industry and academia is crucial for any entrepreneurial ecosystem. One way that policymakers can encourage such a link is by supporting legislation that facilitates the commercialization of research, such as laws that vest intellectual property rights with the institutions that fund research. For example, in 2009 Russia passed Federal Law 217, which allows universities to use IP generated with public funds to create private start-up companies, leading to the creation of 973 startups by June 2011.[88] The Bayh Dole Act (1980) in the United States has had similarly positive results, with more than 5,000 new companies founded since its passage based on university funded research.[89] IP frameworks that allow for commercialization of research both incentivize investment in future research and increase the number of startups working on cutting edge issues. Additionally, startups that emerge from university research create a pipeline for employment for university students and foster information exchange between educational institutions and the private sector. Together, these factors can contribute to a vibrant entrepreneurial ecosystem, which will be beneficial for a region attempting to break into the market for AI technologies.

(3) Supporting Capacity Development

Another critical opportunity for policymakers working to mitigate the digital divide is to encourage technological innovation through academic capacity development. Universities are particularly suited to serve as centers of capacity development by serving as the locus for investment in research, data collection, and training, given both their institutional function to further research in societal interest, as well as existing substantive capacity and expertise related to AI technologies.[90] That said, capacity development often occurs outside of the university setting, where training can be more targeted and efficient. For example, the Centers of Excellence in the ITU Academy, which provide important ICT training, are a mix of both universities and small training centers.[91] Similarly, the ITU's Digital Skills Toolkit highlights the role that

[85] Matshelane Mamabolo, "Botswana Innovation Hub to host US $3 million development programme," IT Web Africa, Aug. 21, 2017, http://www.itwebafrica.com/business-intelligence/508-botswana/239590-botswana-innovation-hub-to-host-us3-million-development-programme.
[86] Subrahmanya, "Comparing the Entrepreneurial Ecosystems," 55.
[87] Mail & Guardian
[88] Juan Julio Gutierrez and Paulo Correa, "Commercialization of Publicly Funded Research and Development (R&D) in Russia: Scaling up the Emergence of Spinoff Companies," Policy Research Working Paper, World Bank, Nov. 2012, https://openknowledge.worldbank.org/bitstream/handle/10986/19932/wps6263.pdf?sequence=1, 21.
[89] Catherine Kirby, "True Impact of Bayh-Dole Act," The McNair Center for Entrepreneurship & Innovation at Rice University's Baker Institute, Dec. 6, 2016, http://mcnair.bakerinstitute.org/blog/true-impact-bayh-dole-act/.
[90] "Capacity-building," Academic Impact, United Nations, https://academicimpact.un.org/content/capacity-building.
[91] ITU Academy (last visited June 15, 2018), https://academy.itu.int/index.php?lang=en.

that primary and secondary schools play in building digital skills and capacities.[92] Key considerations for capacity development include:

(a) **Capacity development should focus on both soft and hard skills**. In order to adapt to a labor market that integrates AI technologies, the next generation of workers will need to develop a broad range of new skills, as well as the ability to evolve skill sets throughout their careers at a rate previously unseen.[93] While technical or hard skills are crucial, equally important are business, entrepreneurial, and other soft skills (e.g., team working, curiosity, and communication).[94] AI technologies, instead of replacing occupations, will likely result in a greater emphasis on social skills within existing occupations that the technologies cannot replicate.[95] Accordingly, policymakers and regulators might consider soft skills capacity development through training programs. For example, the BEIGE Foundation in Ghana launched the BEIGE Talent initiative in 2015 to train recent university graduates in soft skills necessary to succeed in the workforce, from personal goal setting to customer care.[96] Moreover, both hard and soft skills development is particularly important for groups that have been traditionally underrepresented in the workforce, particularly women.[97] Policymakers and regulators should consider programs that target such groups to ensure that the benefits of an AI integrated economy are evenly distributed; this includes programs and policies to address the cases where education and training is insufficient to address labor displacement. In addition to skill building programs for populations, individual countries can invest in developing and retaining top expertise to promote R&D; for instance, the Canadian Institute for Advanced Research (CIFAR) recently announced a major investment in academic capacity for the country,[98] and Canada is developing programs such as the 150 Research Chairs Program to develop and attract leaders in the field.[99]

(b) **Ensure investments in educational capacity development are evenly distributed.** Policymakers and regulators should work to ensure that investments in capacity development are accessible to a broad range of students.[100] Concentrating resources in a small number of cities or universities, may limit the benefits of capacity development efforts to only those that have access to those institutions. Providing more resources to more institutions may require alternative

---

[92] "Digital Skills Toolkit," ITU, 2018, https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf.
[93] "Across nearly all industries, the impact of technological and other changes is shortening the shelf-life of employees' existing skill sets." "The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industry Revolution - Executive Summary," World Economic Forum, Jan. 2016, http://www3.weforum.org/docs/WEF_FOJ_Executive_Summary_Jobs.pdf, 3.
[94] "ITU-Academia Partnership Meeting: Developing skills for the digital era - Final Report," ITU Academy, Sept. 21, 2017, https://www.itu.int/en/ITU-D/Capacity-Building/Documents/ITU-Academia%20Partnership%20Meeting%202017/FinalReportITUAcademiaPartnershipMeeting201729Sept17.pdf, 4.
[95] "The Future of Jobs," World Economic Forum, 3.
[96] "The Soft Skills Imperative," The Adecco Group, Jan. 2017, https://www.adeccogroup.com/wp-content/themes/ado-group/downloads/the-adecco-group-white-paper-the-soft-skills-imperative.pdf, 10.
[97] Ibid., 5.
[98] Canadian Institute for Advanced Research, "Canada funds $125 million Pan-Canadian Artificial Intelligence Strategy," news release, Mar. 22, 2017, https://www.newswire.ca/news-releases/canada-funds-125-million-pan-canadian-artificial-intelligence-strategy-616876434.html.
[99] Ibid.
[100] ITU-Academia Partnership Meeting, ITU, 4.

funding approaches, such as those that Nigeria experimented with in 1998 and 2003, which allowed for non-governmental sources of funding.[101] Additionally, educational resources can be leveraged through coordinated and collaborative networks, such as the Global Network of Internet & Society Centers, which can act to fill capacity gaps, bridge disciplinary divides and facilitate meaningful interaction amongst diverse communities, and translate research into action by creating high quality channels of information for policy makers.[102]

(c) **Invest in Centers of Excellence (CoEs).** CoEs, such as those that are a part of the ITU Academy, are a structural alternative for facilitating capacity development within universities.[103] While CoEs can take many different forms, in the university context they are usually committed to research on a single topic and are often financially distinct entities within institutions. The specificity of subject matter enabled by the CoE design might be useful for capacity development focused on highly complex technologies such as AI. Additionally, the financial independence of CoEs may be particularly effective for capacity development in developing countries, where universities are often faced with budgetary constraints.[104] CoEs also provide an attractive format for investment from both the private sector[105] and international organizations.[106] One notable example includes the European Commission's recent announcement of a series of mechanisms to significantly increase capacity and investment in AI, including the formation of joint research excellence centers that strengthen coordinated research endeavors across countries.[107]

1. Addressing Information Asymmetries
2. Building Public-Private Partnerships
3. Bridging the Digital Divide
4. Sustaining a Competitive Environment

[101] Ibid., 23.
[102] "Global Network of Internet and Society Research Centers," http://networkofcenters.net/.
[103] Tomas Hellstrom, "Centres of Excellence as a Tool for Capacity Building - Draft Synthesis Report," Programme on Innovation, Higher Education and Research for Development (IHERD), OECD, https://www.oecd.org/sti/Draft_OECD%20synthesis%20report_final.pdf, 4,
[104] Ibid., 9.
[105] In March of 2018, the Indian Institute of Technology Kharagpur announced that it will set up an AI CoE with the help of an investment of more than $860,000 from Capillary Technologies Ltd. Subhankar Chowdhury, "IIT to have centre of excellence in AI," The Telegraph, Mar. 3, 2018, https://www.telegraphindia.com/calcutta/iit-to-have-centre-of-excellence-in-ai-212835.
[106] In 2014 the World Bank approved $150 million to finance 19 university-based CoEs in West and Central Africa to promote studies in STEM-related disciplines, agriculture, and health. The World Bank, "World Bank to Finance 19 Centers of Excellence to Help Transform Science, Technology, and Higher Education in Africa," press release, Apr. 15, 2014, http://www.worldbank.org/en/news/press-release/2014/04/15/world-bank-centers-excellence-science-technology-education-africa.
[107] "Communication Artificial Intelligence for Europe," European Commission, https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe, 8.

VII. Tools for Building and Sustaining a Competitive Environment

When France announced its AI strategy in March 2018, advisors to Emmanuel Macron noted that the country was lagging behind the US and China's AI prowess and would be unable to match those countries' investments in AI research, even while announcing a EUR 1.5 billion investment into AI research.[108] Similarly, the European Commission recently committed EUR 1.5 billion in research and innovation in AI technologies, the creation of AI research excellence centers, and more.[109] For those policymakers and regulators seeking to enhance their country's AI technologies, the task of becoming competitive can appear daunting, particularly with limited financial resources. And financial investments are not the only barriers to competition. Because AI is so data-intensive, network and lock-in effects can further complicate efforts to compete; companies like Google and Facebook train AI on their massive datasets and then use that AI to improve their products and attract more users and data.

In such an environment, policymakers and regulators face a difficult task of trying to build and sustain a level playing field for those developing and deploying AI-based tools. That said, creating a fertile, competitive environment for innovation has long been an important role for ICT regulators.[110] Moreover, although investments in AI research are important, they are not the only nor even the most important tool that policymakers and regulators have at their disposal for building and sustaining a competitive innovation landscape. The recent EU Communication on AI reflects this, highlighting financial investments, but also discussing education and training systems, as well as ethical and legal frameworks. It is this latter element where policymakers and regulators have the greatest opportunity to lay a foundation for supporting AI innovation. Of course, no set of approaches will instantly make a country competitive with China or the US in AI development, but these approaches may help support local AI innovation.

Well-crafted legal and technical frameworks can have an important influence on the competitiveness of the AI landscape. Because AI technologies are so dependent on data, that means that intellectual property laws can have a significant impact on how easy it is to develop new AI applications. The importance of data for AI means privacy and open data frameworks can mitigate lock-in effects. And similarly, technical and legal interoperability frameworks can impact the ease by which AI technologies can be used across national and regional boundaries.

Guiding Principles

- **Experiment with policy and support technical experimentation.** Just as AI is still being experimented with, so too should AI policy. It is tempting to think that the options are binary: either do not regulate or try to craft a complete regulation today. But instead, policymakers and regulators can create spaces that allow them to experiment in an iterative fashion with policies

[108] Nicholas Vinocur, "Macron's €1.5 billion plan to drag France into the age of artificial intelligence," Politico, April 14, 2018, https://www.politico.eu/article/macron-aims-to-drag-france-into-the-age-of-artificial-intelligence/.
[109] "Communication Artificial Intelligence for Europe," European Commission, https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe.
[110] *See, e.g.,* "Competition and Price: Market Regulation for Information and Communications Technologies," ICT Regulation Toolkit, ITU, April 2012, http://www.ictregulationtoolkit.org/toolkit/2.

and regulatory approaches, that still allow for the development of new AI technologies, while still advancing core values of public safety, privacy, consumer protection, and due process.

- **Favor principles over rules.** With the pace of AI technological development, a rules-based approach to governance can become outdated before it even has a chance to take effect. Instead of rigid rules (e.g., vehicles must follow at a minimum distance of 200 feet), policymakers and regulators can adopt more flexible principles (e.g., vehicles must follow at a safe distance), which are more resilient to technical changes, without necessarily sacrificing policy objectives.[111]
- **Emphasize data sharing, collection, and measurement.** Data is important to AI competitiveness in several ways. First, data is an essential ingredient for machine learning, and fostering the collection and sharing of high-quality open datasets can boost the creation of AI technologies. Second, data is important to AI competitiveness because crafting effective governance approaches is difficult without a clear sense of the problem, and it is difficult to define the problem in the absence of baseline measurements and the ability to measure changes over time.

In putting these principles into action there are a range of tools that policymakers and regulators can promote a level playing field. In particular, by reducing legal frictions, reducing technical frictions, and promoting data sharing and metrics, policymakers and regulators can lay a foundation for a innovative, competitive AI industry.

(1) Reducing Legal Frictions for AI Innovation

One way for policymakers and regulators to level the playing field for local AI innovation is by carefully considering the entire legal and regulatory landscape and updating legal barriers that are based on outdated assumptions or norms and that are hindering AI development. Such obstacles might include intellectual property laws that limit smaller innovators from developing new AI technologies, and unclear or inflexible regulations that cannot adapt quickly enough to new, innovative AI applications. That does not mean that regulation of AI technologies is unnecessary, as the technology can create significant physical, economic, and social harms for which regulation may be necessary. What it does mean is that policymakers and regulators must try to optimize across several different values, including innovation, as they consider tradeoffs between potential AI governance interventions.

(a) Optimizing Intellectual Property Rules. When balancing across these myriad values, one dial that policymakers and regulators can adjust relates to the permissiveness (or lack thereof) of their intellectual property rules. Overly restrictive intellectual property rules can limit the opportunities for smaller AI startups, whereas overly permissive intellectual property rules can reduce incentives for innovation. Policymakers and regulators must work to deploy "IP in the right dosage" as the World Intellectual Property Organization describes the middle ground between anti-competitive, broadly extended IP and unprotected, underemployed IP.[112] As the

[111] For a good summary of the tradeoffs between principle and rule-based regulations, see Chris Brummer and Daniel Gorfine, "Fintech: Building a 21st-Century Regulator's Toolkit," Center for Financial Markets, Milken Institute, October 2014, http://assets1b.milkeninstitute.org/assets/Publication/Viewpoint/PDF/3.14-FinTech-Reg-Toolkit-NEW.pdf.

[112] "IP and Competition Policy," WIPO, http://www.wipo.int/ip-competition/en/ (last accessed May 2, 2018).

European Commission Communication on AI stated "Reflection will be needed on interactions between AI and intellectual property rights, from the perspective of both intellectual property offices and users, with a view to fostering innovation and legal certainty in a balanced way."[113]

One area of IP policy in which policymakers and regulators can add legal certainty is with regard to the IP rights of AI-generated outputs. Currently there is little guidance about whether to grant copyright protection to programmers, the public domain, or the AI itself.[114]

(b) Enhancing Regulatory and Technical Experimentation. Policymakers and regulators can create spaces that enable innovators to explore new applications without fear of legal punishment. Such spaces also allow policymakers and regulators to learn about emerging technologies, and develop new regulatory approaches. For example, since 2016 the Hong Kong Monetary Authority has used the Fintech Supervisory Sandbox in order to enable banks and technology firms to pilot nearly 30 fintech products without fully complying with applicable regulations.[115] Similarly, the UK's Financial Conduct Authority at the end of 2017 announced their third cohort of 18 business invited to test their products and services within their sandbox.

In other cases, simply providing greater clarity about regulatory standards can enable experimentation and innovation. A 2015 European Parliament report, for example, discussed the importance of developing standards regarding AI that would "provide predictable and sufficiently clear conditions under which enterprises could develop applications and plan their business models on a European scale."[116]

(2) Reducing Technical Frictions for AI Innovation

In addition to removing legal frictions, policymakers and regulators can also support AI innovation by reducing technical frictions. In particular, by facilitating data exchange and through establishing technical standards, policymakers and regulators can enable interoperability. Although there are notable exceptions, interoperability can in many conditions be a key driver of innovation in AI just as it is within the ICT context.[117]

---

[113] "Communication Artificial Intelligence for Europe," European Commission, https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe.
[114] Andres Guadmuz, "Artificial intelligence and copyright," WIPO Magazine, October 2017, http://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html. For a primer on AI-generated art, see Jessica Fjeld and Mason Kortz, "A Legal Anatomy of AI-generated Art: Part I," JOLT Digest, November 21, 2017, http://jolt.law.harvard.edu/digest/a-legal-anatomy-of-ai-generated-art-part-i.
[115] "Fintech Supervisory Sandbox (FSS)", Hong Kong Monetary Authority, March 27, 2018, http://www.hkma.gov.hk/eng/key-functions/international-financial-centre/fintech-supervisory-sandbox.shtml.
[116] Motion for a European Parliament Resolution A8-0005/2017 by the Committee on Legal Affairs of the European Parliament, January 27, 2017, http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A8-2017-0005+0+DOC+XML+V0//EN.
[117] Urs Gasser and John Palfrey, "Breaking Down Digital Barriers: When and How ICT Interoperability Drives Innovation," Berkman Publication Series, November 2007, https://cyber.harvard.edu/interop/pdfs/interop-breaking-barriers.pdf.

(a) Supporting Data Openness. The sharing of both technical data and training data can facilitate AI innovation by making it easier for startups and smaller competitors to enter the AI market. For example, Google has published the source code for their TensorFlow AI platform, which has been used by Airbnb, Uber, SAP, Snapchat, Qualcomm, and others in building their own AI systems.[118] Even more helpful can be the sharing of high-quality training data, which can be used in building AI systems. For example, the 2018 EU Communication on AI calls for the wider availability of privately held data. Of course, making private sector data sets public can create legal risks if the data contains personal or other sensitive data, necessitating legal protections in order to incentivize data sharing.[119] This is why the EU Communication on AI calls for a "new support centre for data sharing will provide public authorities and companies with legal and technical support when trying to access data from public sector bodies and companies."[120]

Another way to facilitate data sharing is through data harmonization efforts, increasing the ease by which data can be shared and used. One way policymakers and regulators can promote data standards is by adopting such standards internally. For example, the UK's Cabinet Office created open standard principles to develop common and secure IT infrastructure through agreed and open standards.[121]

(b) Supporting Technical Standards. The use of technical standards can also promote interoperability for developing a competitive AI landscape. Technical standards like single-sign on digital ID infrastructure, simplifies technical developments and encourages users to sign up for new new services.[122] Even something as simple as the EU mandate for a common standard for mobile phone chargers promotes greater competition in the mobile phone market by easing the costs of switching devices.[123] In the AI context, initiatives like the IEEE's Global Initiative on Ethics of Autonomous and Intelligent Systems is working to create AI specific technical and ethical standards.[124] And the ITU-T Focus Group on Machine Learning for Future Networks including 5G is preparing technical reports and draft protocols that determine how AI can be used for things like network traffic management.[125]

(3) Developing metrics and tools for measurement of AI Impacts

---

[118] "TensorFlow," https://www.tensorflow.org (last accessed May 2, 2018).
[119] "Global Agenda Council on Cybersecurity," World Economic Forum, April 2016, http://www3.weforum.org/docs/GAC16_Cybersecurity_WhitePaper_.pdf, 18.
[120] "Communication Artificial Intelligence for Europe," European Commission, https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe.
[121] "Policy Paper: Open Standards principles," UK Government, April 5, 2018, https://www.gov.uk/government/publications/open-standards-principles/open-standards-principles.
[122] Urs Gasser, "GSR discussion paper: Interoperability in the digital ecosystem," ITU, June 25, 2015, https://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR2015/Discussion_papers_and_Presentations/Discussionpaper_interoperability.pdf, 15.
[123] Ibid., 9.
[124] "Ethics in Action: The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems," IEEE, https://ethicsinaction.ieee.org (last accessed May 2, 2018).
[125] ITU-T, "Focus Group on Machine Learning for Future Networks including 5G," (last visited June 15, 2018), https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx.

Metrics and data are critical to the process of identifying the challenges of AI technologies, and developing the appropriate governance responses. The AI Index is one approach to addressing this challenge. The AI Index is a not-for-profit project that aims to collect data about the uses and progress of AI. In their 2017 Annual Report they observed that "without the relevant data for reasoning about the state of AI technology, we are essentially 'flying blind' in our conversations and decision-making related to AI."[126]

One key area in which metrics are important relate to the UN's Sustainable Development Goals, which represent 17 goals centered around ending poverty, protecting the environment, and ensuring widespread prosperity.[127] Increasingly, it is recognized that AI may have significant impacts on these SDGs, either as an enabler or a challenge.[128] As a result it is important to collect and make accessible data that enables policymakers and regulators to benchmark, observe, and respond to the impacts that AI is having in these important areas. For example, the UN has launched the Open SDG Data Hub, which currently includes data on 132 of the global indicators and over 460,000 records. Similarly, expert workshops focused issues of AI impact measurement in Asia has noted the importance of collecting, tracking, and making available AI-related data in areas such as employment, diversity and inclusion, and education.[129] Policymakers and regulators have an important role to play in helping to enable this data generation, collection, and sharing, starting with data available within government. This is critical for AI governance, because "the data that are easy to get may not be the most informative."[130] In particular, opening up additional data from global south and developing countries will provide important insights for AI governance that is currently lacking.

VIII. Conclusion

This report has identified several sets of tools that that policymakers and regulators can deploy to develop approaches to enhance AI's positive impacts and restrain its negative impacts. Some of the tools discussed above present inherent contradictions. Some involve greater regulation of AI technologies, others involve less. Some involve local action, others international. And some involve unilateral action, while other tools defer to collective, multistakeholder processes. These contradictions are not a flaw in the framework we have described; instead, they reflect the reality that governing often involves difficult tradeoffs.

The tools described above can help policymakers and regulators better understand the challenges that AI poses, and can help in developing innovative governance approaches to address those challenges. But there is no shortcut for resolving these tradeoffs, this framework is designed to help position

---

[126] "2017 Annual Report," Artificial Intelligence Index, November 2017, http://cdn.aiindex.org/2017-report.pdf, 59.
[127] "Sustainable Development Goals," UN, https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (last accessed May 2, 2018).
[128] XPRIZE, "How the AI XPRICE is helping achieve the SDGs," press release, ITU News, May 2, 2018, https://news.itu.int/how-the-ai-xprize-is-helping-achieve-the-sdgs/.
[129] "Global AI Dialogue Series: Observations from the China-US Workshop in Beijing (December 2, 2017)," Berkman Klein Center for Internet & Society at Harvard University, January 24, 2018, https://medium.com/berkman-klein-center/global-ai-dialogue-series-212279519169.
[130] "2017 Annual Report," Artificial Intelligence Index, November 2017, http://cdn.aiindex.org/2017-report.pdf, 51.

decisionmakers to be able to make those tradeoffs with greater confidence. No one has all of the answers when it comes to AI, but by experimenting with the tools identified here, decisionmakers will be better positioned to understand the problems, the potential approaches, and the necessary tradeoffs. Experimentation sometimes involves mistakes, but only through that process can policymakers and regulators ultimately help their constituents better adapt to AI's challenges and opportunities.

Appendix

Summary of Potential Approaches

---

1. **Addressing Information Asymmetries**
2. Building Public-Private Partnerships
3. Bridging the Digital Divide
4. Sustaining a Competitive Environment

Guiding Principles

- Create compelling opportunities for experts to join government.
- Reduce participatory friction for experts.
- Obtain hands-on experiences with AI technologies.

Potential Approaches

(1) Build internal capacity
  (a) Recruit individual expertise.
  (b) Build institutional expertise.
(2) Develop knowledge exchange interfaces with experts
  (a) Leverage academic expertise.
  (b) Activate stakeholder expertise.

---

1. Addressing Information Asymmetries
2. **Building Public-Private Partnerships**
3. Bridging the Digital Divide
4. Sustaining a Competitive Environment

Guiding Principles

- Develop a terminology, shared across all stakeholders.
- Take advantage of being a second (or third, or fourth, or…) mover.
- Keep an open door and an open mind.

Potential Approaches

(1) Incubate and engage in multistakeholder systems
  (a) Engage AI-specific multistakeholder systems.
  (b) Engage broad-based multistakeholder systems.
(2) Solicit public feedback on AI policies
(3) Utilize diverse forums for information exchange

---

1. Addressing Information Asymmetries
2. Building Public-Private Partnerships
3. **Bridging the Digital Divide**
4. Sustaining a Competitive Environment

Guiding Principles

- Do not simply accept the status quo.
- Prioritize broad-based access to technology.
- Focus on entrepreneurship and innovation, not AI.

Potential Approaches

(1) Support the buildout of physical infrastructure
  (a) Enable infrastructure funding.
  (b) Ensure privacy and cybersecurity.
(2) Support local ecosystems of entrepreneurship and startups
  (a) Develop government programs to support entrepreneurship.
  (b) Create technology business incubators.
  (c) Facilitate commercial transfer of research.
(3) Enhance capacity development
  (a) Focus on both soft and hard skills.
  (b) Ensure investments in educational capacity development are evenly distributed.
  (c) Invest in Centers of Excellence.

---

1. Addressing Information Asymmetries
2. Building Public-Private Partnerships
3. Bridging the Digital Divide
4. **Sustaining a Competitive Environment**

Guiding Principles

- Experiment with policy and support technical experimentation.
- Favor principles over rules.
- Emphasize data sharing, collection, and measurement.

Potential Approaches

(1) Reduce legal frictions for AI innovation
  (a) Optimize intellectual property rules.
  (b) Enhance regulatory and technical experimentation.
(2) Reduce technical frictions for AI innovation
  (a) Support data openness.
  (b) Support technical standards.
(3) Develop metrics and tools for measurement of AI Impacts