Artificial Intelligence and the Law in Africa

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Chapter 2

A technoscience approach to law as technology and the gendering of artificial intelligence policy in South Africa

2.1 Introduction

This chapter examines the work that policy does in the emerging realm of artificial intelligence (AI) governance in South Africa with particular attention to questions of gender. On-going debates around the Fourth Industrial Revolution (4IR) have generated the need for a regulatory and policy framework to govern AI technologies and machine-learning. Given that AI technologies influence multiple sectors of South Africa, the applicable legal apparatus for this purpose is not singular but rather distributed across multiple areas of law. In offering a strategic focus for South Africa to compete in the 4IR, the 2020 South African Report of the Presidential Commission on the 4th Industrial Revolution (PC4IR report) provides a set of priorities and concerns that play a role in shaping debates across various areas of the law for how to govern AI technologies.[1] Through a critical analysis of the PC4IR report, this chapter examines the vision that South Africa has for the governing of AI and suggests how it can be strengthened to attend to gender.

The first part of the chapter briefly discusses how the PC4IR report informs and is informed by narratives of 'techno-legal-optimism' that simultaneously portray the promise of AI-based technologies and AI policy, while shielding them both from critical scrutiny and thus reinforcing the status quo and its hierarchies of race and gender. The second part frames the PC4IR report within understanding law as technology, suggesting that a technoscience approach is needed to understand how AI policy is deployed as a technology that applies and is often shaped by normative understandings of race and gender. The third part models a technoscience approach to critically analysing AI policy by conducting a textual analysis of the PC4IR report that takes colonial and apartheid histories into account, while arguing for greater attention to gender as intersectional and multiple, gendered histories of knowledge production, and interconnections of gender and more-than-humans.

In doing so, it develops a technoscience approach to law as technology to examine how the law is deployed not just to govern society, but is also actively shaped by society and its normative values. This approach enables an understanding of how the PC4IR report articulates limited conceptions of gender informed by Western understandings of binary gender, while simultaneously offering suggestions for how the PC4IR report could address gender in more multiple and relational ways to strengthen its vision of the 4IR for South Africa towards a more meaningful future that ensures

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1 Report of the Presidential Commission on the 4th Industrial Revolution (PC4IR report).

dignity for all as enshrined in the Constitution of South Africa.[2] This chapter also argues that what is needed is not just more regulation of AI, but a fundamental rethinking through a technoscience approach of the very assumptions that undergird efforts toward the governing of AI-based technologies. More equitable gendered relations and the wellbeing of those who self-identify beyond the gender binary depends on so much more than economic prosperity, and is deeply connected to wellbeing for others, including nonhuman beings.

2.2 Narratives of techno-legal-optimism

A technoscience approach to law, as is elaborated on in the next section, enables an understanding of how the PC4IR report is informed by and contributes to narratives of what I refer to as 'techno-legal-optimism'. At the same time, it goes towards conceptualising the PC4IR report (and AI policy more broadly) not as a neutral tool, but rather a situated technology for governing AI-based technologies that is shaped by rather than demarcated from dominant values and narratives of society. Narratives of techno-legal-optimism can be understood as accounts that portray the promise of both technologies and the law to ensure simultaneously advanced technological and legal futures with a hope, confidence, and positivity that hinders an understanding of their limits and potential harms. As an example of such narratives and as modes of cultural production, news media accounts distributed across the continent of Africa craft and contribute to public understandings and perceptions of the promise of both AI technology and the law.[3] They portray AI technologies through an ideology of techno-utopianism that assumes technology will advance human progress and betterment. Recent media headlines pronounce how AI technologies have the potential to end hunger in Africa,[4] combat malaria,[5] rescue endangered rhinos,[6] and drive economic growth into the 4IR.[7] These narratives reflect a hopefulness and optimism that AI technologies can solve deep social problems.

   At the same time, narratives of techno-optimism touting the potential of AI technologies have risen alongside the promise of the law to regulate and govern these technological futures. News media directed to audiences across the African continent proclaim that 'strong policy action is needed' to 'run with the machines'[8] and that government has a 'special responsibility' to carefully assess the risks of AI technology[9] as policies are needed for 'guiding and facilitating the use of AI'[10] and that regulators will need to

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2 Constitution of the Republic of South Africa 1996.
3 News media accounts work alongside other social actors such as academics, researchers, technology experts, politicians, and executives within various industries (e.g. finance, manufacturing, and health care) who perpetuate similar narratives of techno-optimism, but in the interest of space, the focus here will remain on news media.
4 Ruvaga L 'Could Big Data Help End Hunger in Africa?'
5 IBM South Africa 'AI in the Fight Against Malaria'.
6 Gilbert P 'MS Azure comes to rescue of on-the-brink rhinos'.
7 Adinde I 'Nigeria must invest in ICT education for youth empowermen'.
8 Lagarde C 'Looking ahead to chart today's course: The future of work in sub-Saharan Africa'.
9 Hamann R 'Developing countries need to wake up to the risks of new technologies'.
10 Kanyua J 'Connecting Kenya: AI as a government tool to accelerate manufacturing sector growth'.

'up their game' to address AI innovations[11] and promote ways of 'engineer[ing] AI in a safer way'.[12] There is an optimism in the role of government and law to govern AI technologies. The PC4IR report contributes to this optimism by offering a set of priorities for the future of South Africa in the 4IR.

As society and policy are always and already co-constituted, these narratives are similarly constructed and reinforced within emerging South African AI policy. In developing a strategic vision for the 4IR for development, the PC4IR report shares that the proposed dream for the country in the 4IR is: 'South Africa will have a globally competitive, inclusive and shared economy with the technological capability and production capacity that is driven by people harnessing the 4IR to propel the country forward towards its social and economic goals, instead of falling behind.'[13] Its vision attests and imbues AI technologies with the potential and promise to increase the 'economic competitiveness' of the nation-state and the 'social wellbeing' of its people.[14] This dream imagines AI technologies within a techno-utopia, thrusting South Africa and its people into competitive development futures.

At the same time, it imagines a future where the South African nation-state government is 'the institutional custodian of the 4IR strategy'[15] and 'director of techno-industrial outcomes'[16] with a responsibility to orchestrate policies that 'will be the backbone for economic growth' in the 4IR.[17] The South African government needs 'to be cognisant of the [4IR] and how this revolution, through policy creation and a clear coordinated strategy, can aid inclusive economic growth in South Africa.'[18] The PC4IR report thus holds out law and regulation as key elements for ensuring that the progress and promise of the 4IR and its technological advances is met for the (economic) future of South Africa.[19]

These narratives enable South African officials to position the country in strategic ways to take advantage of increased levels of funding and resources related to AI and its governing. International organisations such as the United Nations and global north countries, including the United States and organisations in the United Kingdom and

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11 Nwannekanma B 'Nigerians need knowledge to benefit from innovations in financial services'.

12 Snell R 'Ethical considerations for artificial intelligence'.

13 *GG* 43834 at 140.

14 Ibid. at 137.

15 Ibid. at 220.

16 Ibid. at 160.

17 Ibid. at 20.

18 Ibid. at 220.

19 The PC4IR report urges the need for 'smart laws' to ensure 'technological advancement' (at 49), data protection laws and labour law to regulate the gig economy (at 84), open data laws (at 103), intellectual property laws to ensure commercialization (at 112). It contends that law and regulation that must not 'slow down the uptake of 4IR' (at 113). It calls for policies to ensure equal participation in the 4IR, address risks of inequality such as data ownership and IP (at 27) and remove obstacles to innovation (at 98). It also notes that '[s]ome examples (not covering the full scope of the 4IR) include policy and legislation related to data access, data privacy, education, skills development, research and development, industrial policy, trade, business development, AI, cyber-security, biotechnology, and autonomous vehicles, amongst many others. The work stream will engage with specialist researchers to develop a detailed mapping' (at 112).

European Union, have directed significant funds towards advancing AI-based innovation, which establishes funding priorities globally. At the same time, it presents opportunities for countries in the global south such as South Africa that then become compelled to adopt similar narratives of techno-legal-optimism to utilise and secure these new channels of funding.

The trouble, though, is that these progress narratives of techno-legal-optimism reinforce the authority of both technology and law, and they obscure more critical understandings of these development futures in terms of gender and race. Narratives of techno-optimism, as Ruha Benjamin warns, act as a 'shiny veneer' and 'feel-good grammar' that hides complexity and makes it difficult to recognise the destructive processes of technology, and much less intervene in how they reinforce the status quo.[20] In the context of South Africa, in particular, they impede critical understandings of how AI-related technologies may exacerbate or address racialised gender inequalities, or how to incorporate an intersectional gendered analysis into AI policy. They hinder a gendered analysis too of how practices of 'data colonialism' may differ in scale, intensity, and context from colonialism but continue to capture and control human life itself through the appropriation and extraction of data from it for profit.[21] According to Sonja van Wichelen they also dismiss how law itself is a technology that has played a central role in shaping society and history with its normative assumptions of universalism and individualism.[22] To critically examine the work that the PC4IR report does in crafting a vision for South Africa and how it can be strengthened, it becomes important to examine what it means to understand the report itself as a technology.

2.3   A technoscience approach to understanding AI policy as technology

A technoscience approach to law enables an understanding of how South Africa is promising AI policy itself as a technology, bolstered by narratives of techno-legal-optimism, that can govern AI-based innovations with certainty and predictability to ensure justice. By technoscience, this chapter is referring to a theoretical approach informed by the field of science and technology studies that analyses how science is not separate from but shaped simultaneously by technological applications (hence the joining of the terms 'techno' and 'science') and associated desires to make science work for capitalist means of production and profit in unequal ways. Conceptualising law as shaping and being shaped by society and thus not value-neutral, a technoscience approach to the law enables understandings into how dominant institutional forces deploy law as a technology (actually and metaphorically) to reinforce the status quo. Conceptualising law as a technology provides a framework for understanding the work that the PC4IR report does in promoting a vision of South Africa in the 4IR, and how it remains limited for addressing questions of intersectional gender. The PC4IR report is more than a legal document or set of guidelines. The Presidential Commission sets it forth as a technology to produce an aspirational set of priorities, values, and

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20 Benjamin R *Race After Technology Abolitionist tools for the New Jim Code*.
21 Couldry N and Mejias UA *The Costs of Connection: How Data is Colonizing Human Life and Appropriating it for Capitalism*.
22 Van Wichelen S 'Law as Antikinship: The Colonial Present in Global Surrogacy' at 1–21.

assumptions for the future of South Africa and its people in the 4IR, which changes how we think about both AI-based technology and AI law and policy. As a techno-science approach to law modelled here will make apparent though it is not a value-neutral legal device, but one deeply informed by society and its colonial legacies of race and gender.

A technoscience approach to the law becomes more apparent though with a discussion in this section that first distinguishes approaches to law *and* technology from those of law as technology. It then demonstrates how theories of law and critical legal scholarship (for example Socratic method, legal formalism, legal realism, new legal realism) have conceptualised law as a tool in different ways that, as I contend, offer valuable insights for scholars of science and technology studies who are alternatively theorising law as technology.

Notions of law *as* technology are not the same as how lawyers and legal scholars tend to focus on questions of law *and* technology. A prevailing South African textbook, *Information and Communications Technology Law*, for instance, acquaints students with a study of 'informatics law' that focuses on legal problems arising from information and communications technologies (ICTs) such as the following: patenting of hardware and software, data security and privacy, e-commerce (contracts, electronic payments, consumer protections), trademarks and domain names, copyright infringement and protection of electronic databases, freedom of expression (defamation, hate speech, harassment), and the protection of digital property.[23] Van der Merwe D et al. also note the study of legal informatics such as the emergence of legal technologies that aid in the storage, retrieval, and processing of legal information to assist in legal decision-making. Informatics law must contend with questions of gender and technology, for example, that consider gender disparities in the AI-based workforce and access to ICTs.

In contrast, the technoscience approach to the study of law developed here is informed by different interpretations and shifts in what is meant by law as technology. In the late nineteenth century, Christopher Langdell, faculty at Harvard Law School, sought to frame law as a science by introducing the case study method into United States law schools,[24] which eventually became the dominant approach to legal education globally, including in South Africa. Informing and informed by theories of 'legal formalism' that understood the law as detached from society, the pedagogical technique endeavoured to teach students how to observe and analyse prior cases to discover the truth behind formal rules of legal precedence and then mechanically apply them to new fact patterns to generate just and equitable decisions without regard to social interests or public policy. Proponents of legal formalism, by analogising legal reasoning to scientific method, offered a sense of predictability and certainty to legal decision-making, while simultaneously engendering a metaphorical vision of the law as a science.[25]

However, a new vision of law understood as 'legal realism', that embraced both a metaphorical and literal understanding of the law as a tool for shaping society while offering a more flexible approach to legal reasoning as a science began to emerge. In her discussion of debates over Conflicts of Law doctrine, Annelise Riles examines how theories of legal realism beginning in the 1930s generated a 'new' scientific vision of

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23 Van der Merwe D et al. *Information and Communications Technology Law*.
24 Riles A 'A new agenda for the cultural study of law: Taking on the technicalities' at 1001.
25 Ibid. at 998.

the law by deploying metaphors of the law as a tool. In response to formalist portrayals of law as a machine disconnected from society, proponents of legal realism produced conceptions of the law as a 'technical machine' for social and economic engineering.[26] This conception of the law as a means to an end embraced a rationalist and scientific legal reasoning that would take social interests and public policy into account. The lawyer and the legal scholar were likened to an engineer or mechanic whose job was to focus less on discovering the certainty of legal doctrine and more on thinking through the technicalities of the law, applying legal reasoning through a more flexible and experimental process of re-evaluating and modifying legal rules as new fact patterns emerged and social conditions changed.[27] The metaphorical idea that the law was like a tool and like a machine, Annelise Riles argues, shifted in the mid-twentieth century to include a quite literal understanding of the law as a tool of social policy and state power.[28]

More recently, critical legal scholars invested in empirical studies of law and society have developed a 'new legal realism' that offers a different understanding of the law as a tool.[29] While legal realist conceptions understood law as a tool directed at shaping social interests, they remained attached to a scientific vision of the law that failed to consider how society in turn shapes the law. They assumed the law to be a value-neutral tool. In contrast, proponents of new legal realism understand the law as a tool that can promote certainty, predictability, guidance, reasoning, institutional responsibility, and dispute resolution, but that is also shaped by social context and thus not value-neutral.[30] The law can be a tool for regulating society, but it is not a one-way direction, it is also governed by society and social norms that inform and constrain its directions.

Through a different trajectory, critical legal scholars drawing upon science and technology studies have developed understandings of law as a technology, meaning a system or coordinated collection of legal tools that shape and are shaped by society. To frame law as technology grapples with how the law is deployed as a tool, but brings a different focus on how the law is an application of and is constructed by and through technological, social, political, historical, and economic forces; in other words, a tech-noscience approach to law as technology focuses on co-constituted interactions of law, technology, and society.[31] In this respect it shares a similar emphasis to new legal realism on the interrelatedness of law and society, but shifts the focus to law as technology rather than the law as a tool. Thinking about law as technology, as Biagioli and Buning contend, brings into question what is meant by technology and the law.[32] The old approach of patents, for example, as tools that the law applied to protect different

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26 Ibid. at 1002.

27 Ibid.

28 Ibid. at 981.

29 Macaulay S 'The new versus the old legal realism: "Things ain't what they used to be"' at 392.

30 Shaffer G 'The new legal realist approach to international law' at 189–210.

31 Jasanoff S (ed.) *States of Knowledge: The Co-production of Science and Social Order*; Jasanoff S *Science at the Bar: Law, Science, and Technology in America*; Van Wichelen 'Law as Antikinship: The Colonial Present in Global Surrogacy' at 1–21; Biagioli M and Buning M 'Technologies of the law/law as a technlogy' at 3–17; Eaglin J 'When critical race theory enters the law & technology frame' at 151–168.

32 Biagioli and Buning at 3.

technologies has given way to one in which 'the interaction between law and technology develops both new articulations of patenting as well as new definitions of technology'.[33]

Extending their analysis here, I suggest that framing such analysis as a technoscience approach to law as technology offers more explanatory power as it makes its connections to the theoretical insights of the field of science and technology studies more apparent, and its foundational assumption of law as technology clearer. Taking this further, a technoscience approach imparts a focus thus on what I refer to as 'techno-legalities', meaning the manner in which law and technology are co-constituted in relation to each other and thus always and already informed by socio-historical pasts and their residues, which is modelled after the language of 'technoscience' to emphasise how technology and science are continually constructing and reinforcing one another, and recent analyses of 'biolegalities' that explore the interactions of law with new biotechnologies and biological knowledge.[34]

A technoscience approach can provide new insights into how dominant forces have deployed law as a technology to order the world through division and differentiation,[35] and for colonialism and apartheid.[36] Colonial settlers deployed the legal doctrine of *terra nullius*, for example, as a tool to extract South African lands and resources, and the National Party implemented the 1950 Population Registration Act (among other legislation) and its racial classification scheme to ensure white supremacy. Thinking about the use of these legal doctrines and legislation more as a technology demonstrates the interconnections of law and scientific classification, while bringing into question dominant conceptions of both law and science as objective and value neutral.

At the same time, it provides understanding into how individuals and groups have deployed the law to challenge hierarchies and relations of power. In response to legacies and historical residues, the African National Congress, for example, deployed the law as a technology to counter the status quo and to reimagine the nation-state in 1996 when it ratified the South African Constitution. In doing so, it changed how people understood the rule of law and racial classification schemes. It became more apparent that colonial and apartheid-era laws were not natural and divined by God, but were a man-made technology of governing meant to reinforce whites as superior and thus deserving of protected rights to property and capital. It promoted an aspirational vision of the law as a technology that could be redrafted and tinkered with to address past injustices and ensure the dignity of all peoples of South Africa, and an understanding of law not as ahistorical but as deeply informed by society its historical pasts and legacies. While the guarantee of the South African Constitution to ensure dignity and equitable opportunities remains a promise in theory that has not been realised through implementation, the promise itself in the role of government to ensure the positive rights of its people (rather than the negative right not to interfere) is quite radical indeed. A

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33 Ibid. at 7.

34 Van Wichelen S 'Changing rights to family life: Biolegalities in the globalization of reproduction' at 26–50.

35 Alvarez-Nakagawa A 'Law as magic: Some thoughts on ghosts, non-humans, and shamans' at 1247–1275.

36 Posel D 'Race as common sense: Racial classification in twentieth-century South Africa' at 87–113.

technoscience approach to law as a technology, therefore, should be quite familiar to scholars of South African law and policy.

Addressing the law less a tool and more as a technology, a technoscience approach is different from a technological perception of the law and, at the same time, it enables an understanding of associated knowledge practices and assumptions that undergird the law. For example, it shows how knowledge practices that promote a technological understanding of the law represent a way of thinking and being that reinforce values of ordering, sorting, classifying, predicting, managing, and regulating the world. As histories and residues of the gendered classification of race are similarly grounded in these logics of classification and bifurcation, a technological understanding of the law as a calculated tool for social policy risks further constructing and reinforcing these hierarchical ways of being and knowing. It becomes important then for law and policy scholars to develop a technoscience approach that can critically attend to the assumptions that inform and are informed by AI policy, what their potential limits are, and what possibilities exist for governing AI-related technology towards more meaningful social justice futures that dismantle hierarchies of classification. The next section begins to develop and model this approach by critically examining the PC4IR report with the goal of strengthening its attention to gender and gender relations.

2.4 Gendering artificial intelligence policy

The PC4IR report acts as a technology that works to create a vision for South Africa in the 4IR. Its main purpose is to establish a set of priorities for advancing South Africa as a leading producer, rather than mere adopter, of digital technologies into the future.[37] It explicitly claims that it is meant to address past injustices from colonialism and apartheid rule. Thus, it deploys the law as a technology that is situated within historical legacies, rather than as a technology detached from them. However, while the PC4IR report attempts to challenge colonial and apartheid pasts it remains limited. For instance, it does not go far enough to meaningfully consider intersectional gender, gendered colonial histories and modes of knowledge production, or interconnections of gender and more-than-humans. Although it aspires to deploy AI policy as a tool towards social wellbeing, the PC4IR report too easily slips into bringing AI policy into service as a value-neutral technology meant to realise the economic prosperity and leadership of the South African nation. It is these tension between moments of the PC4IR report as technology that become important sites of inquiry for gendering AI policy. As the members of the Presidential Commission would likely agree, there is much more work to be done to establish a vision for the 4IR that addresses these complex facets of gender and gendered relations. If the PC4IR report and AI policy are more generally understood through a technoscience approach, it can be recalibrated to consider gender in more complex ways to enable just futures in the 4IR. In this section, the chapter offers some initial ways for rethinking the PC4IR report to attend to gender in more meaningful ways.

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37 Adams R 'The gendered impact of artificial intelligence and the fourth industrial revolution in South Africa: Inequality, accessibility and skills development'.

2.4.1 *Attend to gender as intersectional and multiple*

Examining the governing of AI-based technologies through a technoscience approach provides insights into how the PC4IR report and similar policies are informed by normative understandings of gender as binary, but also how they can be recalibrated to enable notions of gender as intersectional and multiple. It provides an understanding into how the PC4IR report as a technology is an application of law and policy thinking for the purposes of governing the 4IR, but also an enactment of hierarchies of knowledge production that have historically constructed meanings of gender in limited ways.

Society narrowly understands gender often in dominant (often read as Western) binary terms as limited to expressions of normative masculinity and femininity, and frequently conflates gender with sex as confined to characteristics of male and female. This results in a dismissal of different expressions of gender identity, of intersex, and the multiplicity of sex across chromosomes, hormones, gonads, genitalia, and internal reproductive organs. Alternatively, feminist scholars have produced valuable insights into how cultural and social understandings of gender inform biological understandings of sex and vice versa[38] and how racialised colonial practices of viewing the body have constructed and reinforced Western hierarchies of understanding sex and gender across Africa.[39] Conceptions of sex/gender are thus intersectional and multiple, and they manifest differently in different African contexts where, as Oyěwùmí argues,[40] gendered social roles in Yoruba society, for example, are based more on social questions of seniority and age, and less on naturalised categories of the body as assigned the male or female sex. A technoscience approach to examining the PC4IR report reveals how its discussion of gender is limited in that it shapes and is shaped by normative societal understandings of binary sex/gender (male/female or masculine/feminine), and often conflates gender as sex rather than intertwined with it.

The PC4IR report, for example, addresses gender but unfortunately relegates its brief discussion mostly to the topic of sex-ratios within a two-page overview section on socio-economic and human development. A key take away stated in the report is that, despite a sex-ratio at birth that tends to favour the birth of boys, there are more females than males in South African society given their higher life expectancies.[41] The assessment of sex-ratios provides some context into the current status quo in South Africa, but without further discussion regarding gender and gendered relations as intersectional and multiple, the PC4IR report establishes and reinforces normative assumptions of binary gender as guiding the governing of digital technologies. It also presents gender at the outset as strictly connected to biology, which naturalises gender as socially fixed and limited to normative roles of masculine and feminine that are understood to flow neatly from sex-assignments at birth as male or female. This detracts from an understanding of gender and gender relations as more fluid and multiple, and how biological sex is itself informed by social understandings of gender.[42] It

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38 Butler J *Gender Trouble: Feminism and the Subversion of Identity*; Martin E 'The Egg and the Sperm: How Science has Constructed a Romance based on Stereotypical Male-Female Roles'.
39 Oyěwùmí O 'Visualizing the body: Western theories and African subjects'.
40 Ibid.
41 *GG* 43834 at 235.
42 Richardson SS *Sex Itself: The Search for Male and Female in the Human Genome*.

thus leaves little room to consider an AI future for people who identify as non-binary, transgender, and genderqueer and who defy dichotomous categories of gender.

By conceptualising gender first through a discussion of sex-ratios, the PC4IR report also obscures how gender is shaping and being shaped by race. While women may have a longer life expectancy than males, Black women continue to experience greater health disparities due to histories and experiences of racial discrimination that may lower their life expectancies.[43] Shifting away from the naturalising of gender as binary, the governing of AI-based technologies must arise out of a more explicit articulation of gender as intersectional and multiple.[44] The stakes are much too high in the 4IR not to establish a more nuanced approach to gender for guiding AI policy.

Gender can be a powerful marker of social identity and mode of social movement belonging, but the PC4IR report fails to address how in the 4IR, as Thao Phan demonstrates,[45] capitalist enterprises have further transformed gender into a reductive data point to sell products, target consumers, and personalise advertising. The restyling of gender for algorithmic quantification in the service of capitalism is also a concern arising across the continent of Africa. For instance, AI-based digital assistants deploy a feminised voice that further entrenches racialised and gendered norms of domesticity and servitude informed by colonial histories.[46] The financial industry in South Africa, Kenya, Nigeria and Ghana is beginning to utilise AI-based technologies for banking services, credit scoring, and fraud detection, but it risks amplifying gender bias and inequalities because of its use of poorly designed algorithms and biased data sets.[47] Through a study of images of politicians serving in the parliaments of South Africa, Rwanda and Senegal, Joy Buolamwini and Timnit Gebru also find that facial analysis algorithms perpetuate gender and racial bias by misclassifying the faces of darker skinned females more often than lighter skinned males.[48] The PC4IR report, as a technology, with its narrow attention to gender as sex-ratios and its lack of attention to the algorithmic quantification of gender, means it is limited as a policy device to address gender in the 4IR.

It is also limited by its lack of attention to how the future of work in the 4IR impacts women across the African continent in different ways. AI-based technologies can provide opportunities for challenging hierarchies of racialised gender, especially through the inclusion of women within new domains of work, but AI policy must develop an intersectional analysis to address potential inequities in a meaningful way. For instance, in a study of 160 companies across 21 African countries, the AI workforce is found to comprise a significantly less number of females (29%) than males

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43 Chinn J, Martin I and Redmond N 'Health equity among Black Women in the United States' at 212–219.

44 Beyene T and Frost R 'Gender variance and the gender digital divide'.

45 Phan T 'Programming gender: Surveillance, identity, and paranoia' at 46–64.

46 See Adams. See also Phan T 'Amazon echo and the aesthetics of whiteness' at 1–38; Atanasoski N and Vora K *Surrogate Humanity: Race, Robots, and the Politics of Technological Futures*.

47 Ahmed S 'A gender perspective on the use of artificial intelligence in the African fintech ecosystem: Case studies from South Africa, Kenya, Nigeria, and Ghana'.

48 Buolamwini J and Gebru T 'Gender shades: Intersectional accuracy disparities in commercial gender classification' at 1–15.

(71 %).[49] Furthermore, the shift to the 'gig economy' puts in jeopardy some of labour rights that certain women across Africa have gained over the years and, at the same time, the potential automation of agriculture threatens to upend an industry where, as Chiweshe notes,[50] most women across Africa are employed and have no labour protections and rights to begin with. These gender disparities mean that the lived experiences of African women are not considered in the product development cycle, and, this chapter argues, not regarded in AI policy development. Thus, AI technologies are not designed or governed with their needs, desires, and interests in mind. These examples show that the emergence of AI-based technologies is giving rise to new yet familiar modes of inclusion and exclusion along lines of both gender and race, thus demonstrating the need for AI policy to account for gender as intersectional and multiple.

The proliferation of digital technologies has also compounded the problem of racialised gender-based violence in the form of cyber violence. The PC4IR report takes care to briefly mention gender-based violence as impacting socio-economic and human development within the country but leaves cyber violence unaddressed. It notes that the murder rate of women remains significantly higher in South Africa than other countries, and women continue to experience higher rates of rape and sexual violence than men.[51] It also states that gender-based violence contributes to high levels of precarity among women and their children, which impacts their security and wellbeing and that of all members of society.[52] While physical violence against women and girls remains high across South Africa there is also the often-related threat of cyber violence. Internet platforms driven by complicated algorithms that evade scrutiny presents new challenges of gendered cyber violence, which can take the form of online abuse, harassment and stalking that lead to unwanted, offensive and threatening behaviour.[53] This can include cyber stalking, non-consensual pornography, slut-shaming, unsolicited pornography, sextortion, doxing, rape and death threats.[54]

Cyber violence against women and girls is a particular concern across Africa. As the Covid-19 pandemic restricted movement and required social isolation measures, technologically-facilitated gender-based violence exponentially increased and impacted, for example, women and girls in Malawi who responded by blocking their attackers or leaving online platforms altogether.[55] Cyber bullying disproportionately impacts girls,

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49 Ondili M 'Artificial Intelligence: Labour Gender Gap in Africa'. A study of women in the San Francisco tech industry found that black women who identified as LGBTQ and presented as gender fluid did not report the same level of inclusion and acceptance from their male colleagues as their white and Asian women counterparts who identified and presented in similar ways. See also Alfrey L & Twine FW 'Gender-fluid Geek Girls: Negotiating Inequality Regimes in the Tech Industry' at 31. This demonstrates the need for research on how race, sexuality, and gender interact to reproduce structural inequalities in the AI workforce in different ways across Africa.
50 Chiweshe MK 'Fourth Industrial Revolution: What's in it for African Women?'.
51 *GG* 43834 at 236.
52 Ibid.
53 Laxton C 'Virtual world, real fear: Women's aid report into online abuse, harassment and stalking'.
54 European Institute for Gender Equality (EIGE): 'Cyber Violence Against Women and Girls' (2017).
55 Malanga DF 'Tackling gender-based cyber violence against women and girls in Malawi amidst the COVID-19 pandemic'.

but race appears to be a more significant explanatory factor as Black children report the highest incidence of cyber aggression in South Africa.[56] Cyber violence, therefore, violates the rights of women and girls, as enshrined in the African Declaration on Internet Rights and Freedoms to access information online, use the Internet and digital technologies for freedom of assembly and association, maintain their privacy, and protect their personal data.[57] Although South Africa recently expanded the Domestic Violence Amendment Act to better protect against online sexual harassment, and countries such as Ethiopia, Kenya, Senegal and Uganda have put mechanisms in place to address some forms of cyber violence, there needs to be more specific legislation in place to combat technologically-facilitated gender-based violence.[58] A more nuanced attention to gender as intersectional and multiple, as modelled here through this tech-noscience approach to examining AI policy, is needed to address the way algorithms facilitate gender-based cyber violence, employment discrimination, and race and gender bias.

2.4.2 *Address gendered histories of knowledge production*

To strengthen its efforts for promoting South African innovation in the 4IR, the PC4IR report must address racialised gendered histories of knowledge production. In concep-tualising South Africa as an innovator of AI-based technologies, the PC4IR report is deployed as a technology for challenging histories of colonialism, albeit in limited ways. A technoscience approach to AI policy should be attentive to how colonialism and its legacies have constructed and reinforced South Africa as a 'living laboratory' for extracting resources and knowledge, rather than as a place of knowledge production and technological innovation.[59] Colonialism, as Clapperton Chakanetsa Mavhunga contends, enacted and justified the dehumanisation of *vatema* (black peoples) as a tool, pest and non-thinking things.[60] These histories were further bolstered by and justified Western philosophies that theorised reason and rationality as associated with white masculine norms, thus excluding women and people of colour from full personhood as rational subjects.[61] They also included gendered colonial practices of scientific racism that exploited women's bodies as mere objects of study to classify San and Khoi peo-ples as less than human,[62] which in turn informed apartheid-era racial hierarchies and their lasting legacies.[63]

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56 Burton P and Mutongwizo T 'Inescapable violence: Cyber bullying and electronic violence against young people in South Africa'.

57 African Declaration on Internet Rights and Freedoms.

58 Power T 'New Law Protects Women Against Online Abuse'.

59 Tilley H *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge, 1870–1950*.

60 Mavhunga CC *The Mobile Workshop: The Tsetse Fly and African Knowledge Production*. While my use here of 'black peoples' in lowercase risks reinscribing such histories of dehumanisa-tion, I make the decision here to use the preferred spelling of Mavhunga who writes 'black' in lowercase.

61 Lloyd G 'The man of reason'; Weheliye AG *Habeas Viscus: Racializing Assemblages, Biopolitics, and Black Feminist Theories of the Human*.

62 Abrahams Y 'Gender and locating Sarah Baartman in the present'; Schiebinger LL *Nature's Body: Gender in the Making of Modern*.

63 Dubow S *Scientific Racism in Modern South Africa*.

While a technoscience lens to AI policy should address these histories and their residues, it should also attend to how the PC4IR report as a technology offers pathways to contest these histories by positioning South Africa as a leader of innovation in the 4IR. For example, the PC4IR report deftly begins by situating its vision within South Africa's own histories of technological innovation. It strategically discusses the Kingdom of Mapunguwe, a pre-colonial South-African state of approximately 5000 people, known for its class-based political order and sophisticated gold and ivory trading.[64] In doing so, the PC4IR report demonstrates how science and technology is not limited to the industrial capabilities of sixteenth century Europe, but also flows from the advanced civilisation of Mapunguwe and its sophisticated technological capabilities and international trade practices as early as the twelfth century.[65] This grounding of AI policy within pre-colonial histories of South Africa provides a strategic narrative to counter Euro-American understandings of technology as flowing from the West to the rest, and to enable people of South Africa in their efforts to become producers of technological knowledge and innovation in the 4IR.

A lens of law as technology through a technoscience approach enables an awareness of how the PC4IR report by rooting itself, albeit only briefly, in histories serves as a counter to Western understandings of technological and legal modes of knowledge production as only objective (and hence true) if they remain detached from past histories and their legacies. The United States' National Artificial Intelligence Research and Development Strategic Plan, for example, gives no mention of histories whatsoever.[66] The PC4IR report thus seemingly differs in its approach by attending to AI-based technology and AI policy not as separate sets of knowledge practices but as techno-legalities that are co-constituted. Although its historicising is commendable, the analysis here might be too generous though as the PC4IR report spends little time on situating its vision for the 4IR within past histories and more time on its key focus of ensuring economic growth.

The PC4IR report could be strengthened further with more elaboration and continual attention to how the governing of AI policy is embedded within such histories, in particular how innovation is gendered. Chirikure, Hall and Rehren contend that Mapungubwe metallurgy (male domain) and pottery (female domain) were, contrary to popular belief, not strictly separate technological domains.[67] While strict taboos forbade women from metal smelting spaces and men from pottery-making areas, these boundaries were relaxed within the shared space of the home.[68] Kalanga women assisted their husbands by pumping bellows during smelting, and Njanja women and children are reported to have assisted with metal smelting during times of high demand.[69] At the same time, although men were prohibited from entering firing localities, they contributed to earlier stages of the pottery-making production process.[70] The PC4IR report

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64 *GG* 43834 at 135.
65 Ibid.
66 National Science and Technology Council (NSTC): 'The National Artificial Intelligence Research and Development Strategic Plan'.
67 Chirikure S, Hall S and Rehren T 'When ceramic sociology meets material science: Sociological and technological aspects of crucibles and pottery from Mapungubwe, Southern Africa' at 23–32.
68 Ibid.
69 Ibid. at 30.
70 Ibid. at 24.

deploys pre-colonial histories of Mapunguwe innovation as a discursive narrative to demonstrate South African leadership and expertise as a past and future producer of technology, but without an attention to these gendered relations the vision of 4IR remains limited and exclusive to men and male norms. AI policy that attends to inter-sectional gendered histories of knowledge production will provide a more valuable compass for guiding the 4IR into a future that meaningfully addresses past injustices of racialised gendered inequality, while recognising the contributions of women to the 4IR.

Asserting themselves as designers and makers of AI-based technologies, women are advancing innovation across Africa. Doctor Shamim Nabuuma Kaliisa, for example, founded the Ugandan femtech company, CHIL AI Group, which is an AI-guided female e-hospital providing women with AI-based technology for managing chronic female diseases such as testing and treatment for cervical cancer.[71] Debbie Rogers, CEO at Praekelt.org, also led the service design of the National Department of Health in South Africa's MomConnect service, which is a mobile phone app based partially on AI-technology that guides women through what to expect during their pregnancy and links them to their healthcare providers.[72] While not founded by women tech designers, more examples of Africa-based innovation in femtech are Sophie Bot (Kenya), which is a chatbot platform that answered questions on sexual and reproductive health, and Wekebere (Uganda) an AI-based mobile app and wearable belt for foetal monitoring.[73] Attention to the contributions of women experts such as these and to gendered histo-ries and knowledge production will better enable AI policy to ensure that AI-technology into the future will support the needs and interests of women and those that identify outside the confines of binary gender.

2.4.3   *Address interconnections of gender and more-than-humans*

To promote a more sustainable vision of growth for South Africa in the 4IR, the PC4IR report must also address interconnections of gender and more-than-humans. A lens of law as technology through a technoscience approach enables an awareness of how the PC4IR report again differs from similar policies in the Global North in its noteworthy commitment to putting the 'human at the centre' of its development vision for the 4IR to resolve 'the nation's historical scars' that continue to manifest in a 'triple scourge' of poverty, unemployment, and inequality.[74] This human-centric approach is founded, however, upon a very narrow definition of the 4IR as 'an era where people are using smart, connected and converged cyber, physical and biological systems and smart business models to define and reshape the social, economic and political spheres.'[75] This definition flows directly from Klaus Schwab, who coined the present technological condition as the 4IR, which is said to differ from previous industrial revolutions by the exponential pace at which technological advances are emerging and transforming

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71 Ugwuede K '"I am Every Woman": CHIL AI Group's Full-fledged Tech Shop for African Women'. I retain the use of the terms 'women' and 'female' as used by Chil AI Group but the use of these terms should be problematised further within the emerging femtech indus-try to ensure that they address transgender health care.

72 Banning-Lover R 'MomConnect Lets Expectant Mothers Know What to Expect'.

73 < https://wekebere.org/ > .

74 *GG* 43834 at 121.

75 Ibid. at 247.

society. It is characterised by a fusion of technologies that, according to Schwab, are blurring the lines across the 'physical, digital, and biological worlds'.[76] The 4IR, however, is more than the use of new interconnected technologies. It also represents a shift in the relationship between technology and the human, and in ways of producing knowledge about the world. The PC4IR report recognises this as much when it says the 4IR presents 'a new concept of human life and identity'[77] but as a technology its application of the definition of the 4IR as informed by Schwab and the language of the World Economic Forum leaves little to no room for generating a human-centric approach that understands how conceptions of the 'human' are themselves deeply racialised and gendered, but also connected to more-than-human life.

Colonialism and apartheid violence have defined who is considered fully human by equating certain humans (read women and people of colour) as less than human, while simultaneously subordinating animal and plant life. Histories of slavery and their residues have reduced the bodies of Black men and women to mere tools of slave labour to ensure white capitalist supremacy. The bodies of women, especially Black and Indigenous women, have been characterised as mere vessels of reproductive labour.[78] Such practices were informed and justified by normative conceptions of rationality that have excluded women and people of colour as rational subjects by characterising them as closer to nature (for example animals and plants) and the body, thus denying them full personhood and participation in social, political, and economic life.[79] It is this link between who is considered fully human and the debasement of non-human life that becomes important to consider for understanding the limits of an AI policy that only centres the human and fails to consider other forms of life.

Colonial and apartheid modes of exclusion have been predicated upon delimiting human life as superior to non-human life, thus it becomes important to address hierarchies of gender through a multi-species approach that also attends to plants and animals. Through the writing of Aristotle, as Michael Marder demonstrates,[80] plants were characterised as the lowest order of life because of their lack of movement and uncontrolled growth. Animals were relegated further up on the hierarchy of life due to their proclivity for movement, sensation, and desiring appetite. Aristotle conferred supremacy only to certain humans (read: white and male) because of their ability to reason, generate language, and produce higher concepts of science and knowledge. Women were considered less capable of reason and rationality thus Western hierarchies of human exceptionalism are highly gendered.[81] Western conceptions of rationality and associated binaries of Man *versus* nature undergird innovation in the 4IR. Through Aristotle, man is defined as a rational animal meant to use reason to deduce the truth through formal rules of logic and, in turn, to rule over and control non-human life. Descartes further emphasised reason as a fundamental facet of personhood with his contention 'I think therefore I am', which further entrenched hierarchies of human versus non-human.

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76 Schwab K *The Fourth Industrial Revolution* at 7.
77 *GG* 43834 at 134.
78 Roberts DE *Killing the Black Body: Race, Reproduction, and the Meaning of Liberty*.
79 Lloyd at 150–152; Plumwood at 44–47; Wynter at 300–305.
80 Marder M *Plant-thinking: A Philosophy of Vegetal Life*.
81 Lloyd at 44–47.

Their writings inspired Enlightenment ideals of universality and the belief that mathematics could represent the relationships and truthfulness of every phenomenon. This view of personhood became foundational to AI and the development of a thinking machine to enhance or even surpass human intelligence.[82] While centring the human in AI policy helps to ensure that thinking machines do not supplant but rather support human wellbeing, an alternative framing might be to focus on a human and more-than-human centric approach that attends to networks of gender, race, plants, animals and minerals. The 4IR should not be just defined by the blurring of lines between the physical, digital, and biological spheres, but by the lessening of boundaries between human and more-than-human life and their relation to hierarchies of racialised gender.

Attending to the interconnections of gender and more-than-human life would enable a more meaningful vision of growth for South Africa in the 4IR. As the economic laden definition of the 4IR demonstrates, the PC4IR report creates too narrow a vision for the 4IR by linking innovation to economic competitiveness. Its dream for South Africa in the 4IR explicitly puts forward the 'wellbeing of her people' but the overwhelming focus is on economic growth of the nation-state. There is mention of 'inclusive growth' to be sure, but as Julie Livingston aptly argues in her parable foregrounding Botswana,[83] economic growth under capitalism becomes a 'self-devouring growth' that negatively impacts social well-being and upends efforts towards social equality. What is needed, she contends, is not better technology, but a greater accounting of the web of relationships between humans, non-human beings, plants and minerals that growth entails.

Take, for instance, the vision that the PC4IR report has for the future of agriculture in the 4IR. With the advent of precision agriculture there has been a shift towards the use of algorithmic-based software, sensors and farming equipment. The PC4IR report as a technology is deployed to emphasise how precision agriculture technologies will increase crop yields in the future and thus should be a key site for profitable investment.[84] To ensure that precision agriculture delivers benefits in equitable ways, it also stresses the need to promote reskilling and tertiary education programs to train workers on the use of such technologies.[85] The trouble though is that the PC4IR report as a technology is limited in its discussion of agriculture by not attending to gender, or considering how a more meaningful vision of growth may emerge if the health of plants (rather than just their crop yields) is addressed.

Agriculture remains a key industry on the African continent with 23 % of sub-Saharan Africa's GDP coming from agriculture and with approximately 60 % devoted to small-scale farming.[86] African women comprise a large portion of the agricultural work force, constituting between 60 % and 80 % of the total agricultural labour force.[87] In terms of precision agriculture, while the industry remains a male-dominated field, women tech developers have begun to contribute to precision agriculture innovations. For instance, Nazirini Siraji from Uganda designed the Farmers Companion App, which helps farmers fight the devastating effects of fall army worm on local maize

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82 Mhlambi S 'From rationality to relationality: Ubuntu as an ethical and human rights framework for artificial intelligence'.

83 Livingston J *Self-Devouring Growth: A Planetary Parable as Told from Southern Africa*.

84 *GG* 43834 at 57.

85 Ibid.

86 Goedde L, Ooko-Ombaka A and Pais G 'Winning in Africa's Agricultural Market'.

87 AUDA-NEPAD: 'Agriculture in Africa: Transformation and Outlook'.

crops.[88] Using Google's Tensor Flow AI-based software in 2019, Siraji developed the mobile app to help farmers spot an infestation early and then suggest the appropriate treatment depending on the life cycle of the pest.

A technoscience approach to AI policy contends with much more than the role of women in agriculture and precision agriculture, but also with gendered processes of ownership and hierarchies of knowledge production. While precision agriculture offers tremendous benefits for detecting disease and for growing of crops with less water and fewer pesticides, it raises concerns over its use of farmers' knowledge and who owns the intellectual property rights over their data.[89] It may mean that women farmers will have fewer meaningful opportunities to own and protect their knowledge and expertise. While African women farmers hold expert knowledge about local soils, plants and animals, the ethos of algorithmic culture bestows greater value on AI-based technologies of precision agriculture as producing more exact, true and precise knowledge of farming. In turn, it reinforces nature and plants as objects of raw material to be managed and optimised further through precision agriculture. The devaluing of women's farming knowledge is thus integrally related to the denigration of non-human life. Precision agriculture after all works best with standardised rows of trees and plants for scanning and sensing. Thus, it is reinforcing monoculture farming. A more gender inclusive AI policy governing precision agriculture, therefore, would need an accounting of its impact on relations of gender as well as plant life.

Attending to the interconnections of gender and more-than-humans can encourage more critical ways of thinking about economic progress and the development of more meaningful models of growth that centre care and responsibility towards multiple modes of identity and networked forms of life. In the case of precision agriculture, addressing these connections brings the management of plants and farm labour into sharper focus. It incites inquiries into how AI-based technologies can enable growth away from monoculture crops towards protecting soil, water, land, plants and trees not as mere commodities and objects of property but as beings integrally related to the lives of humans (and technology). The future of food in the 4IR becomes a much different vision when care and responsibility are directed towards plants as precise and intelligent beings, not just as raw material or resource for food. Likewise, the future of health in the 4IR requires attention not only to racialised gendered health disparities, but also to the health of more-than-humans as their own worlds not just in service to humans.

2.5   Conclusion

Challenging narratives of techno-legal-optimism that guard the law from critical examination, this chapter develops and models a technoscience approach for understanding the PC4IR report as a technology. In doing so, it demonstrates how the PC4IR report deploys a rhetoric of South African politics that simultaneously confronts colonial and apartheid pasts, while reinforcing them through a narrow vision of the 4IR that leaves hierarchies of race and gender intact. Through a technoscience approach it then offers

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88 Adrikos J 'Conquering the fall armyworm in Uganda'; Bell-Gorsia N 'Machine learning meets African agriculture'.

89 Foster L et al. 'Smart farming and artificial intelligence in East Africa: Addressing indigeneity, plants, and gender' at 1–10.

a fundamental rethinking of how the PC4IR report could promote a more meaningful vision and governing of AI-based technologies through an attention to gender as intersectional and multiple, to gendered histories of knowledge production, and interconnections of gender and more-than-humans.

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