Seeding Sustainability over Extracting Capital: Advancing a Vision for Technology Justice in the Canadian Agri-Food Sector

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Abstract

The detrimental consequences associated with industrial models of food production are becoming more difficult to ignore. In response, one dominant approach to mitigating the myriad environmental, social, and ethical harms relating to food has sought to increase the efficiency of agricultural outputs through scientific and technological innovation. Although technology certainly has some role to play in any vision of a sustainable future, technocratic approaches to problem solving are insufficient—and arguably inappropriate—for addressing many of the kinds of complex challenges that we face today.

There are recent indications that both agri-food law and policy and innovation policy are being taken more seriously in Canada, which creates an opportunity to reflect more deliberately on their ends and means. This dissertation explores the topic of how laws, policies, and other tools of governance can work to better align technological innovations in the agri-food sector with shared environmental goals and ethical aspirations. Taking a critical legal perspective closely informed by feminist insights and the work of existing, analogous justice movements, I examine several interlinkages between technology, law, the environment, and society to evaluate some of the failings of existing approaches to food systems transformation and to offer a contribution to the conversation about alternative pathways. Given the context-specific nature of food systems and food systems governance, my focus is primarily on Canada, but the universal importance of food in a globalized world renders some comparative and transnational discussion unavoidable.

I use case studies and discourse analysis to demonstrate that, when considered through a justice-oriented lens, several of the new and emerging technologies being championed in the agri-food sector may not be as beneficial as their proponents claim. Instead, they may serve to retrench injustice and cement existing, exploitative power structures, making them more difficult to challenge and change later down the line. Thus, if technologies are to serve public instead of private interests in the ways they are incentivized, designed, regulated, and used, we will need to see broad systemic and structural reforms informed by thoughtful shifts in our values and priorities, rather than merely reactive adjustments to our policies and practices. Though this undertaking will be difficult, it is not impossible; this dissertation offers one way to facilitate the process of seeding change for environmental sustainability and technological justice.

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Dedication

My work, as ever, is dedicated to my late mother, who always saw the scholar, writer, and change maker in me. My efforts are a constant endeavour to live up to what she imagined possible for my future, and I hope she would be proud.

Acronyms

Agriculture and Agri-Food Canada (AAFC)

Agroecology (AE)

Appropriate technology (AT)

AquAdvantage salmon (AAS)

Canadian Biotechnology Advisory Committee (CBAC)

Canadian Biotechnology Strategy (CBS)

Canadian Environmental Protection Act, 1999 (*CEPA, 1999*)

Canadian Food Inspection Agency (CFIA)

Canadian International Development Agency (CIDA)

Civil society organizations (CSOs)

Climate justice (CJ)

Climate smart agriculture (CSA)

Critical discourse analysis (CDA)

Environment and Climate Change Canada (ECCC)

Environmental justice (EJ)

Ethical, Legal, and Social Implications (ELSI)

European Union (EU)

Federal Sustainable Development Act (*FSDA*)

Federal Sustainable Development Strategy (FSDS)

Fisheries and Oceans Canada (DFO)

Food and Agriculture Organization of the United Nations (FAO)

Food policy councils (FPCs)

Food Secure Canada (FSC)

Genetically engineered (GE)

Genetically modified (GM)

Genetically modified organisms (GMOs)

Greenhouse gas emissions (GHGs)

In vitro meat (IVM)

Information and communication technologies (ICTs)

Innovation, Science and Economic Development Canada (ISED)

Intellectual property (IP)

Intellectual property rights (IPRs)

Intergovernmental Panel on Climate Change (IPCC)

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

International Panel of Experts on Sustainable Food Systems (IPES-Food)

New Substances Notification Regulations (Organisms) (NSNR (Organisms))

Non-governmental organizations (NGOs)

Organisation for Economic Co-operation and Development (OECD)

Research and development (R&D)

Responsible innovation (RI)

Responsible research and innovation (RRI)

Science, technology, engineering, and mathematics (STEM)

Science, technology, and innovation (STI)

Science and Technology Studies (STS)

Sustainable Development Goals (SDGs)

Sustainable intensification (SI)

Technology assessment (TA)

United Kingdom (UK)

United Nations (UN)

United States (US)

United States Department of Agriculture (USDA)

United States Food and Drug Administration (FDA)

Value sensitive design (VSD)

World Economic Forum (WEF)

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1. Introduction

Our planet is currently confronting an unprecedented environmental era.[1] Indeed, the language of "crisis" is increasingly being adopted as a more accurate characterization of the situation we are facing.[2] This crisis has been extensively confirmed in terms of metrics like loss of biodiversity[3] and biogeochemical flows,[4] and is being experienced around the world in the form of more extreme weather events[5] (including more frequent heatwaves[6]), and rising sea levels.[7] Global temperatures have steadily increased over recent decades—pushing the past five years into record-breaking territory—with the trend showing no signs of abating.[8] One of the most remarkable aspects of this distressing state of affairs is that, according to scientific consensus, much of it is human-induced.[9]

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[1] Will Steffen et al, "Trajectories of the Earth System in the Anthropocene" (2018) 115:33 PNAS 8252.
[2] Damian Carrington, "Why the Guardian is changing the language it uses about the environment", *The Guardian* (17 May 2019), online: <https://www.theguardian.com/environment/2019/may/17/why-the-guardian-is-changing-the-language-it-uses-about-the-environment>.
[3] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, "Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating'", Media Release (5 May 2019), online: <https://www.ipbes.net/news/Media-Release-Global-Assessment>; Sandra Diaz et al, "Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services", Advance Unedited Version (6 May 2019), online: <https://www.ipbes.net/sites/default/files/downloads/spm_unedited_advance_for_posting_htn.pdf>.
[4] Stockholm Resilience Centre, "Planetary boundaries research", online: <http://www.stockholmresilience.org/research/planetary-boundaries.html>.
[5] Center for Climate and Energy Solutions, "Extreme Weather and Climate Change", online: <https://www.c2es.org/content/extreme-weather-and-climate-change/>.
[6] Damian Carrington, "Extreme global weather is 'the face of climate change' says leading scientist", *The Guardian* (27 July 2018), online: <https://www.theguardian.com/environment/2018/jul/27/extreme-global-weather-climate-change-michael-mann>.
[7] Matthew McClearn, "Rising seas and climate change: Everything you need to know", *The Globe and Mail* (14 March 2018), online: <https://www.theglobeandmail.com/canada/article-sea-change-primer/>.
[8] National Oceanic and Atmospheric Administration (US), "2018 was 4th hottest year on record for the globe" (6 February 2019), online: <https://www.noaa.gov/news/2018-was-4th-hottest-year-on-record-for-globe>; NASA, "2018 Fourth Warmest Year in Continued Warming Trend, According to NASA, NOAA", Press Release (6 February 2019), online: <https://www.nasa.gov/press-release/2018-fourth-warmest-year-in-continued-warming-trend-according-to-nasa-noaa>; World Meteorological Organization, "WMO confirms past 4 years were warmest on record", Press Release (6 February 2019), online: <https://public.wmo.int/en/media/press-release/wmo-confirms-past-4-years-were-warmest-record>; Met Office (UK), "Forecast suggests Earth's warmest period on record", News Release (6 February 2019), online: <https://www.metoffice.gov.uk/news/releases/2019/forecast-suggests-earths-warmest-period>.
[9] Climate change, in particular, is widely accepted to be anthropogenic in nature: see e.g. NASA, "Scientific consensus: Earth's climate is warming", online: <https://climate.nasa.gov/scientific-consensus/>.

Environmental destruction has both direct and indirect consequences for people. One of the domains in which these consequences are most significant is in food and agriculture. Clean air, fresh water, and fertile soil are not only important to preserve as the basic building blocks on which growing and producing food depends, but agriculture is also a key driver of global environmental change,[10] including in the forms of deforestation, water shortages,[11] pesticide resistance, land degradation, and ocean dead-zones.[12] The EAT-Lancet Commission report published in 2019, the result of a multi-year study bringing together 37 experts from 16 countries, comes to the alarming conclusion that "[a] radical transformation of the global food system is urgently needed."[13] The report adds to a growing and cogent body of evidence acknowledging the numerous ways in which industrial agricultural models are profoundly unsustainable.[14]

Against this backdrop, questions about how we are going to sustainably feed a growing global population[15]—with its correspondingly growing appetite[16]—are highly significant. Although we live in a time of abundance from a relative perspective, the immense toll that has

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[10] See e.g. J Poore & T Nemecek, "Reducing food's environmental impacts through producers and consumers" (2018) 360 Science 987.

[11] See e.g. Food and Agriculture Organization of the United Nations, *Coping with water scarcity: An action framework for agriculture and food security* (Rome: FAO, 2012), online: <http://www.fao.org/docrep/016/i3015e/i3015e.pdf>.

[12] See e.g. Edward L Golding, *A History of Technology and Environment: From stone tools to ecological crisis* (New York: Routledge, 2017) at 124-125; KJ Van Meter, P Van Cappellen & NB Basu, "Legacy nitrogen may prevent achievement of water quality goals in the Gulf of Mexico" (2018) 360:6387 Science 427.

[13] EAT-Lancet Commission, *Food, Planet, Health: Healthy Diets From Sustainable Food Systems* (Summary Report, 2019) at 5 [*Food, Planet, Health*].

[14] See e.g. Andrew Kimbrell, ed, *Fatal Harvest: The Tragedy of Industrial Agriculture* (Washington, DC: Island Press, 2002); Jennifer Clapp, *Food*, 2d ed (Malden, MA: Polity Press, 2016).

[15] Recent projections estimate that the global population will swell to 8.5 billion by 2030, 9.7 billion by 2050, and 10.9 billion by 2100. United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects 2019: Highlights*, ST/ESA/SER.A/423 (New York: UN, 2017), online: <https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf> at 1.

[16] On a global scale, appetites for meat and other animal products in particular are trending upward. See e.g. H Charles J Godfray et al, "Meat consumption, health, and the environment" (2018) 361:6399 Science, DOI: <10.1126/science.aam5324>; DA Hume, CBA Whitelaw & AL Archibald, "The future of animal production: improving productivity and sustainability" (2011) 149 J Agric Sci 9.

been and continues to be extracted to produce our food through industrial methods is being levied against future generations' ability to survive on Earth, much less thrive. The accelerating pace and compounding effect of drivers like climate change, pollution, and loss of biodiversity gravely threaten the long-term viability and resilience of Earth's ecosystems. Put starkly, if we are to maintain human and planetary health, there needs to be a "great food transformation" entailing a number of major dietary shifts, including increased consumption of plant-based foods while, in many settings, substantially limiting animal-sourced foods.[17] Various actors are therefore thinking about and working towards how to best effect such a transformation, including efforts made on the part of states.[18]

One approach to addressing the myriad environmental, social, and ethical challenges related to food has sought to increase the efficiency of agricultural outputs through scientific and technological innovation.[19] Hailing technological fixes as providing win-win solutions to some of the most vexing social and environmental problems has an intuitive appeal: they are often politically palatable, financially lucrative, highly visible, and do not demand or require radical behavioural changes. Accordingly, in Canada (as in other countries), many stakeholders are increasingly trumpeting the importance of science and technology for the agri-food sector, especially in terms of the national economy and international trade. International organizations

[17] *Food, Planet, Health, supra* note 13 at 12, 16, 21.
[18] The UK, for example, has undertaken several initiatives related to the future of food, including commissioning programmes, reports, and other related efforts. See e.g. The Oxford Martin Programme on the Future of Food, online: <https://www.futureoffood.ox.ac.uk/>; Foresight, *The Future of Food and Farming: Challenges and choices for global sustainability*, Final Project Report (London: The Government Office for Science, 2011).
[19] See e.g. Amanda Little, *The Fate of Food: What We'll Eat in a Bigger, Hotter, Smarter World* (New York: Harmony Books, 2019).

like the Organisation for Economic Co-operation and Development[20] (OECD) and the World Economic Forum[21] (WEF) have also echoed this sentiment.

However, scientific and technological innovation is not necessarily an uncontested public good. Technologies are not necessarily benign, and they can have significant material and intangible consequences extending beyond their intended scopes, which often present in unintentional and unpredictable ways. The agri-food sector alone is rife with cases in point, from the fraught and ongoing debate about genetically modified (GM) foods to divergent appraisals as to whether the Green Revolution was ultimately a positive or negative development.[22] Although innovation is often justified with rhetoric that speaks to laudable intentions, the outcomes of efficiency- and/or profit-driven projects do not always match the pictures painted by their proponents, especially when it comes to more diverse and long-term goals relating to social justice, human health, and ecological resilience. For example, the kinds of technologies that attract attention and investment are often resource and energy-intensive, which can undercut purported environmental benefits based on highly specific and hypothetical use scenarios. Additionally, the benefits and burdens associated with technologies are often distributed

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[20] OECD, *Innovation, Agricultural Productivity and Sustainability in Canada*, OECD Food and Agricultural Reviews (Paris: OECD Publishing, 2015); OECD, "Agricultural productivity and innovation", online: <http://www.oecd.org/agriculture/topics/agricultural-productivity-and-innovation/>.

[21] See e.g. World Economic Forum (prepared in collaboration with McKinsey & Company), *Innovation with a Purpose: The role of technology innovation in accelerating food systems transformation* (World Economic Forum, 2018), online: <http://www3.weforum.org/docs/WEF_Innovation_with_a_Purpose_VF-reduced.pdf>.

[22] The Green Revolution, a suite of research, agricultural, and technology transfer initiatives that took place in the mid-20th century, has been credited with a range of positive outcomes, including poverty reduction, lowered food prices, and an extraordinary growth in food crop productivity: see e.g. Prabhu L Pingali, "Green Revolution: Impacts, limits, and the path ahead" (2012) 109:31 PNAS 12302. However, others have argued that the Green Revolution also contributed to severe ecological and social harms: "The strategy of the Green Revolution was aimed at transcending scarcity and creating abundance. Yet it put new demands on scarce renewable resources and generated new demands for non-renewable resources. The Green Revolution technology required heavy investment in fertilizers, pesticides, seed, water and energy. Intensive agriculture generated severe ecological destruction, and created new kinds of scarcity and vulnerability, and new levels of inefficiency in resource use. Instead of transcending the limits put by natural endowments of land and water, the Green Revolution introduced new constraints on agriculture by wasting and destroying land, water resources, and crop diversity." Vandana Shiva, *The Violence of the Green Revolution: Third World Agriculture, Ecology, and Politics* (Lexington: The University Press of Kentucky, 2016) at 46. See also Golding, *supra* note 12 at 52-53.

unevenly, and can serve to exacerbate the marginalization and vulnerability of individuals and groups like women, racial minorities, those in the Global South, and smaller-scale producers—a problem that has seldom been prioritized in conversations about technological development, deployment, and regulation.

More than other goods, food is imbued with myriad health, social, economic, cultural, and ethical qualities, and the implicit and explicit choices that are made regarding food and agriculture at individual, institutional, national, and global scales have profound ramifications. When it comes to reforming our food systems, I argue that we need to draw on multifaceted approaches, informed by a plurality of perspectives and disciplinary traditions, to ensure that technological innovations—if and when they are used—can more directly serve human needs, particularly those of the most marginalized, while minimizing harm to the environment. To this end, this dissertation explores the topic of how laws, policies, and other tools of governance can help to better align technological interventions in the agri-food sector with shared environmental goals and ethical aspirations.

Although it has important mediating possibilities, the role of law in the technology-environment-society nexus remains indeterminate and undertheorized. Does law merely serve as an *ex post facto* regulator of technologies and their associated consequences? Or does it play more of a determinative role in shaping the trajectory of technological developments? More significantly, what should the role of law be in the context of new and emerging technologies that carry both significant promises and potential perils? There are no clear answers to such questions, and there is no one type of knowledge or expertise that can provide authoritative guidance. Instead, responses inescapably turn on a host of auxiliary considerations, including "visions of what sustainability actually 'looks' like, based on deeper ethical and aesthetic convictions in relation to our role in the natural world, the nature of human progress, definitions of freedom and ultimately what constitutes the 'good life'."[23] It is important, then, to do away with the misconception that certain types of data and methods (i.e. scientific ones) should take primacy in guiding collective decision-making, and that ethical appraisals have no rightful place in conversations about technology regulation and innovation policy in a changing world.

There are extant and influential bodies of literature in areas like Science and Technology Studies (STS) that consider issues arising in efforts to regulate new and emerging technologies writ large. That being said, there are particular dimensions of the legal landscape in Canada that heighten the challenge of regulating new and emerging technologies in the agri-food sector and that merit further study. Despite several promising initiatives on the part of the current federal government—including the development, for the first time, of a national food policy for Canada[24]—there is still a great deal of work to be done when it comes to using both technology and law to help build a more inclusive, ethical, socially just, and environmentally sustainable food future for all.

As part of that collective and ongoing project, this dissertation advances a vision for technology justice in Canada, using the agri-food sector as a specific locus of study. Taking a critical perspective closely informed by feminist insights and the work of existing, analogous justice movements, I examine several interlinkages between technology, law, environment, and society to evaluate some of the failings of existing approaches to food systems transformation and to offer a contribution to the conversation about alternatives. Though I use case studies to

[23] Tara Garnett, "Food sustainability: problems, perspectives and solutions" (2013) 72 Proceedings of the Nutrition Society 29 at 31-32.

[24] Agriculture and Agri-Food Canada, *Food Policy for Canada: Everyone at the Table* (Ottawa: Agriculture and Agri-Food Canada, 2019), online: <https://www.canada.ca/en/campaign/food-policy/thefoodpolicy.html> [*Food Policy for Canada*]. See Chapter 2.3.3.

ground my analysis, my aim is not to focus on a specific form of technology, but rather, to examine the use of technologies within a particular sector, against a contextualized backdrop. Further, while the critiques that I raise in relation to the specific technologies discussed as part of this project are rooted in current conditions, the suggestions that I offer for reform are also intended to be future-oriented, in that they can hopefully be extrapolated to other emerging technologies and as yet unrealized impacts.

1.1 Environmental Context

Just as foods vary in nutritional value, they also come with differential environmental impacts. Categorically, industrially produced animal products represent a particularly heavy environmental burden.[25] A study published in the leading journal *Science* in 2018 used an immense data set to assess the environmental impacts of 40 key food products at each stage of the supply chain. It found that "the impacts of animal products can markedly exceed those of vegetable substitutes, to such a degree that meat, aquaculture, eggs, and dairy use ~83% of the world's farmland and contribute 56 to 58% of food's different emissions, despite providing only 37% of our protein and 18% of our calories."[26] The data set used in the study covered five comprehensive environmental impact indicators: land use; freshwater withdrawals weighted by local water scarcity; and GHG, acidifying, and eutrophying emissions, as opposed to GHG emissions only.[27]

As other studies have concurred, industrially produced animal products fare extremely poorly compared to plant-based foods when it comes to their relative land use, water use, and

[25] See e.g. Joyce D'Silva & John Webster, eds, *The Meat Crisis: Developing more sustainable and ethical production and consumption*, 2d ed (New York: Routledge, 2017).
[26] Poore & Nemecek, *supra* note 10 at 990.
[27] *Ibid* at 987.

emissions.[28] Over and above environmental concerns, when approximately one billion people remain chronically undernourished,[29] "using highly productive croplands to produce animal feed, no matter how efficiently, represents a net drain on the world's potential food supply."[30] Accordingly, the need to shift diets for sustainability by reducing or eliminating the consumption of the most destructive food items has been identified as a priority area for some governments[31] and has generated a substantial amount of research, including in the emerging area of environmental/ecological nutrition.[32]

The harms attributable to the agri-food sector are a major cause for concern when it comes to climate considerations alone. The Intergovernmental Panel on Climate Change (IPCC) has estimated that the agricultural sector is responsible for about 24 percent of direct global greenhouse gas emissions (GHGs),[33] with some studies estimating these numbers to be even

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[28] See e.g. Tara Garnett, "Livestock-related greenhouse gas emissions: impacts and options for policy makers" (2009) 12 Enviro Science & Pol'y 491; Pierre J Gerber et al, *Tackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities* (Rome: FAO, 2013), online: <http://www.fao.org/docrep/018/i3437e/i3437e.pdf>; Yukyan Lam et al, *Industrial Food Animal Production in Low- and Middle-Income Countries: A Landscape Assessment* (Baltimore, MD: John Hopkins Center for a Livable Future, 2016), online: <http://www.jhsph.edu/research/centers-and-institutes/johns-hopkins-center-for-a-livable-future/_pdf/projects/IFAP/IFAPLowmid_income_countriesWeb1.pdf>; Erik Frenette, Olivier Bahn & Kathleen Vaillancourt, "Meat, Dairy and Climate Change: Assessing the Long-Term Mitigation Potential of Alternative Agri-Food Consumption Patterns in Canada" (2017) 22:1 Environ Model Assess 1.

[29] Jonathan A Foley et al, "Solutions for a cultivated planet" (2011) 478 Nature 337; Food and Agriculture Organization of the United Nations et al, *The State of Food Security and Nutrition in the World 2017: Building Resilience for Peace and Food Security* (Rome: FAO, 2017), online: <http://www.fao.org/3/a-I7695e.pdf> at 1 (estimating that approximately 815 million people were undernourished in 2016).

[30] Foley et al, *ibid* at 338.

[31] See e.g. The Oxford Martin Programme on the Future of Food, *supra* note 18; Janet Ranganathan et al, "Shifting Diets for a Sustainable Food Future" (2016) World Resources Institute Working Paper 11, online: <http://www.wri.org/sites/default/files/Shifting_Diets_for_a_Sustainable_Food_Future_1.pdf> ["Shifting Diets for a Sustainable Food Future"].

[32] See e.g. Pamela Mason & Tim Lang, *Sustainable Diets: How Ecological Nutrition Can Transform Consumption and the Food System* (New York: Earthscan, 2017); Joan Sabaté, Helen Harwatt & Samuel Soret, "Environmental Nutrition: A New Frontier for Public Health" (2016) 106:5 AJPH 815.

[33] Intergovernmental Panel on Climate Change, "Summary for Policymakers" in *Climate Change 2014: Mitigation of Climate Change – Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2014), online: <https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf> at 9.

higher when all direct and indirect impacts are accounted for.[34] Moreover, not all emissions are created equal. Livestock production has been identified as the single most important source of methane,[35] which has stronger greenhouse warming potential than other GHGs, like carbon dioxide.[36] However, methane has a shorter lifespan in the atmosphere, and can therefore be a good target for more immediate GHG reductions. From a climate policy perspective, aiming for absolute reductions in methane emissions attributable to livestock production would be a relatively straightforward way to help meet overall emission targets, as well as being more politically pragmatic insofar as quicker returns and demonstrable impacts are important to voters. There are also numerous co-benefits associated with reducing our reliance on industrial animal agriculture for food production, especially if such reduction is undertaken strategically with broader environmental and social targets in mind.

Thus, the agri-food sector, and industrial animal agriculture in particular, constitutes both a significant challenge and opportunity when it comes to climate change mitigation[37] and other broad-based efforts at reducing our ecological footprints.[38] When it comes to operationalization, however, technological improvements are necessary but not sufficient to close the gap between potential and realized GHG mitigation.[39] Barriers relating to policy (both climate and non-

[34] See e.g. Julie Wolf, Ghassem R Asrar & Tristram O West, "Revised methane emissions factors and spatially distributed annual carbon fluxes for global livestock" (2017) 12:16 Carbon Balance and Management, DOI: <10.1186/s13021-017-0084-y>.
[35] Godfray et al, "Meat consumption, health, and the environment", *supra* note 16 at 4.
[36] Intergovernmental Panel on Climate Change, *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2013) at 714, Table 8.7. Methane was calculated to be 34 times stronger as a heat-trapping gas (global warming potential) than carbon dioxide over a 100-year time scale, including climate-carbon feedbacks.
[37] Food and Agriculture Organization of the United Nations et al, *The State of Food Security and Nutrition in the World 2018: Building Climate Resilience for Food Security and Nutrition* (FAO: Rome, 2018), online: <http://www.fao.org/3/i9553en/i9553en.pdf> [*The State of Food and Nutrition in the World 2018*].
[38] Meidad Kissinger, "Approaches for calculating a nation's food ecological footprint—The case of Canada" (2013) 24 Ecological Indicators 366.
[39] Tara Garnett, "Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)?" (2011) 36 Food Policy S23 at S31.

climate related) and "institutional, social, educational, and economic constraints" have been identified as major hurdles,[40] and creating sustainable food systems will require much more aggressive intervention on the part of decision-makers than simply making minor adjustments to an otherwise business-as-usual course of action.

Action is urgently required. The situation is already precarious, as detrimental effects to the agri-food sector sharply spike with even the smallest increments in warming. In a special report released in October 2018 as part of its Sixth Assessment Cycle, for example, the IPCC highlighted a number of impacts of climate change that could be avoided by limiting global warming to 1.5°C.[41] The report states that "[c]limate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further with 2°C."[42] It report further notes that "1.5°C pathways that include low energy demand …, low material consumption, and low GHG-intensive food consumption have the most pronounced synergies and the lowest number of trade-offs with respect to sustainable development and the [Sustainable Development Goals]."[43]

In appraising the present situation and determining where to go from here, it is clear that, if our objective is to dramatically reduce the environmental burdens associated with the agri-food sector, as the evidence calls for, the greatest beneficial impact will come from a coordinated approach that steers both production and consumption patterns toward more sustainable ground. In other words, neither increasing the efficiency of production or demanding restraint in

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[40] Pete Smith et al, "Greenhouse gas mitigation in agriculture" (2008) 363 Phil Trans R Soc B 789.
[41] Intergovernmental Panel on Climate Change, *Global Warming of 1.5 °C: an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty – Summary for Policymakers* (6 October 2018), online: <http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf>.
[42] *Ibid* at 11.
[43] *Ibid* at 26.

consumption will be sufficient on its own; more sweeping changes in governance that acknowledge the dynamic interactions among myriad interlocking systems are essential for meeting the task.[44]

1.2 Social Context

In addition to their ramifications for environmental sustainability, food production and consumption practices are intimately tied to a range of social justice goals and concerns. Individually and collectively, food and water are inescapable requirements for maintaining human life, but access to both can be restricted for several reasons, including financial and environmental ones. No matter the cause, poverty and hunger create fertile grounds for struggle and conflict, and alleviating both can be seen as a prerequisite to the loftier objectives of attaining peace and prosperity for all. Here, again, climate change compounds the challenge, as climate variability and extremes have already been identified as a key driver behind the recent rise in global hunger and one of the leading causes of severe food crises.[45]

Agricultural work currently constitutes "a source of livelihood for a significant proportion of people on the planet",[46] especially in low- and middle-income countries. According to the Food and Agriculture Organization of the United Nations (FAO), "family farms occupy a large share of the world's agricultural land and produce about 80 percent of the world's food."[47] However, the ability to sustain oneself and make a living through agricultural work is increasingly under threat, due in part to the encroaching corporatization, concentration, and

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[44] Garnett, "Food sustainability: problems, perspectives and solutions", *supra* note 23 at 34.
[45] *The State of Food and Nutrition in the World 2018*, *supra* note 37 at 38.
[46] Jennifer Clapp & Doris Fuchs, "Agrifood Corporations, Global Governance, and Sustainability: A Framework for Analysis" in Jennifer Clapp & Doris Fuchs, eds, *Corporate Power in Global Agrifood Governance* (Cambridge, MA: The MIT Press, 2009) 1 at 13.
[47] Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2014 – Innovation in family farming* (Rome: FAO, 2014), online: <http://www.fao.org/3/a-i4040e.pdf> at vi [*The State of Food and Agriculture 2014*].

commoditization of the global food supply.[48] The rapid industrialization of the global food system has, *inter alia*, displaced smallholders, threatened traditional knowledge systems, and intensified animal suffering[49] on a massive scale, which—beyond being ills in their own right—have also generated ancillary harms. Unfortunately, within the constraints of Western capitalist market systems, profoundly unequal power structures, and deep-seated institutional inertia, it seems unlikely that these kinds of trends will abate without significant and strategic interventions.

Even while small family farms are crucial to helping the world achieve food security, the irony is that many of these farmers are food insecure themselves.[50] Poverty is widely understood to be a driving reason behind food insecurity, with the implication being that any efforts to increase food security must deal with the underlying causes of poverty, and not just its consequences.[51] Effectively addressing food insecurity is about more than simply eliminating temporary or persistent states of hunger for affected people.[52] Food security has been defined as existing when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."[53]

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[48] See e.g. Jennifer Clapp & S Ryan Isakson, *Speculative Harvests: Financialization, Food, and Agriculture* (Halifax: Fernwood Publishing, 2018); Clapp, *supra* note 14; D Pimentel, "Ethical issues of global corporatization: agriculture and beyond" (2004) 83:3 Poultry Science 321; Vandana Shiva, *Stolen Harvest: The Hijacking of the Global Food Supply* (Cambridge, MA: South End Press, 2000); IPES-Food, *Too Big to Feed: Exploring the impacts of mega-mergers, consolidation and concentration of power in the agri-food sector* (Brussels: International Panel of Experts on Sustainable Food Systems, 2017), online: <http://www.ipes-food.org/_img/upload/files/Concentration_FullReport.pdf>.

[49] The cruelty and suffering inflicted on the billions of sentient nonhuman animals that have been, are currently being, and will be industrially farmed for food has been referred to as "one of the most pressing ethical issues of our time." Yuval Noah Harari, "Industrial farming is one of the worst crimes in history", *The Guardian* (25 September 2015), online: <https://www.theguardian.com/books/2015/sep/25/industrial-farming-one-worst-crimes-history-ethical-question>.

[50] *The State of Food and Agriculture 2014, supra* note 47 at xvi.

[51] Food and Agriculture Organization of the United Nations, *Rome Declaration on World Food Security and the World Food Summit Plan of Action*, WFS 96/REP (17 November 1996), online: <http://www.fao.org/3/w3613e/w3613e00.htm> [*Rome Declaration*]; Naomi Dachner & Valerie Tarasuk, "Tackling household food insecurity: An essential goal of a national food policy" (2018) 5:3 Canadian Food Studies 230.

[52] Barbara Davis & Valerie Tarasuk, "Hunger in Canada" (1994) 11:3 Agriculture and Human Values 50.

[53] *Rome Declaration, supra* note 51.

The goal of achieving food security for all is not just about securing sufficient quantities of food for everyone to be able to meet their caloric and nutritional requirements, but also ensuring that food is physically and economically accessible at all times, adequate (in the sense that it is nutritious and safe to eat), and appropriate (in that it is produced and obtained in ways that are acceptable, as well as being culturally appropriate).[54]

Food insecurity, on the other hand, has been defined as "the inadequate or insecure access to sufficient food because of financial constraints."[55] Food insecurity manifests not only as physical symptoms (e.g. nutrient deficiencies and inadequacies, greater vulnerability to a range of chronic conditions), but also as mental, psychological, and social symptoms, and represents a major public health and social justice issue.[56] Food insecurity is a serious and ongoing problem both globally and domestically, and stands to be further exacerbated by the growing impacts of climate change.[57] This multiplying effect is troubling from a justice perspective because the impacts of food insecurity are demonstrably uneven as it is; in Canada, already marginalized groups, including Indigenous peoples, populations in Canada's North, single parents, and immigrants are particularly at risk of being food insecure.[58]

Despite the immense gains that have been made in terms of food production, inadequacies in distribution have meant that rates of global hunger have been rising for the past

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[54] See e.g. Michael Carolan, *Reclaiming Food Security* (New York: Routledge, 2013).
[55] Dachner & Tarasuk, *supra* note 51 at 231.
[56] See generally PROOF, "Household Food Insecurity in Canada", online: <https://proof.utoronto.ca/food-insecurity/>.
[57] Iain R Lake et al, "Climate Change and Food Security: Health Impacts in Developed Countries" (2012) 120:11 Environmental Health Perspectives 1520; Carmen G Gonzalez, "Climate Change, Food Security, and Agrobiodiversity: Toward a Just, Resilient, and Sustainable Food System" (2011) 22 Fordham Envtl L Rev 493.
[58] The Council of Canadian Academies, *Aboriginal Food Security in Northern Canada: An Assessment of the State of Knowledge – Expert Panel on the State of Knowledge of Food Security in Northern Canada* (Ottawa: Council of Canadian Academies, 2014); Valerie Tarasuk, Andy Mitchell & Naomi Dachner, *Household Food Insecurity in Canada 2014* (Toronto: PROOF, 2016), online: <http://proof.utoronto.ca/wp-content/uploads/2016/04/Household-Food-Insecurity-in-Canada-2014.pdf>.

few years, after a period of prolonged decline.[59] High rates of food insecurity remain an enduring and growing concern, even in wealthy, industrialized countries like Canada.[60] Many have already pointed out that this situation is not attributable to absolute scarcity or lack of food production capacity, but rather, to longstanding "problems of political power, infrastructure inadequacies, economic inequity, and geopolitics."[61] Isolated improvements in the efficiency of food production will not resolve these issues. Instead, wide-ranging social and political changes are needed if we are to effectively tackle the distributional deficiencies underlying global hunger and persistent food insecurity.

1.3 Connecting Technology, Environment, Society, Justice, and Law

The growing encroachment and influence of technology on ever more spheres of human life has rendered the contemplation of questions and concerns about technological innovation and technological change an integral part of the work of building a more ecologically and socially just future. Technologies and technological infrastructures can have the effect of not only worsening existing inequalities, but also generating new ones. Yet, there has been relatively little systematic analysis of the relationship between technology and justice, and especially not from a critical legal perspective. As Gwen Ottinger, Javiera Barandiarán, and Aya Kimura observe, "much more remains to be done to understand how technology and technological infrastructures may be cementing environmental inequalities and making progress toward environmental justice very difficult."[62]

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[59] *The State of Food Security and Nutrition in the World 2018*, *supra* note 37.

[60] Tarasuk, Mitchell & Dachner, *supra* note 58; United Nations General Assembly, *Report of the Special Rapporteur on the right to food, Olivier De Schutter: Mission to Canada*, A/HRC/22/50/Add.1 (24 December 2012).

[61] Carolyn Mattick & Brad Allenby, "The Future of Meat" (2013) 30:1 Issues in Science and Technology 64 at 68.

[62] Gwen Ottinger, Javiera Barandiarán & Aya H Kimura, "Environmental Justice: Knowledge, Technology, and Expertise" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2016) 1029 at 1043.

This work builds on a strong foundation of research and activism on social and distributive justice more broadly, but an underdeveloped body of literature on technology justice specifically. To date, the term "technology justice" appears only to have been explicitly leveraged in a limited number of instances. Andrés Ortega and Francisco Andrés Pérez, of the Elcano Royal Institute in Madrid, have advocated for a "G20 agenda for technological justice".[63] Though they state broadly that "[t]echnology justice can play an important role within the international system in resolving global challenges and creating a smart and more equal world society",[64] the scope of their analysis is mostly limited to the G20 and the 2030 Agenda for Sustainable Development.

United Kingdom (UK)-based organization Practical Action, which seeks to "help people use ingenuity to tackle the world's toughest problems",[65] appears to have gone the furthest with the idea of technology justice. Practical Action approaches the concept from an international development-oriented perspective, believing that "the goal of development should be to create sustainable wellbeing for all, and that access to technology is an essential component of achieving this."[66] In a book titled *Rethink, Retool, Reboot: Technology as if people and planet mattered*, Simon Trace, former CEO of Practical Action, argues that our approach to the development and use of technology needs to be guided by a radically different frame of reference. To this end, he suggests that technology justice is a principle or vision of a world where everyone has "the right to the technologies needed to live the life they value, tempered by

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[63] Andrés Ortega & Francisco Andrés Pérez, "A G20 agenda for technological justice" (3 June 2018), online: <http://www.realinstitutoelcano.org/wps/portal/rielcano_es/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/ari31-2018-ortega-andres-g20-agenda-for-technological-justice>. G20 is a collective of 19 countries and the European Union that seeks to address systemic economic and policy issues that transcend national borders.
[64] *Ibid*.
[65] Practical Action, online: <https://practicalaction.org/>.
[66] Practical Action, "Technology Justice", Policy Position Paper (2012), online: <https://infohub.practicalaction.org/bitstream/handle/11283/556931/Policy%20Position%20Paper%20Technology%20Justice.pdf?sequence=1> at 3.

the recognition that ecological limits and notions of fairness mean we must avoid diminishing the ability of others, now and in the future, to realize the same right."[67]

Similarly, though they do not use the term "technology justice", Melissa Leach, Ian Scoones, and Andy Stirling, in their book *Dynamic Sustainabilities: Technology, Environment, Social Justice*, observe that "linking environmental sustainability with poverty reduction and social justice, and making science and technology work for people who are poor have become central practical, political and moral challenges of our times."[68] Thus, they advocate for "an approach that embraces the dynamic interactions between social, technological and ecological processes; takes seriously the way that diverse people and groups understand and value these; and acknowledges the role of economic and institutional power in shaping the resulting choices."[69] Some common threads in this emerging area of scholarship and activism are apparent: poverty reduction and social justice as underlying goals, with an expanded conception of the relationship between technology, environment, and society guiding the formulation of a new approach to governing the use and development of technological innovations.

The nascent literature on technology justice is extremely useful as a preliminary exploration of the concept, but there are also multiple ways in which this work can be further built upon. For example, the ways in which technologies can impinge on environmental sustainability and human wellbeing are clearly not limited to poor countries or extremely marginalized peoples. Indeed, addressing some of the inequities enabled by technology in wealthy or so-called "developed" countries may be an important step in thinking about how to

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[67] Simon Trace, *Rethink, Retool, Reboot: Technology as if people and planet mattered* (Rugby, UK: Practical Action Publishing Ltd, 2016) at 40.
[68] Melissa Leach, Ian Scoones & Andy Stirling, *Dynamic Sustainabilities: Technology, Environment, Social Justice* (Washington, DC: Earthscan, 2010) at 2.
[69] *Ibid*.

prevent replicating them in low- and middle-income or so-called “developing” ones.[70] Further, a specifically legal perspective can contribute to the development of quantifiable targets, enforceable remedies, effective strategies, and a more robust analysis of barriers to change.

To be sure, theory is toothless if it is not coupled with pragmatic and concrete agendas for action. However, theoretical insights are crucial to informing and generating shifts in power structures, because the invisible power of ideologies and infrastructures that are largely considered to be given, normal, and unquestionable makes them difficult to break out of without first exposing the fallibility of the presuppositions that they rest upon. Laws and policies, tax and other financial structures, and education systems can all feed into the creation and maintenance of background rules and conditions that foster inequality. Meanwhile, vigorous resistance to change from powerful, vested interests that benefit by preserving the status quo further stymies reform efforts.

The work of critical legal scholars, who have long emphasized the fact that liberal ideology works by covering up oppressive and contradictory structures of society,[71] provides an important template for ongoing efforts “to disrupt the hegemony of the law from within its contradictions, formulating normative arguments that use its tools while knowingly inhabiting its tensions.”[72] As Carys Craig puts it, “critical perspectives perceive the ways in which … inequalities flow through the inherited legal constructs, and so demand a more fundamental reimagination of legal norms and institutions, always with a view to disrupting prevailing power

[70] The commonly invoked dichotomy between “developed” and “developing” countries has been criticized as being outdated and misleading: see e.g. Ruth Gordon, “The Dawn of a New, New International Economic Order?” (2009) 72 Law & Contemp Probs 131 at 134-138.
[71] Alan Hunt, “The Theory of Critical Legal Studies” (1986) 6:1 Oxford J Legal Studs 1; J Stuart Russell, “The Critical Legal Studies Challenge to Contemporary Mainstream Legal Philosophy” (1986) 18:1 Ottawa L Rev 1.
[72] Carys J Craig, “Critical copyright law and the politics of ‘IP’” in Emilios Christodoulidis, Ruth Dukes & Marco Goldoni, eds, *Research Handbook on Critical Legal Theory* (Northampton, MA: Edward Elgar Publishing, Inc., 2019) 301 at 319.

structures."[73] Awareness of how existing conditions arose and the particular problems they engender is a prerequisite to any attempt to challenge them, or to replace current arrangements with more appropriate ones.

1.4 Theoretical Framework

The primary theoretical framework that I use in this research is ecofeminism, which is a political and philosophical movement that sees close connections between ecological degradation and social oppressions. Ecofeminism first emerged in the 1980s as an outgrowth of the environmental and women's movements that were flourishing at the time, but has since become a diverse movement encompassing a range of different perspectives.[74] In general, the common thread uniting ecofeminist perspectives is a "recognition that solutions to ecological problems must be tied to social and gender transformations."[75]

Although ecofeminism has been much maligned by its critics, including on charges of gender essentialism and ethnocentrism, and has struggled with tensions with other activist groups,[76] it is a distinctively useful lens to use when thinking about the various impacts of technologies. In making explicit links between environmental and social harms, ecofeminism reminds us of the interconnectedness of all life on Earth, and stresses the need to effect paradigmatic as opposed to piecemeal changes. Critical theories like ecofeminism (and feminism more broadly) can also help uncover inherent biases within the law and other powerful

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[73] *Ibid* at 322.
[74] See generally Maria Mies & Vandana Shiva, *Ecofeminism* (Halifax: Fernwood Publications, 1993); Karen J Warren, "The Power and the Promise of Ecological Feminism" (1990) 12 Enviro Ethics 125; Karen Warren & Barbara Wells-Howe, eds, *Ecological Feminism* (New York: Routledge, 1994).
[75] Carolyn Sachs, "Reconsidering Diversity in Agriculture and Food Systems: An Ecofeminist Approach" (1992) Agriculture & Hum Values 4 at 6.
[76] See e.g. Greta Gaard, "Ecofeminism Revisited: Rejecting Essentialism and Re-Placing Species in a Material Feminist Environmentalism" (2011) 23:2 Feminist Formations 26 at 32-41. See also Greta Gaard, "New Directions for Ecofeminism: Toward a More Feminist Ecocriticism" (2010) 17:4 Interdisciplinary Studies in Literature and Environment 643.

institutions that not only fail to solve, but can serve to perpetuate the structural causes underlying environmental and social injustices.[77]

For example, feminist critiques of science have pointed to an exaltation of traditional Western, liberal, masculine characteristics (e.g. reason, rationality, autonomy), [78] with a concomitant denigration of characteristics construed as "feminine" (e.g. emotion, experience, cooperation).[79] As a growing body of research in behavioural economics reveals, rationality and impartiality are elusive ideals,[80] and even science, as a discipline, is not immune from the effects of cognitive biases.[81] Yet, science is often seen to be the definitive basis for policy and decision-making, by virtue of its supposed neutrality. The privileging of this particular lens risks devaluing or altogether overlooking other elements for consideration, especially those that are pressing and relevant from other standpoints.

Feminist perspectives also reject value-hierarchical thinking that gives rise to normative dualisms such as man/woman, culture/nature, mind/body, public/private, and reason/emotion.[82] Such dualisms, and the gendered associations that have been made as a result, have fed into to "the ideological construction of women as inferior."[83] Consequently, women's contributions to

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[77] Elaine L Hughes, "Fishwives and Other Tails: Ecofeminism and Environmental Law" (1995) 8:2 CJWL 502; Heather McLeod-Kilmurray, "An Ecofeminist Legal Critique of Canadian Environmental Law: The Case Study of Genetically Modified Foods" (2008) 26 WRLSI 129 at 136-137.
[78] Wendy Faulkner, "The Technology Question in Feminism: A View from Feminist Technology Studies" (2001) 24:1 Women's Studs Int'l Forum 79.
[79] Jytte Nhanenge, *Ecofeminism: Towards Integrating the Concerns of Women, Poor People, and Nature* (Toronto: University Press of America, Inc, 2011) at 166.
[80] Dan Ariely, *Predictably Irrational: The Hidden Forces that Shape our Decisions*, Revised and Expanded Edition (New York: Harper Perennial, 2010).
[81] See e.g. Regina Nuzzo, "Fooling Ourselves" (2015) 526:7572 Nature 182.
[82] Mies & Shiva, *supra* note 74 at 5; Judy Wajcman, *Feminism Confronts Technology* (University Park, PA: The Pennsylvania State University Press, 1991) at 5.
[83] Wajcman, *ibid* at 145.

knowledge production in science and technology have been heavily discounted, and their experiences with and critiques of science and technology regularly sidelined.[84]

In contrast with the scientific approach, the epistemological premises of ecofeminism are much more explicitly provisional and pluralistic, allowing for subjectivity and partiality without descending into mere relativism. In their efforts to include and value alternative forms of knowledge and knowing, ecofeminists "reject the epistemological strategy that views objective facts as central to the process of justifying moral claims",[85] and instead, "recognize that claims to knowledge are always influenced by the values of the culture in which they are generated".[86] This perspective can serve to illuminate the disproportionate impacts created by technological disruptions.

Some tenets of traditional ecofeminist philosophy sit uneasily with any concessions to technological solutions. As Wendy Faulkner puts it, "a literal reading of some ecofeminist tracts would dismiss the entire modernist technological project as being hopelessly bound up with a masculine world view that is detached from nature and from people."[87] However, the dim view of technology taken at one extreme of ecofeminism can be tempered by another approach that "is self-consciously neither pessimistic nor optimistic."[88] Prominent ecofeminist and activist (and physicist) Vandana Shiva explains that by linking production and consumption with processes of regeneration, "ecological feminism creates the possibility of viewing the world as an active subject, not merely as a resource to be manipulated and appropriated."[89]

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[84] See e.g. *ibid*; Faulkner, *supra* note 78; Elisabeth K Kelan, "The Politics of Gender and Technology" in Jan Kyrre Berg Olsen, Stig Andur Pedersen & Vincent F Hendricks, eds, *A Companion to the Philosophy of Technology* (Malden, MA: Blackwell Publishing Ltd, 2009) 338-341.
[85] Lori Gruen, "Toward an Ecofeminist Moral Epistemology" in Karen J Warren, ed, *Ecological Feminism* (New York: Routledge, 1994) 120 at 121.
[86] *Ibid* at 124.
[87] Faulkner, *supra* note 78 at 80.
[88] *Ibid*.
[89] Mies & Shiva, *supra* note 74 at 33-34.

Contemporary ecofeminism is not necessarily opposed to technology outright, but maintains that "critical technology use involves careful, context-specific implementation with a focus on the needs of particular local or indigenous social groups and the ecological situation."[90] Ecofeminists are also "skeptical of mechanistic, reductionist, and fragmented approaches to understanding the natural world that result in the development and use of unsafe, harmful technologies that are meant to conquer and subdue nature."[91] This belief system is one of the biggest issues when it comes to technologies posing as solutions. In designing, developing, and deploying technologies, there needs to be an awareness of the underlying assumptions and the limitations of technological solutions within a particular set of circumstances.

Although an ecofeminist interrogation of the political, social, and ethical dimensions of technologies and the ways in which they are regulated may be imperfect, it is arguably a necessary corrective for some of the most damaging facets of a more uncritical approach. Ecofeminism, together with other critical theoretical frameworks, can assist with identifying the problems within the current institutional framework, while also shedding light on potential solutions, and the processes necessary to implement them. In taking a "post-modern ecological feminist" perspective on climate change, Linda Malone notes, *inter alia*, that "[u]niversal, "objective" solutions to environmental problems are suspect. Ecofeminism is contextual and recognizes that even commonly shared environmental problems cannot be addressed with the same methods."[92] Thus, ecofeminism underscores the importance of ongoing reflexivity,

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[90] Julia E Romberger, "Ecofeminist Ethics and Digital Technology: A Case Study of Microsoft Word" in Douglas A Vakoch, ed, *Ecofeminism and Rhetoric: Critical Perspectives on Sex, Technology, and Discourse* (New York: Berghahn Books, 2011) 117 at 121.
[91] Sachs, *supra* note 75 at 6.
[92] Linda A Malone, "Environmental Justice Reimagined through Human Security and Post-Modern Ecological Feminism: A Neglected Perspective on Climate Change" (2015) 38 Fordham Int'l LJ 1445 at 1468.

relationality, context-sensitivity, and inclusivity in order to effectively address complex global problems, including those involving new and emerging agri-food technologies and their impacts.

Both skeptical and speculative evaluations of technology's role in effecting food systems reform have a role to play in moving us away from a progressively untenable business-as-usual position. Many optimistic outlooks have already trumpeted the transformative potential that could be unleashed by more strategic investments in innovation, often coupled with derisions of positions labelled as "technophobic" or "Luddite"—the implication being that such positions are regressive and ill-informed. However, it is increasingly difficult to deny that our attitudes to technology have to be tempered with a recognition of their Janus-faced nature. To this end, the insights provided by theories and perspectives like ecofeminism are a valuable and integral part of leading us toward technologies that will "create, not destroy."[93]

1.5 Methodology and Scope

I adopt a critical legal studies approach in my research, because I am concerned with exposing the relationships between power, society, and the law as they are expressed through technologies. To do so, I look broadly at the entrenched and emerging discourses around concepts like science, technology, sustainability, and innovation that are constructed by differently situated stakeholders. I also undertake a qualitative, textual analysis of relevant primary and secondary sources, including the collection of laws, regulations, and policy documents that currently govern new and emerging technologies in Canada, and the ways in which these documents are interpreted by a variety of groups, including the judiciary, regulators, civil society organizations (CSOs) and non-governmental organizations (NGOs), the media, and the general public.

[93] Joan A Rothschild, "A Feminist Perspective on Technology and the Future" (1981) 4:1 Women's Studs Int'l Q 65 at 72.

More specifically, I employ a post-structuralist methodology and methods, including critical discourse analysis (CDA). CDA is a relational, dialectical, and transdisciplinary form of research[94] that views linguistic and non-linguistic practices as closely involved in (re)producing power relations.[95] Discourse can be defined as “a practice not just of representing the world, but of signifying the world, constituting and constructing the world in meaning”.[96] Through discourse, the world is made not just sensical, but also meaningful in particular ways. Following Foucault and others, I emphasize the plurality of available interpretations and the instability of concepts that are often taken as fixed, especially once they become codified in written and spoken language, social norms, and the practices of law and policy.[97]

The fact that dominant discourses on new and emerging technological innovations in the media and in policy conversations often oversimplify or omit broader dimensions of the debate matters, because the privileging of certain sense-making stories over others does not necessarily occur through a meritorious process. Rather, the sanctioning of particular ideologies can be seen as making “meaning in the service of power”.[98] Feminist theory and methodology is also germane here, as the work of scholars like Luce Iragaray have brought to light the ways in which many facets of Western culture are profoundly androcentric, and how “basic psychic, logical, and linguistic structures perpetuate masculine domination.”[99] The more that familiar scripts are repeated, especially by authoritative actors and institutions who we depend on to order our lives,

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[94] Norman Fairclough, *Critical Discourse Analysis: The Critical Study of Language*, 2d ed (New York: Routledge, 2010) at 3.
[95] Terry Locke, *Critical Discourse Analysis* (New York: Continuum, 2004); Ruth Wodak & Michael Meyer, eds, *Methods of Critical Discourse Analysis*, 2d ed (Los Angeles: SAGE, 2009); Fairclough, *ibid*.
[96] Norman Fairclough, *Discourse and Social Change* (Cambridge: Polity Press, 1992) at 64.
[97] See e.g. Rachel Adams, “Michel Foucault: Discourse”, Critical Legal Thinking (17 November 2017), online: <http://criticallegalthinking.com/2017/11/17/michel-foucault-discourse/>.
[98] John B Thompson, *Ideology and Modern Culture: Critical Social Theory in the Era of Mass Communication* (Malden, MA: Polity Press, 1990) at 5.
[99] Serene J Khader, “The Work of Sexual Difference” in Mary C Rawlinson, Sabrina L Hom & Serene J Khader, eds, *Thinking with Irigaray* (Albany, MY: State University of New York Press, 2011) 1 at 1.

the more opaque they become, making their blind spots and faults more difficult to identify and challenge.

CDA has clear relevance for examining law and policy in the environmental[100] and technological[101] domains, each of which is infused with its own precepts. Upon closer inspection, it becomes apparent that there are many value statements and normative expectations that are channelled through language. For example, terms that are commonly found in the environmental science lexicon, such as "[e]cosystem *health*, ecosystem *integrity*, and *alien* species" presuppose some expectations about a preferred state of things.[102] Indeed, "recognizing something as a 'problem' requires a pre-existing set of values as to what is 'normal', 'natural', and thus 'right'."[103]

In the context of environmental law more specifically, Joshua Gellers notes that "nature is a contested concept, discourses can bind debate about acceptable policy prescriptions, discourses can be analyzed as a kind of cultural politics, and language deployed in the discussion of environmental issues can be viewed as part of a broader project to discipline society."[104] The construction of the environment as something separate and apart from ourselves is enabled, in part, by language and mindsets that turn "nature into a construct rather than seeing nature as a force or entity with its own dynamics."[105] The use of terminology like "natural resource

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[100] See e.g. Maarten A Hajer, *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process* (New York: Oxford University Press, 1995); John S Dryzek, *The Politics of the Earth: Environmental Discourses*, 3d ed (New York: Oxford University Press, 2013).
[101] See e.g. Amy Koerber, "Toward a Feminist Rhetoric of Technology" (2000) 14:1 Journal of Business and Technical Communication 58; Ian Roderick, *Critical Discourse Studies and Technology: A Multimodal Approach to Analysing Technoculture* (London: Bloomsbury Academic, 2016).
[102] Michael S Carolan, "The Bright- and Blind-Spots of Science: Why Objective Knowledge is Not Enough to Resolve Environmental Controversies" (2008) 34:5 Critical Sociology 725 at 732 [emphasis in original].
[103] *Ibid*.
[104] Joshua Gellers, "Greening critical discourse analysis: Applications to the study of environmental law" (2015) 12:3 Critical Discourse Studies 482 at 483.
[105] Ursula M Franklin, *The Real World of Technology*, Revised Edition (Toronto: House of Anansi Press Inc, 2004) at 85.

management" helps uphold a paradigm in which Nature is reduced to its component parts—something that can be quantified, commoditized, and effectively controlled using human technologies and ingenuity. Simultaneously, concepts like "sustainable development" are sites of continual struggle regarding their meaning, interpretation, and implementation.[106]

Likewise, parsing the positions taken by different stakeholders on issues such as how new and emerging food innovations should be regulated reveals that these are informed by very different understandings of science, progress, and the role of law in balancing competing priorities. While one group, intoxicated by the "enchantments of technology",[107] may prioritize the fostering of scientific and technological development, another may seek to safeguard public and environmental health and safety above all else, made leery by experience or evidence of past risks. Apprehensions about the impacts and implications of technological interventions in our food system often serve as proxies for a host of deeper underlying concerns, and examining the way these are conveyed via language and other forms of discourse can greatly clarify the driving values and priorities.

Although the way various stakeholders use discourse to serve their own agendas is not necessarily nefarious, or even deliberate, it is apparent that the ways in which issues and their solutions are framed has significant bearing on how they are formally approached. If a given problem—like agricultural sustainability—is characterized as a fundamentally technical issue, then it becomes much more amenable to a technical solution. However, if the root of the problem

[106] Maarten Hajer & Wytske Versteeg, "A Decade of Discourse Analysis of Environmental Politics: Achievements, Challenges, Perspectives" (2005) 7:3 J Envt'l Pol'y & Planning 175 at 176. See Chapter 2.1.2.
[107] Lee Worth Bailey, *The Enchantments of Technology* (Chicago: University of Illinois Press, 2005). "Enchantments may narrow the focus of society's consciousness into a consensus agreement on certain beliefs and behaviors, such as optimism about technological progress. Enchantments introduce certain meanings into cultural life that take on a serious, rational tone but have a deep undercurrent of emotional and imaginative power." (at 3)

is seen as being social or ethical, then the ways in which the policy options are conceived and configured may be dramatically different.

Thus, the ways in which technologies, their promises, and the concerns and consequences that they engender are written, spoken, and thought about, both formally and informally, are highly illuminating. The narratives that are assembled through dominant discourses feed directly into the mobilization and validation of the activities of a wide range of actors. Discourse comprises a significant channel by which specific pathways become legitimated, while others are foreclosed. In a more direct sense, "[t]he very act of investment [in a particular technology], together with the accompanying promotional material, can be unpacked as statements revealing a commitment to a particular future."[108] As a result, it is important to consider not only what technologies and their regulatory structures promise or claim to do, but also the alternatives that they prevent.

The scope of my research will primarily be limited to Canada and its settler colonial legal system,[109] although the intricately connected global flow of food as a commodity[110] means that an acknowledgment of impacts and conditions beyond the country's bounds is unavoidable, and some aspects of alternative legal orders will bear mentioning at relevant points. Canada is an interesting focus of analysis for several reasons. First, the country's position as a major agricultural producer and exporter uniquely situates it to benefit from increasing the efficiency

[108] Kornelia Konrad et al, "Performing and Governing the Future in Science and Technology" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 465 at 467.
[109] As contrasted with Indigenous legal orders, a topic on which important research has been and continues to be done by several Canadian scholars: see e.g. John Borrows, "Indigenous Legal Traditions in Canada" (2005) 19 Wash U J L & Pol'y 167; Hadley Friedland, "Reflective Frameworks: Methods for Accessing, Understanding and Applying Indigenous Laws" (2012) 11:1 Indigenous LJ 1; Val Napoleon, "Thinking About Indigenous Legal Orders" in René Provost & Colleen Sheppard, eds, *Dialogues on Human Rights and Legal Pluralism* (New York: Springer, 2013) 229-245.
[110] I use the word "commodity" descriptively here, rather than normatively. As expanded on elsewhere in this dissertation, the increasing commoditization of food and agricultural products is arguably one of the major problems with industrial agricultural systems.

and economic strength of its agri-food sector. The reputational stakes are high, as Canada has already been lauded as being a standard-setting jurisdiction when it comes to certain metrics, like food safety.[111] Additionally, the current federal government has recently undertaken several major initiatives in food law and policy, as well as establishing an ambitious innovation agenda. The possibilities opened up by such initiatives—as well as the multiple ways in which they are in tension—provide fertile grounds for enquiry.

Though there is value in looking at other jurisdictions, there are some significant philosophical and practical differences between cultural and regulatory approaches to technologies like genetically modified organisms in North America and other places like the European Union (EU),[112] which makes a fulsome comparative analysis challenging. Further, although there are many scholars in countries like the United States (US) who have undertaken critical examinations of science and technology from a legal perspective,[113] there has not been as much research in this area in Canada.

Taking a critical approach to the purportedly rational and value-free domains of science, technology, and law is by no means an uncontentious exercise. However, having an ethical and political position is an inescapable part of research,[114] and the same holds true for scientists and technologists as much as it does for critical legal scholars. Accordingly, in the spirit of feminist positionality, I want to explicitly acknowledge the position from which I approach this work.

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[111] See e.g. Jean-Charles Le Vallée & Sylvain Charlebois, *2014 World Ranking: Food Safety Performance* (Ottawa: The Conference Board of Canada, 2014).
[112] See generally Claire Dunlop, "GMOs and Regulatory Styles" (2000) 9:2 Envtl Politics 149; Anton Wohlers, "Regulating genetically modified food: Policy trajectories, political culture, and risk perception in the U.S., Canada, and EU" (2010) 29:2 Politics & The Life Sciences 17.
[113] See e.g. Sheila Jasanoff, "Constitutional Moments in Governing Science and Technology" (2011) 17 Sci Eng Ethics 621; Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (Cambridge, MA: Harvard University Press, 1995); Sheila Jasanoff, *The Ethics of Invention: Technology and the Human Future* (New York: W.W. Norton & Company, 2016).
[114] Morwenna Griffiths, *Educational Research for Social Justice: Getting off the Fence* (London, UK: Open University Press, 1998) at 133.

Among other relevant characteristics, I identify as a woman, a visible minority, a first-generation immigrant, an environmentalist, and a vegan (for environmental and ethical reasons). I have an interdisciplinary educational background in the social sciences and humanities, and am a voracious reader of both fiction (including genres like science fiction) and non-fiction (including research in behavioural economics and other social science subjects), which inspires and informs my work in multiple, ongoing ways. I was raised religious (in the Christian tradition), but I now consider myself secular, albeit with a set of spiritual beliefs that defy classification along conventional lines. I lack formal training in the "hard" sciences, and do not claim any kind of expertise in the scientific realm. My politics are progressive, and I am attentive to numerous grounds of oppression of relevance to this research, including race, gender, class, colonialism, and species. I am deeply concerned about the future of the planet, but also hopeful about our ability to draw on our collective reserves of creativity, compassion, and cooperation in order to, at minimum, mitigate some of the gravest harms.

Of course, despite my best efforts, it is impossible to fully extract myself from the insidiously oppressive structures that I have set out to critique, especially due to the imperfections of language. I recognize that I may inadvertently replicate problematic assumptions, beliefs, and expectations. I do not claim to live up to a standard of perfection or anything close to it, and both learning about and attempting to dismantle the ongoing legacies of patriarchy and colonialism are ongoing processes.

Further, while my intention is not to merely substitute the biases I tend to prefer for those that currently prevail, I endorse Karen Warren's position that whatever bias a feminist ethic has in centralizing the voices of oppressed persons "is a *better bias*—'better' because it is more inclusive and therefore less partial—than those which exclude those voices."[115] My emphasis on including marginalized and lay perspectives in formal debates about scientific and technological developments is not to propose a total turn towards populism, nor to reject specialized expertise entirely. Instead, I contest the view that there is an objective, "science-based" standard of evaluation of scientific and technological developments and their associated risks that can be identified and agreed upon as an optimal basis for decision-making. I also challenge the notion that formal training and narrowly defined expertise is a necessary precondition to engage in decidedly non-scientific concerns raised by scientific activities.

Much the same way that all knowledge claims are inflected with bias, all regulatory strategies and approaches reflect certain compromises—between flexibility and certainty, independence and accountability, reliance on expertise and public consultation, and so on. The aim of this research is to try to better calibrate those balances such that they no longer tilt as sharply toward taken-for-granted presumptions and skewed priorities that unduly narrow the range of possibilities available to us in creating a better future. At the very least, I hope to draw attention to the fact that in spite of the disagreement and miscommunication that too often proliferates, it is still possible to distil a common set of values and aspirations that can guide our individual and collective actions, including how these are shaped through the law.

1.6 Outline

The remainder of this dissertation proceeds as follows. Chapter 2 furthers the contextual analysis by looking more closely at food and agriculture in Canada: the political and economic significance of the agri-food sector, the direction it is taking, and some defining features of the existing governance framework, from notable gaps and ongoing weaknesses to promising recent

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[115] Warren, *supra* note 74 at 140 [emphasis in original].

developments. It also includes a discussion of the relationship between food systems and sustainability, a foundational theme throughout the rest of this work.

Chapter 3 begins by considering the meanings of the terms “science”, “technology”, and “innovation”, particularly as they can be defined to serve specific political and economic ends. I then engage with some insights from STS to explain the importance of critical, intersectional approaches to thinking about the role of science and technology in society, before scrutinizing the ideology underlying technological solutionism that has tended to dominate in certain circles and that may be limiting alternative avenues to transformative change. I highlight some of the most salient shortfalls of a technocentric pathway to enhancing the social and environmental sustainability of our food systems, and discuss the salutary role of taking a more explicitly ethical approach to our relationships with technology.

Chapter 4 engages more explicitly with the role of law. I am particularly interested in the boundary-defining function of law, and how law operates in liminal or linked spaces. The interaction of law with society is complicated, because law is created and put into practice through social processes, while simultaneously driving social change. In other words, law is one of the fundamental ways in which social norms and hierarchies of power are sustained—but also one of the ways in which they can be disrupted. The relationships between law and science and law and technology are also complex, particularly since each of these fields wields a significant degree of authority in society. As an examination of some of the defining features of existing justice movements goes to show, the relationship between law and justice is fraught as well. Background conceptions of rights and responsibilities serve to define the scope of legitimate legal concern in any given area; at the same time, the development and entrenchment of legal principles have a marked influence on attitudes toward the desirability and the effectiveness of legal interventions. Law, on its own, cannot and does not necessarily enhance justice, especially without sustained reflection as to what justice means or demands.

Building on the analysis in Chapter 4, Chapter 5 elaborates on and advances a vision for technology justice, stressing the importance of accounting for justice-related concerns in the design, development, deployment, and regulation of technologies. I make a case for why a stand-alone concept of technology justice is valuable, and outline some suggested areas of intervention. To realize a vision of technology justice in which technology is used sustainably, can be accessed equitably, and responds to real social and environmental needs, I propose that our approaches to technology and governance need to be rethought and reconfigured in several significant ways, including when it comes to drivers of innovation, discourses of risk, and distribution of returns.

To assess the real and potential impacts of the shifts enabled by technologies and their underlying legal and epistemological frameworks, I utilize three case studies (selected due to their scope, relevance, and the novelty of my perspective in analyzing their impacts), to which Chapter 6 is devoted. First, I examine two different kinds of animal biotechnologies for food production—specifically, products of cellular agriculture and genetically engineered animals, such as the AquAdvantage salmon (AAS). Next, I consider a suite of approaches that I classify under the banner of "smart agriculture", including technologies associated with the concept of climate smart agriculture, such as digital farm management systems. Applying abstract theoretical principles to concrete examples helps illustrate the often unpredictable and counterintuitive consequences of technologies that can manifest when they are actualized, thereby underscoring the need for a more critical approach to regulation and more careful attention to law-in-action.

Having identified some of the major failings of existing approaches in previous chapters, Chapter 7 presents some components of recipes for reform. Suggestions for substantive legal and regulatory reforms are couched within the understanding that such improvements will be insufficient on their own to generate the kind of paradigm shifts that are necessary; corresponding changes to societal and cultural norms will be essential to any process of transformation. Targeted policy recommendations engage with some of the more practical questions relating to technology justice and offer some reflections as to how justice-related concerns might be advanced both substantively and procedurally within the Canadian legal framework, and the agri-food sector in particular. Finally, in addition to summarizing my critiques of existing social, economic, technological, and legal paradigms, Chapter 8 concludes with some closing thoughts on how we might break free from a "perpetual state of status quo".[116]

[116] Lyne Létourneau, "The Regulation of Animal Biotechnology: At the Crossroads of Law and Ethics" in Edna Einsiedel & Frank Timmermans, eds, *Crossing Over: Genomics in the Public Arena* (Calgary: University of Calgary Press, 2005) 173 at 189.

2. Setting the Table: Food, Agriculture, and Sustainability in Canada

The conditions under which food and agricultural products are produced and consumed have important environmental, economic, and social ramifications for all people, rendering the legal and policy structures that regulate the space significant in turn. Indeed, by one account, the agri-food sector is "one of the most highly controlled sectors of the [Canadian] economy."[1] Unfortunately, the challenges faced by the agri-food sector have become increasingly complex,[2] and the way the sector has been governed in Canada throughout the past several decades has arguably undermined its fitness to address a broad range of objectives pertaining to the environment, social justice, and health and nutrition.

That being said, there are promising indications that the federal government is taking agri-food law and policy more seriously. In recent years, there has been marked and measurable growth in the amount of awareness, analysis, and activism in the field of Canadian agri-food law and policy by policymakers, the civil sector, academics, students, and practitioners, among others. In addition to the development and launch of the first-ever national food policy, there are a number of other initiatives related to food and agriculture that are currently taking place at the federal level, including Health Canada's Healthy Eating Strategy,[3] Fisheries and Oceans Canada's Sustainable Aquaculture Program,[4] and Employment and Social Development

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[1] Michael Bloom, Michael Grant & Barbara Slater, *Governing Food: Policies, Laws, and Regulations for Food in Canada* (Ottawa: The Conference Board of Canada, 2011) at i [*Governing Food*].
[2] Attributable to a range of factors, including: globalization, trade agreements, population growth, changing market demand, technological innovations, and the impacts of climate change and other environmental variables.
[3] Government of Canada, "Health Canada's healthy eating strategy", online: <https://www.canada.ca/en/services/health/campaigns/vision-healthy-canada/healthy-eating.html?_ga=1.142640561.500057124.1461007692> (last updated December 16, 2019).
[4] Fisheries and Oceans Canada, "Canada's Sustainable Aquaculture Program", online: <http://www.dfo-mpo.gc.ca/aquaculture/programs-programmes/sustainable-durable/index-eng.htm> (last updated March 3, 2015).

Canada’s Poverty Reduction Strategy.[5] Provincial and local governments are also engaging in food law and policy-making to a greater degree, often in creative ways.

One of the most significant recent developments has been the revision of Canada’s food guide—last revised in 2007—in January 2019.[6] As contrasted with the previous iteration, the revised Food Guide for Healthy Eating moves away from a formulaic or prescriptive approach to eating based on recommended food groups, and instead takes offers more holistic suggestions with an emphasis on fruits and vegetables, whole grain foods, and plant-based proteins.[7] The revised Food Guide also encourages the development of broader food-related literacy, skills, and habits, such as avoiding sugary beverages, cooking more often, and making efforts to eat meals with others.[8] Interestingly, the revision process, which took place over several years, included stakeholder engagement, save for specific meetings with food and beverage industry representatives, to avoid conflicts of interest.[9]

However, as the revised Food Guide goes to show, increased attention does not necessarily translate to better outcomes.[10] Though there is a rich body of research available to

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[5] Government of Canada, “Canadian Poverty Reduction Strategy”, online: <https://www.canada.ca/en/employment-social-development/programs/poverty-reduction.html> (last updated August 30, 2019).
[6] Government of Canada, “Canada’s food guide”, online: <https://food-guide.canada.ca/en/> (last updated January 13, 2020).
[7] *Ibid*.
[8] *Ibid*.
[9] Government of Canada, “Revision process for Canada’s food guide”, online: <https://www.canada.ca/en/health-canada/services/canada-food-guide/about/revision-process.html> (last updated November 25, 2019).
[10] Many have criticized the revised Food Guide to being prohibitively expensive for lower-income Canadians: see e.g. CBC News, “Meeting Canadian Food Guide ‘next to impossible’ for some: Manitoba researcher”, *CBC News* (22 November 2020), online: <https://www.cbc.ca/news/canada/manitoba/canadian-food-guide-traditional-indigenous-diet-1.5812177>; Sarah Duignan, “Commentary: Canada’s food guide failure”, *Global News* (26 January 2019, updated 31 October 2020), online: <https://globalnews.ca/news/4885166/canada-food-guide/>; The Canadian Press, “More than half of Canadians may have trouble adopting new food guide, survey suggests”, *CBC News* (14 March 2019), online: <https://www.cbc.ca/news/health/canada-food-guide-survey-half-of-canadians-face-barriers-1.5056251>; Nick Saul, “The new Canada Food Guide highlights the biggest obstacle to healthy eating—poverty”, *Maclean’s* (29 January 2019), online: <https://www.macleans.ca/society/health/the-new-canada-food-guide-highlights-the-biggest-obstacle-to-healthy-eating-poverty/>; Kelly Crowe, “The dark side of Canada’s new food guide—many Canadians can’t follow it”, *CBC News* (12 January 2019), online: <https://www.cbc.ca/news/health/canada-food-guide-school-food-program-1.4975302>.

draw on that looks at both the problems with and the potential solutions to governing in this space (including scientific and technological ones in particular), this knowledge must be effectively applied and leveraged in order for Canadian agri-food law and policy to evolve beyond its current form. In an effort to clarify the importance of and the barriers to this endeavour, this chapter surveys several salient dimensions of the Canadian agri-food sector. It begins by defining some key concepts, including “food systems” and “sustainability”, and elucidating the connections between the two. The focus in this part is more descriptive than normative. Next, the performance of the Canadian agri-food sector is evaluated against several different kinds of metrics according to the definitions of sustainability previously discussed. Finally, the current state of Canadian agri-food law and policy is mapped, including an overview of the new Food Policy for Canada.

2.1 Food Systems and Sustainability

While differently situated stakeholders may share the end goals of increasing food security, improving human health outcomes, and alleviating ecological pressures associated with food and agricultural practices, they often diverge in terms of how they understand and prioritize strategies for attaining these goals. There is no one clear route to achieving any one of these outcomes—much less all three in tandem—and so any course of action is inevitably coloured by subjective presuppositions and unstated principles. As such, it is important to first articulate what I mean when I refer to the food system, its sustainability, and some of the proposed pathways for getting there.

2.1.1 Food Systems

To start, a food system can be understood as encompassing all of the activities and resources associated with food production and consumption, including growing, harvesting, packing, processing, transforming, transporting, marketing, selling, preparing, eating, and disposing of (or repurposing, e.g. as animal feed or compost) food and food waste.[11] As the federal government has acknowledged, "[f]ood systems are interconnected and are integral to the wellbeing of communities, including northern and Indigenous communities, public health, environmental sustainability, and the strength of the economy."[12] Each of the processes involved in bringing food from the farm to the table is a component of a larger whole, and any given piece cannot be manipulated in isolation without creating intended or unintended consequences elsewhere along the chain.

Because food systems are enormously complex, many scholars and activists have advocated for taking a holistic, systems approach to addressing problems and challenges associated with them, which "is a way of thinking and doing that considers the food system in its totality, taking into account all the elements, their relationships and related effects."[13] From a policy perspective, this means that interventions must be considered in a plethora of domains, ranging from:

> agricultural input subsidies, trade and investment policies, occupational health and safety rules and labor inspection mechanisms, nutritional standards, land tenure regulations, energy subsidies, environmental regulations, public procurement practices, food safety regulations, social policies to provide subsidized food to poor communities or guarantee minimum wages to farmworkers, and different ways of informing and influencing consumer behavior.[14]

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[11] Food and Agriculture Organization of the United Nations, "Sustainable food systems: Concept and framework" (FAO, 2018), online: <http://www.fao.org/3/ca2079en/CA2079EN.pdf>. See also The Oxford Martin Programme on the Future of Food, "What Is The Food System?", online: <http://www.futureoffood.ox.ac.uk/what-food-system>.

[12] Agriculture and Agri-Food Canada, *Food Policy for Canada: Everyone at the Table* (Ottawa: Agriculture and Agri-Food Canada, 2019), online: <https://www.canada.ca/en/campaign/food-policy/thefoodpolicy.html> at 3.

[13] FAO, "Sustainable food systems: Concept and framework", *supra* note 11 at 2. See also Pamela Mason & Tim Lang, *Sustainable Diets: How Ecological Nutrition Can Transform Consumption and the Food System* (New York: Earthscan, 2017) at 304-305; IPES-Food, *The New Science of Sustainable Food Systems: Overcoming Barriers to Food Systems Reform* (Brussels: International Panel of Experts on Sustainable Food Systems, 2015), online: <http://www.ipes-food.org/_img/upload/files/NewScienceofSusFood.pdf>; Roni A Neff, Kathleen Merrigan & David Wallinga, "A Food Systems Approach To Healthy Food And Agriculture Policy" (2015) 34:11 Health Affairs 1908 at 1908.

[14] IPES-Food, *ibid* at 4.

Understandably, systems approaches are difficult to undertake, as they involve accounting for significantly more variables than in approaches that focus on only one sector. However, the results of adopting systems approaches are often invaluable. Systems approaches have served to expose many of the shortcomings of the direction the current global food system has taken,[15] and have helped bring to light "reinforcing and balancing feedback loops, tensions between the various components and flows of food systems, and interactions that are cyclical, multilayered and multi-scale."[16] Although many systems approaches evaluate the global food system in its entirety, food systems can also be identified and analyzed at smaller scales, from regional to local. Both macro- and micro-level analyses are useful and necessary for furthering our understandings of the multifaceted interactions between the component parts of food systems, as is a constant attention to context more generally.

2.1.2 Sustainability

Definitions of sustainability range from the expansive to the very narrow. One way of understanding sustainability situates it within the broader discourse of sustainable development (as popularized by the Brundtland Report in 1987), which has been a foundational theme of contemporary environmentalism.[17] According to such an approach, sustainable development is considered to mean "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[18]

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[15] See e.g. Jennifer Clapp, *Food*, 2d ed (Malden, MA: Polity Press, 2016); Geoff Tansey & Anthony Worsley, *The Food System* (New York: Earthscan, 1995); Raj Patel, *Stuffed and Starved: The Hidden Battle for the World Food System* (Toronto: HarperCollins Publishers Ltd., 2007).

[16] IPES-Food, *supra* note 13 at 3.

[17] For a brief history of the context in which the concept of sustainable development emerged, see John Robinson, "Squaring the Circle? Some Thoughts on the Idea of Sustainable Development" (2004) 48:4 Ecological Economics 369 at 370-373.

[18] World Commission on Environment and Development, *Our Common Future*, UN Doc A/42/427 (1987), online: <http://www.un-documents.net/our-common-future.pdf>. Many subsequent conceptualizations of sustainable development allude to the three "pillars" of environment, society, and economy, see e.g. Bill Hopwood, Mary

Many common conceptualizations of sustainable development allude to the "pillars" or "bottom lines" of environment, society, and economy, with all three to be considered in an integrated manner. For example, the preamble of the *Canadian Environmental Protection Act, 1999* (*CEPA, 1999*), a key piece of federal environmental legislation, states that the Government of Canada "seeks to achieve sustainable development that is based on an ecologically efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government and private entities".[19] This reflects what has been referred to as a "weak" approach to sustainable development or sustainability, as contrasted with a "strong" approach that recognizes the primacy of environmental wellbeing as a precondition to social and economic wellbeing.[20]

At the international level, several multilateral agreements and plans of action for attaining sustainable development have been developed since the Brundtland Report.[21] In 2015, all United Nations (UN) Member States adopted the current framework, the 2030 Agenda for Sustainable Development,[22] as a "15-year global framework of action for people, planet, prosperity, peace, and partnership."[23] The 2030 Agenda for Sustainable Development adopts the definition of

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Mellor & Geoff O'Brien, "Sustainable Development: Mapping Different Approaches" (2005) 13 Sustainable Development 38.

[19] *Canadian Environmental Protection Act, 1999*, SC 1999, c 33, Declaration [*CEPA, 1999*].

[20] See e.g. Klaus Bosselmann, *The Principle of Sustainability: Transforming Law and Governance*, 2d ed (New York: Routledge, 2017) at 24: "The ecologist approach is critical of growth and favours ecological sustainability (*strong sustainability*). The environmental approach assumes the validity of growth and poses equal importance on environmental sustainability, social justice and economic prosperity (*weak sustainability*)." [emphasis in original]

[21] For example, Agenda 21, adopted at the Earth Summit held in Rio de Janeiro, Brazil, in 1992. United Nations Conference on Environment & Development, "Agenda 21", online: <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf>. For a full history, see United Nations, "Sustainable Development Goals", online: <https://sustainabledevelopment.un.org/?menu=1300>.

[22] United Nations, *Transforming Our World: The 2030 Agenda for Sustainable Development*, A/RES/70/1, online: <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>.

[23] Government of Canada, "The 2030 Agenda for Sustainable Development", online: <https://international.gc.ca/world-monde/issues_development-enjeux_developpement/priorities-priorites/agenda-programme.aspx?lang=eng> (last updated December 20, 2018).

sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", and acknowledges that "[f]or sustainable development to be achieved, it is crucial to harmonize three core elements: economic growth, social inclusion and environmental protection."[24] At the heart of the 2030 Agenda for Sustainable Development are the Sustainable Development Goals (SDGs), a collection of 17 objectives that seek to improve global environmental and social conditions according to specifically identified measures. According to the UN, the SDGs are "the blueprint to achieve a better and more sustainable future for all."[25] Addressing poverty and other deprivations is seen to be a crucial part of this agenda for change.

Nearly all of the current SDGs are relevant to food and agriculture in some way,[26] but it has only been recently that the central role of food and agricultural systems and their governance is being more explicitly acknowledged in conversations about sustainable development. Unfortunately, the concept of sustainable development itself stands on shaky ground; despite its status as a nationally and internationally recognized principle, it has been met with its fair share of criticism,[27] having been lambasted as being vague and unworkable at best and contradictory and regressive at worst. Exemplifying the latter position, Annie Rochette asserts that "[t]he main

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[24] United Nations, "The Sustainable Development Agenda: Frequently Asked Questions", online: <https://www.un.org/sustainabledevelopment/development-agenda/>.
[25] United Nations, "About the Sustainable Development Goals", online: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.
[26] United Nations, "Sustainable Development Goals", *supra* note 21. (including No Poverty; Zero Hunger; Good Health and Well-Being; Gender Quality; Clean Water and Sanitation; Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Reduced Inequalities; Responsible Consumption and Production; Climate Action; Life Below Water; Life on Land). See also World Economic Forum (prepared in collaboration with McKinsey & Company), *Innovation with a Purpose: The role of technology innovation in accelerating food systems transformation* (World Economic Forum, 2018), online: <http://www3.weforum.org/docs/WEF_Innovation_with_a_Purpose_VF-reduced.pdf> at 6 (Figure 2); Food and Agriculture Organization of the United Nations et al, *The State of Food Security and Nutrition in the World 2018: Building Climate Resilience for Food Security and Nutrition* (FAO: Rome, 2018), online: <http://www.fao.org/3/i9553en/i9553en.pdf> at 14.
[27] For summaries of some of the main criticisms, see e.g. Sharachchandra M Lélé, "Sustainable Development: A Critical Review" (1991) 19:6 World Development 607; Robinson, *supra* note 17 at 373-377.

flaw of sustainable development lies in its failure to challenge the fundamental assumptions of the dominant development model that it seeks to replace, as well as its dependence on the global market economy."[28] Despite such critiques, it has been difficult to find a more suitable principle to replace sustainable development as the cornerstone of environmental law and policy. Thus, contemporary conversations about sustainability often assume that considerations of society and economy are also relevant, as opposed to narrower definitions that focus primarily on maintaining ecological balance.

2.1.3 Sustainable Food Systems

Within this paradigm, for a food system to be sustainable, it must account for environmental, social, and economic concerns over the long term—but food is a domain in which these concerns are often in tension. For example, organic, locally grown, and minimally processed food is often considered to be optimal from both a health and nutrition and environmental impact perspective. At the same time, the high cost of fresh, local, and organic food often puts it out of reach of many people,[29] in addition to barriers relating to physical access.

Understanding what constitutes a sustainable food system is not as straightforward as simply transposing some definition of sustainability in another context into the realm of food. However, as Alison Blay-Palmer and Mustafa Koc have observed, "food is an excellent lens to apply when grappling with sustainability. It is a common denominator for all people[,] as everyone eats. It involves all aspects of everyday lives and allows us to unpack the

[28] Annie Rochette, "Stop the Rape of the World: An Ecofeminist Critique of Sustainable Development" (2002) 51 UNB LJ 145 at 150.

[29] For example, similar to criticisms levied against Canada's revised Food Guide, a recent study found that "EAT-*Lancet* reference diets are not affordable for much of the world's low-income population": Kalle Hirvonen et al, "Affordability of the EAT-*Lancet* reference diet: a global analysis" (2020) 8:1 Lancet Glob Health E59 at E63. The authors conclude that "[m]easures to alleviate price and income constraints will be essential to bringing healthy and sustainable diets within reach of the world's poor." (at E65)

interconnections between the socio-communal, economic, environmental and policy spaces."[30] As a consequence, reflecting on what a sustainable food system looks like and how it might be achieved can be extremely useful for thinking about sustainability writ large.

The FAO defines a sustainable food system as "a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised."[31] This definition adds food security and nutritional factors to the more familiar considerations of economy, society, and environment. While commendable in theory, the practicability of this definition is questionable, for many of the same reasons that the broader concept of sustainable development is vulnerable to critique. In particular, the definition is highly aspirational in terms of its ends, but is devoid of any reference to the means of attaining the multiple dimensions of the vision it presents, or even a passing recognition of the challenges, complications, and contradictions in attempting to do so.

Taking a more specific approach, Rod MacRae et al have defined a sustainable food system as one that uses

> design and management procedures that work with natural processes to conserve all resources, promote agro-ecosystem resilience and self-regulation, minimize waste and environmental impact, while maintaining or improving farm profitability. Such systems improve the condition of the natural resources on which they depend and the health of those consuming its products.[32]

[30] Alison Blay-Palmer & Mustafa Koc, "Imagining Sustainable Food Systems: The Path to Regenerative Food Systems" in Alison Blay-Palmer, ed, *Imagining Sustainable Food Systems: Theory and Practice* (Burlington, VT: Ashgate Publishing Company, 2010) 223 at 226.

[31] FAO, "Sustainable food systems: Concept and framework", *supra* note 11 at 1.

[32] Rod MacRae, Elisabeth Abergel & Mustafa Koc, "Introduction" in Rod MacRae & Elisabeth Abergel, eds, *Health and Sustainability in the Canadian Food System: Advocacy and Opportunity for Civil Society* (Vancouver: UBC Press, 2012) 1 at 5 (adapted from a definition articulated in Rod J MacRae et al, "Policies, Programs and Regulations to Support the Transition to Sustainable Agriculture in Canada" (1990) 5:2 American Journal of Alternative Agriculture 76 at 76, stating that "sustainable agriculture" is "both a philosophy and a system of farming. It is rooted in a set of values that reflects an awareness of both ecological and social realities and a commitment to respond appropriately to that awareness. It emphasizes design and management procedures that work with natural processes to conserve all resources and minimize waste and environmental damage, while maintaining or improving farm profitability. This is accomplished by taking into account nutrient and water cycles, energy flows, beneficial soil organisms, natural pest controls, and the humane treatment of animals. Such systems also aim to ensure the well-being of rural communities, and to produce food that is nutritious and uncontaminated with products that might harm humans and livestock health.").

This definition emphasizes the production side of food and agriculture, though it also touches on profitability and health. Contrasted with the FAO's definition, the references to design and management procedures, minimization of waste, and acknowledgment of the connections between food consumption and human health are both more concrete and represent a broadening of conventional understandings of sustainability to include factors beyond the environmental, social, and economic, as traditionally understood.

Jason Czarnezki's definition of a sustainable food system focuses less on producers and more on consumers and institutional actors and their power to leverage individual behaviours and social norms to bring about structural changes. He describes a sustainable food system as one that is characterized by "locally and/or efficiently produced, processed, and distributed foods; an economically viable market for farmers and consumers; and ecologically sound and/or organic production, processing and distribution."[33] In terms of how to get there, the "new agricultural model" that he advocates for would "increas[e] direct farm marketing and local food buying, … creat[e] opportunities for new markets and foods; chang[e] the model of institutional purchasing so state and local government can create demand for sustainable foods; and support[] eco-labeling and food education programs so consumers can act on their concerns to influence changes in food and farming practices."[34]

Meanwhile, some go further still. For example, Blay-Palmer and Koc offer a definition of a sustainable food system as one that "nourishes one's body as well as one's cultural, spiritual and pleasure needs, to embrace priorities such as accessible, affordable, culturally appropriate,

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[33] Jason J Czarnezki, "Food, Law & the Environment: Informational and Structural Changes for a Sustainable Food System" (2011) 31:2 Utah Envtl L Rev 263 at 266.
[34] *Ibid*.

healthful foods."[35] They further add that "[t]hese priorities also encompass food providers including producers, processors, distributors and retailers as this presumes that food is produced and distributed in ways that promote healthy people, environments and communities."[36] This explicit inclusion of a comprehensive swath of actors along all nodes of the food chain, as well as the consideration of intangible factors like spiritual and pleasure needs, represents a more ambitious departure from conventional understandings of sustainability in the context of food.

Other challenges to the dominant definition of sustainability strike not at its scope, but its very core. More specifically, some have alleged that the competing priorities of environment, society, and economy can never be suitably balanced; rather than being seen as discrete "pillars", they would be better conceived of as an interconnected whole, underscored by the reality that "[e]cological sustainability is a prerequisite for development and not a mere aspect."[37] As is expressly clear when it comes to food and agriculture, social and economic objectives are, by default, subsidiary to the preservation of ecological integrity, on which all life on Earth depends. A myriad of environmental factors directly impact both the quality and quantity of food production, from climate patterns to soil health. Considering different approaches to enhancing the sustainability of our food systems can therefore be fruitful in destabilizing entrenched and underlying assumptions about sustainability in general, and subsequently informing viable tactics for reshaping our environmental paradigms.

Defining the what, why, and how of sustainable food systems is complex. In addition to the inherent tensions and competing priorities, the challenge is amplified by the fact that context

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[35] Blay-Palmer & Koc, *supra* note 30 at 226.
[36] *Ibid*.
[37] Bosselmann, *supra* note 20 at 31. See also Bob Giddings, Bill Hopwood & Geoff O'Brien, "Environment, Economy and Society: Fitting Them Together into Sustainable Development" (2002) 10 Sustainable Development 187.

matters. Though I certainly agree that a sustainable food system is about more than any one thing, I question both the possibility and the desirability of enumerating any kind of closed lists about what is encompassed by the definition. Instead, I argue the focus should be on understanding food holistically and relationally as an essential element of life and wellbeing, which would include a consideration of all of the myriad impacts of production and consumption practices.

2.2 The Canadian Agri-Food Sector

Due to aspects of settler Canada's geography, society, and economy, the agri-food sector has historically been very important to the country.[38] When evaluated against certain criteria, a quite positive picture of the state of the sector can be painted. For one thing, "Canada is widely regarded as having one of the strongest food safety systems in the world."[39]

Further, as acknowledged both by its own government and by external organizations and bodies, Canada "has abundant natural resources, competitive and generally open markets, an educated labour force, a sound banking system, and good governance. Canadian agriculture offers a variety of crop and livestock products and most commodity sectors are competitive and export-oriented."[40] The numbers bear out this position: exports of Canadian agriculture, agri-

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[38] See e.g. Anthony Winson, *The Intimate Commodity: Food and the Development of the Agro-Industrial Complex in Canada* (Toronto: Garamond, 1993); G Bruce Doern, David Castle & Peter WB Phillips, *Canadian Science, Technology, and Innovation Policy: The Innovation Economy and Society Nexus* (Montreal: McGill-Queen's University Press, 2016) at 261: Speaking of settler populations, "[a]griculture led the settlement and development of this country; the big migrations to and within Canada were largely driven by agriculturally based opportunities in Western Canada and on migration from areas in Eastern Canada where farming faced serious limitations regarding land, geology, soils, and crops. Until the Second World War agriculture employed the largest portion of the Canadian workforce. Farmsteads were home for a plurality of Canadians, and Canada's global position in markets was anchored on huge exports of grain that generated large trade surpluses."

[39] Government of Canada, "Information for media: Safe Food for Canadians Regulations", online: <https://www.inspection.gc.ca/food-safety-for-industry/information-for-media/eng/1528746083978/1528746084227> (last updated January 11, 2019).

[40] OECD, *Innovation, Agricultural Productivity and Sustainability in Canada* (Paris: OECD Publishing, 2015), online: <http://dx.doi.org/10.1787/9789264238541-en> at 17.

food, fish and seafood reached $64.6 billion in 2017,[41] and the federal government recently established an ambitious target of increasing agri-food exports to at least $85 billion annually by 2025.[42] Agriculture is already among the highest categories of federal expenditures on science and technology, amounting to $696,000,000 in 2017/2018.[43]

National and global trends present numerous opportunities for the Canadian agri-food sector to capitalize on existing strengths. Notably, due to its status as a world leader in the production of pulses,[44] Canada stands to greatly benefit from growing demands for plant-based protein. To this end, in 2018, Innovation, Science and Economic Development Canada (ISED) announced the creation of the Protein Industries Supercluster, which will "use plant genomics and novel processing technology to increase the value of key Canadian crops … Building on Canada's worldwide reputation as a leader in agricultural production, this supercluster will make Canada a leading source for plant proteins and, ultimately, feed the world."[45] Similarly, the recently formed pan-Canadian Smart Agri-Food Supercluster promises to "dramatically improve

[41] Government of Canada, "Continued strength and growth expected for Canada's agricultural sector", News Release (27 March 2018), online: <https://www.canada.ca/en/agriculture-agri-food/news/2018/03/continued-strength-and-growth-expected-for-canadas-agricultural-sector.html>.
[42] Innovation, Science and Economic Development Canada, *Building a Nation of Innovators* (Ottawa: ISED, 2019), online: <https://www.ic.gc.ca/eic/site/062.nsf/vwapj/ISEDC_19-044_INNOVATION-SKILLS_E_web.pdf/$file/ISEDC_19-044_INNOVATION-SKILLS_E_web.pdf> at 69. This is up from the target of $75 billion established in Budget 2017: Government of Canada, *Budget 2017: Building a Strong Middle Class* (March 22, 2017) (tabled in the House of Commons by the Honourable William Francis Morneau, PC, MP, Minister of Finance), online: <https://www.budget.gc.ca/2017/docs/plan/budget-2017-en.pdf> at 107.
[43] Statistics Canada, "Table 27-10-0014-01: Federal expenditures on science and technology, by socio-economic objectives (x 1,000,000)", DOI: <10.25318/2710001401-eng> (last updated December 8, 2019). Environment and health, which are also related to food and agriculture, were also significant categories of expenditure in 2017/2018, with $720,000,000 and $872,000,000 being allocated to them, respectively. Environment and health, which are also related to food and agriculture, were also significant categories of expenditure in 2017/2018, with $720,000,000 and $872,000,000 being allocated to them, respectively.
[44] Agriculture and Agri-Food Canada, "Canadian Pulses" (2011), online: <http://www.agr.gc.ca/resources/prod/Internet-Internet/MISB-DGSIM/ATS-SEA/PDF/4692-eng.pdf>.
[45] Government of Canada, "Protein Industries Supercluster", online: <http://www.ic.gc.ca/eic/site/093.nsf/eng/00012.html> (last updated March 17, 2020).

competitiveness, productivity, market value and the environmental performance of Canada's agricultural systems."[46]

More broadly, it is apparent that the agri-food sector forms an important piece of the federal government's ambitious innovation agenda. In 2017, the Advisory Council on Economic Growth[47] identified the agri-food sector as one of several key sectors to target for its "significant untapped potential".[48] Specifically, in its second wave of recommendations, the Council notes that:

> The Canadian agfood sector has great potential, given the large natural endowment of water and arable land, distinctive record of accomplishments in research, and exceptional base of companies and entrepreneurs. This sector also has exposure to favourable global market trends including demand from fast-growing Asian economies where protein consumption is on the rise. These assets, coupled with the scale of the existing obstacles, provide the potential for material economic gains for Canadians while also providing a blueprint for how the government and private sector may work together to unleash Canada's potential in other sectors.[49]

Here, Canada's endowments of land and water are presented as resources to be exploited for economic advantage, and material gains are clearly intended to be the primary aim of innovation. Although the Council adds that it is "not suggesting that growth be pursued at all costs"[50] and that some well-designed regulations may be appropriate, it focuses quite bullishly on the goal of economic growth. Moreover, the frequently invoked rhetoric of "efficiency", "productivity", and "competitiveness" strongly suggest that science and technology are seen as linchpins in improving both the environmental and economic performance of Canada's agri-food sector.

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[46] Smart Agri-Food Supercluster (SASC), online: <https://www.smartagrifoodsupercluster.ca/>.
[47] Established by the Minister of Finance in March 2016, to "develop advice on concrete policy actions to help create the conditions for strong and sustained long-term economic growth." Government of Canada, "Advisory Council on Economic Growth", online: <https://www.budget.gc.ca/aceg-ccce/home-accueil-en.html> (last updated December 8, 2017).
[48] Advisory Council on Economic Growth, *Unleashing the Growth Potential of Key Sectors* (2017), online: <https://www.budget.gc.ca/aceg-ccce/pdf/key-sectors-secteurs-cles-eng.pdf> at 2. The other sectors identified are energy and renewables; mining and metals; healthcare and life sciences; advanced manufacturing; financial services; tourism; and education.
[49] *Ibid*.
[50] *Ibid* at 4.

The Council's recommendations appear to have been taken in stride, as the linkage between increased agricultural production, economic growth, and meeting human demands is echoed and reinforced in multiple government documents, policies, and initiatives. What's more, beyond the Council, increased production is not only tied to environmental and economic goals, but also to social ones, including strategies for alleviating food insecurity both within and outside of the country's borders. The Canadian International Development Agency (CIDA) notes, in the context of its Food Security Strategy for developing countries, that based on present estimates that "global food production must increase by 70 percent by 2050 to keep pace with increasing demand …, investment in agricultural research and development is essential for meeting current and future demand."[51] This position reflects the underlying belief that agricultural production—in both wealthy industrialized nations and elsewhere around the world—needs to ramp up in all visions of the future in order to meet demand, and that Canada has a non-trivial role to play in that process.

Though beyond the scope of this project, it is worth mentioning that there are complex relationships between food and agricultural exports, production processes, and trade and investment policies and practices in terms of environmental and social outcomes, both in Canada[52] and beyond that also merit consideration in this respect.[53] Given both the real and potential trickledown and knock-on effects of increasing and/or intensifying production, it is

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[51] Canadian International Development Agency, *Increasing Food Security: CIDA's Food Security Strategy*, online: <https://www.international.gc.ca/development-developpement/assets/pdfs/partners-partenaires/key_partners-partenaires_cles/food-security-strategy-e.pdf> at 6.

[52] See e.g. Rod MacRae, "Do trade agreements substantially limit development of local / sustainable food systems in Canada?" (2014) 1:1 Canadian Food Studies 103; Elizabeth Ann Smythe, "Food for thought: How trade agreements impact the prospects for a national food policy" (2018) 5:3 Canadian Food Studies 76.

[53] For example, agricultural trade agreements can threaten smallholder livelihoods and undermine food sovereignty in the Global South. See e.g. Équiterre, *International Trade Law and Local Food Policy in Canada* (December 2010); Food Secure Canada, "Discussion Paper 8: International Food Policy", online: <https://foodsecurecanada.org/sites/foodsecurecanada.org/files/DP8_International_Food_Policy.pdf>.

arguably important to get a better sense of whether it is really necessary, if so, to what extent, and the various implications of different models, such as better accounting for aggressive target reductions in food waste.

2.2.1 Sustainable Food in Canada

As previously noted, the principle of sustainable development is enshrined in several different pieces of Canadian legislation,[54] including the *Federal Sustainable Development Act* (*FSDA*).[55] The *FSDA* also establishes the legal framework for developing and implementing the Federal Sustainable Development Strategy (FSDS), [56] which is the "primary vehicle for sustainable development planning and reporting", setting out priorities, establishing goals and targets, and identifying actions to achieve them.[57] The *FSDA* directs the Ministers to develop a FSDS every three years, based on the precautionary principle.[58] The FSDS must "set out federal sustainable development goals and targets and an implementation strategy for meeting each target and identify the minister responsible for meeting each target."[59]

The current FSDS includes, for the first time, a goal relating to Sustainable Food. However, these goals are not binding, and the language of the long-term Sustainable Food goal suggests that ecological sustainability is not necessarily the primary consideration. Rather, the

[54] For a summary of all references to sustainable development in Canadian legislation, see Table 8.1 in Natasha Affolder, "The Legal Concept of Sustainability" in Allan E Ingelson, ed, *Environment in the Courtroom* (Calgary: University of Calgary Press, 2019) 92 at 104-128.
[55] *Federal Sustainable Development Act*, SC 2008, c 33 [*FSDA*]. Section 5 states that "[t]he Government of Canada accepts the basic principle that sustainable development is based on an ecologically efficient use of natural, social and economic resources and acknowledges the need to integrate environmental, economic and social factors in the making of all decisions by government."
[56] See generally Government of Canada, "Achieving a Sustainable Future: A Federal Sustainable Development Strategy for Canada", online: <http://fsds-sfdd.ca/index.html> (last updated April 3, 2020).
[57] Government of Canada, "2019 to 2022 Federal Sustainable Development: strategic environmental assessment", online: <https://www.canada.ca/en/environment-climate-change/services/sustainable-development/strategic-environmental-assessment/public-statements/federal-sustainable-development-strategy-2019-2022.html> (last updated July 25, 2019).
[58] *FSDA, supra* note 55 at s 9(1). For an expanded discussion of the precautionary principle, see Chapter 5.3.1.
[59] *Ibid* at s 9(2).

goal states that: "Innovation and ingenuity contribute to a world-leading agricultural sector and food economy for the benefit of all Canadians."[60] Several references are made to the importance of "innovative technologies" in achieving this long-term goal, as well as the medium-term targets and short-term milestones enumerated.[61]

As exemplified by the FSDS, while environmental considerations related to the agri-food sector do not entirely fall by the wayside, they are often paid little more than lip service. Indeed, the Commissioner of the Environment and Sustainable Development's 2019 Fall Report on the FSDS found that, in relation to the goal of sustainable food, "information on targets, key priorities, and indicators under the goal … was incomplete."[62] Further, the Commissioner criticized Canada's sustainable development policy at large for its lack of coordination, observing that "[f]undamental weaknesses persist in the design of the [FSDS] and departments' sustainable development strategies. These weaknesses make those sustainable development tools difficult to understand and significantly reduce their value and effectiveness."[63] Clearly, there is substantial room for improvement when it comes to Canada's approach to sustainability, and the agri-food sector can be either a leader or a laggard in this area.

Despite the demonstrable lack of information relating to the goal of sustainable food under the FSDS, some efforts have been made in terms to measure the sustainability of Canada's food system through empirical analysis, with different areas of emphasis. For example, borne out

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[60] Environment and Climate Change Canada, *Achieving a Sustainable Future: A Federal Sustainable Development Strategy for Canada 2016-2019* (Gatineau, QC: Environment and Climate Change Canada, 2016) at 60.
[61] *Ibid* at 60-62.
[62] Office of the Auditor General of Canada, *2019 Fall Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada: Review of the 2018 Progress Report on the Federal Sustainable Development Strategy* (December 2019), online: <https://www.oag-bvg.gc.ca/internet/English/parl_cesd_201912_01_e_43478.html>.
[63] Office of the Auditor General of Canada, *2019 Fall Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada: The Commissioner's Perspective* (December 2019), online: <https://www.oag-bvg.gc.ca/internet/English/parl_cesd_201912_00_e_43477.html>.

of a desire to "provide a snapshot of the environmental risks and conditions in agriculture at regional and national scales",[64] in 1993, Agriculture and Agri-Food Canada (AAFC) began to develop a set of "science-based agri-environmental indictors (AEIs) that integrate information on soils, climate and topography with statistics on land use and crop and livestock management practices."[65] Specifically, the AEIs look at farmland management, soil quality, water quality, and air quality and GHGs. According to AAFC, these indicators "are being used increasingly as environmental performance measures for Canadian policy and programming, as well as in international reports on global progress."[66] This includes the national agricultural policy framework, as well as federal and departmental sustainable development strategies.[67]

Several non-governmental organizations have also made efforts to quantify the performance of Canada's agri-food system, and even evaluating it against that of other countries. In 2015, the Conference Board of Canada released a Food Report Card that compares Canada's performance on an international level.[68] Canada received a "C" grade for environmental sustainability, with the report noting that "Canada performs poorly on food waste, with high rates of food losses before and after purchases. It is last with respect to rising rates of greenhouse gas and ammonia emissions. However, Canada performed strongly in soil health, while work remains to be done on improving its seafood sustainability performance."[69]

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[64] RL Clearwater, T Martin & T Hoppe, eds, *Environmental Sustainability of Canadian Agriculture: Agri-Environmental Indicators Report Series – Report #4* (Ottawa: Agriculture and Agri-Food Canada, 2016) at 8.
[65] *Ibid* at 1.
[66] *Ibid* at 8.
[67] *Ibid* at 8-9.
[68] Jean-Charles Le Vallée & Michael Grant, *Canada's Food Report Card 2015: International Comparison* (Ottawa: The Conference Board of Canada, 2016). In 2016, the Conference Board of Canada prepared a report card that evaluated Canada's food performance at a domestic level: Jean-Charles Le Vallée et al, *Canada's Food Report Card 2016: Provincial Performance* (Ottawa: The Conference Board of Canada, 2017).
[69] Le Vallée & Grant, *Canada's Food Report Card 2015*, *ibid* at 62.

More recently, in May 2017, members of the Food: Locally Embedded, Globally Engaged (FLEdGE) research and knowledge sharing partnership produced a pan-Canadian sustainable food systems report card.[70] The development of the report card was guided by a food sovereignty framework and a food systems lens,[71] as opposed to a narrow focus on environmental, economic or health-related indicators. Grouped under six pillars of food sovereignty,[72] the performance of Canada's food system was assessed across 61 indicators to "provide a strong political and values-based focus which favors a consensus around core themes and a common departure point."[73]

As the authors of Food Counts observe, report cards "are not politically neutral."[74] However, they are useful tools for providing unified overviews of the food system, acting "as a benchmark to inform historical analysis as well as comparisons with future developments", and identifying and making visible knowledge and data gaps.[75] While Canada's performance across some indicators, like farm water conservation practices, is getting better, its performance in other areas, like agricultural emissions, is getting worse.[76] Ultimately, the data reflects the fact that there is a lot to be done in terms of making Canadian food systems more sustainable, regardless of the definition of sustainability that is adopted for governance purposes. What is needed now is forward-thinking law and policy in this sector that tackles areas of weakness and advances a holistic set of goals in a realistic and measurable fashion.

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[70] Charles Z Levkoe, Rachael Lefebvre & Alison Blay-Palmer, "Food Counts: A Pan-Canadian Sustainable Food Systems Report Card" (May 2017), online: <https://fledgeresearch.files.wordpress.com/2017/05/food-counts-pan-canadian-sustainable-food-systems-report-card2.pdf>.
[71] *Ibid* at 6.
[72] The pillars are as follows: (1) Focuses on Food for the People; (2) Values Food Providers; (3) Works with Nature; (4) Localizes Food Systems and Puts Control Locally; (5) Builds Knowledge and Skills; and (6) Food is Sacred: *ibid*.
[73] *Ibid* at 7.
[74] *Ibid* at 5.
[75] *Ibid*.
[76] *Ibid* at 55.

2.3 Canadian Agri-Food Law and Policy

Scholars have long criticized Canada's patchwork, fragmented approach to food systems governance, pointing out that it results in threats to food security, environmental sustainability, public health, and more.[77] Furthermore, from a political economy perspective, another part of the problem is that certain actors and industries have been able to exert a disproportionate influence on agri-food law and policy, resulting in the protection and privileging of certain interests at the expense of others.[78] Calls for a "joined-up"[79] approach to agri-food law and policy have thus emphasized the need for greater harmonization, interaction, and coordination across relevant departments, as well as the involvement of a diversity of stakeholders in order to integrate a broader spectrum of perspectives. A new mix of policy tools is also necessary, as "traditional Canadian government policy goals, institutional arrangements, and instruments are insufficient" for modern food policy.[80]

Part of the difficulty in governing food systems in Canada is intrinsic. In addition to the complexities posed by Canada's model of federalism,[81] Canada's legal landscape is also pluralist[82] and multi-juridical.[83] Nebulous subject matters like food and agriculture are especially

[77] See e.g. Karen Rideout et al, "Bringing home the right to food in Canada: challenges and possibilities for achieving food security" (2007) 10:6 Pub Health Nutr 566; Rod MacRae, "A Joined-Up Food Policy for Canada" (2011) 6 Journal of Hunger & Environmental Nutrition 424.
[78] See e.g. National Farmers Union, "Farmers, the Food Chain and Agriculture Policies in Canada in Relation to the Right to Food", Submission of the National Farmers Union of Canada to the Special Rapporteur on the Right to Food, Mr. Olivier De Schutter, Mission to Canada, May 2012, online: <http://www.nfu.ca/sites/www.nfu.ca/files/NFU%20Final%20Report%20to%20Special%20Rapporteur%20on%20the%20Right%20to%20Food,%20May%202012.pdf> at 3 (asserting that "[t]he food manufacturing sector is a powerful lobby in Canada which has been able to obtain favourable regulations and policies which allow costs to be offloaded onto farmers.").
[79] MacRae, "A Joined-Up Food Policy for Canada", *supra* note 77.
[80] *Ibid* at 428.
[81] See e.g. Sarah Berger Richardson & Nadia Lambek, "Federalism and fragmentation: Addressing the possibilities of a food policy for Canada" (2018) 5:3 Canadian Food Studies 28.
[82] Brian Z Tamanaha, "Understanding Legal Pluralism: Past to Present, Local to Global" (2008) 30:3 Sydney L Rev 375; Ghislain Otis, "Constitutional recognition of aboriginal and treaty rights: a new framework for managing legal pluralism in Canada?" (2014) 46:3 The Journal of Legal Pluralism and Unofficial Law 320.
[83] Lindsay Borrows, "Dabaadendiziwin: Practices of Humility in a Multi-Juridical Legal Landscape" (2016) 33:1 Windsor Yearbook of Access to Justice 149.

tough to regulate because they cut across multiple and diffuse areas of concern, including environment, human health, industry, and trade, to name just a few. The introduction of a growing number of new and emerging technologies in the agri-food sector, which often present regulatory complications of their own, further muddles the brew. These challenges complicate matters, to be sure, but they are by no means insurmountable. Looking at the past, present, and future of agri-food law and policy in Canada can illuminate why it has developed in the way that it has, what some of the current sticking points are, and how it might be reimagined.

2.3.1 Brief History

Agricultural policies have a marked influence on production decisions and outcomes. These policies, in turn, are informed by many factors. As Grace Skogstad writes, governments make policy in the context of an overarching policy paradigm that consists of

> broad beliefs about the place of agriculture in the economy and society, the goals for the sector, and the respective roles of governments and markets in realizing these goals. They also include ideas about appropriate means or policy instruments – be it regulation, financial incentives, or an informational campaign, for instance – to achieve policy goals.[84]

Additionally, policies are enacted within a governing paradigm that determines which institutions and actors (both state and nonstate) have the right to drive or even simply participate in the policy-making process.[85]

Agri-food policy is both place and time-specific, and is thus a site where multiple narratives are mapped. In the postwar period, "the agri-food policy paradigm that dominated in North America and Europe was built around the idea that agriculture is an exceptional sector."[86] What this meant in Canada was that, to address problems and challenges facing producers,

[84] Grace Skogstad, "Effecting Paradigm Change in the Canadian Agriculture and Food Sector: Toward a Multifunctionality Paradigm" in Rod MacRae & Elisabeth Abergel, eds, *Health and Sustainability in the Canadian Food System: Advocacy and Opportunity for Civil Society* (Vancouver: UBC Press, 2012) 17 at 18.
[85] *Ibid*.
[86] *Ibid*.

including "low farm incomes, low and fluctuating commodity prices, unstable world markets, and limited farmer bargaining power in the marketplace",[87] the government intervened using expenditure and regulatory instruments to support the goals of productivity and profitability. This domestic policy paradigm "was accompanied by a governing paradigm that put agricultural departments and ministries and the agricultural sector at the centre of agri-food policy making."[88]

From the 1980s onward, developments on the global stage, particularly in the trade arena, eroded the strength of the state assistance model.[89] Critics "advanced and argued for an alternate, market liberal paradigm that rejected the premise of agriculture as a unique sector warranting exceptional treatment and argued that governments should reduce their role in the sector so that competitive markets largely determine producers' incomes."[90] The growth of global neoliberalism had repercussions not only for industry actors, but for individuals as well, in various capacities, including as citizens and as consumers. By the mid- to late-1990s, the erosion of the social safety net in Canada led, unsurprisingly, to growing rates of food insecurity not only among the poorest members of society, but also among individuals and families in the working class.[91] Meanwhile, during this time, CSOs were becoming increasingly vocal about a range of concerns relating to the governance of the agri-food sector, adding to the competing issues to be formally and informally negotiated.[92]

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[87] *Ibid* at 19.
[88] *Ibid*.
[89] *Ibid* at 20.
[90] *Ibid*.
[91] Graham Riches & Valerie Tarasuk, "Canada: Thirty Years of Food Charity and Public Policy Neglect" in Graham Riches & Tiina Silvasti, eds, *First World Hunger Revisited: Food Charity or the Right to Food?*, 2d ed (New York: Palgrave Macmillan, 2014) 42 at 43-44; Rideout et al, *supra* note 77 at 569-570.
[92] Skogstad, *supra* note 84 at 21. See also Mustafa Koc et al, "Getting Civil About Food: The Interactions Between Civil Society and the State to Advance Sustainable Food Systems in Canada" (2008) 3:2-3 J Hunger & Envtl Nutr 122; Rod MacRae & Elisabeth Abergel, eds, *Health and Sustainability in the Canadian Food System: Advocacy and Opportunity for Civil Society* (Vancouver: UBC Press, 2012); Peter Andrée et al, eds, *Civil Society and Social Movements in Food System Governance* (New York: Routledge, 2019).

As previously mentioned, the federal government has exhibited, in the past decade, a real commitment to growing Canada's agri-food sector, for purposes of providing food, employment, and wealth for its populace and disseminating its products to international markets. While this renewed attention to the agri-food sector might be cast, on one hand, as positive, it also means that we are once again seeing tensions and pressures emerge in the context of both policy paradigms and governance paradigms. The fact that Canada is a major producer and exporter of food has clearly contributed to the development of a powerful "trope of national abundance",[93] further compounded by the hitching of the cart of scientific and technological innovation to the agri-food sector's wagon.

The dark side is therefore that preoccupations with increased productivity and economic growth run the risk of compromising broader goals, including those pertaining to environmental sustainability and food security. These risks are amplified by the lack of a robust agri-food law and policy framework designed to address modern challenges. As this necessarily brief overview goes to show, an expanded appreciation of the political economy context in which agri-food law and policy is developed can help shed light on its trajectory, and how that trajectory might be altered.

2.3.2 Acts and Actors

The Canadian agri-food sector is governed by a veritable constellation of laws, regulations, and policies. The *Safe Food for Canadians Act, 2012*[94] (and the coming into force of the corresponding regulations in 2018[95]) streamlined 14 sets of regulations that were previously

[93] Sarah Wakefield, Kaylen R Fredrickson & Tim Brown, "Food security and health in Canada: Imaginaries, exclusions and possibilities" (2015) 59:1 The Canadian Geographer 82 at 86.
[94] SC 2012, c 24.
[95] SOR/2018-108.

under the ambit of four different statutes,[96] but this consolidation has only made a small step towards culling the regulatory thicket. The *Food and Drugs Act*,[97] the *Agriculture and Agri-Food Administrative Monetary Penalties Act*,[98] the *Plant Protection Act*,[99] the *Feeds Act*,[100] and the *Seeds Act*[101] are just a few examples of federal Acts (and their accompanying Regulations) that have direct bearing on the sector.[102] There are also environmental laws and regulations that affect food and agriculture, including the *Fisheries Act*[103] and the *Pest Control Products Act*[104] at the federal level.

Furthermore, a multiplicity of actors engage in law and policy-making that is directly or indirectly relevant to food and agriculture.[105] Numerous departments, agencies, boards, and commissions are charged with various aspects of food and agriculture as part of their mandates. Relevant federal departments include AAFC, Health Canada, the Canadian Food Inspection Agency (CFIA), Fisheries and Oceans Canada (DFO), and Environment and Climate Change Canada (ECCC) (though the latter, quite surprisingly, is rarely seen involved in this domain).

These actors often work largely within their own silos, and each department has different areas of emphasis and different concerns to balance, many of which are often in direct conflict. For example, AAFC demonstrates a strong commitment to ensuring the economic development of Canada's agri-food sector, whereas Health Canada focuses more specifically on public health

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[96] Specifically, the *Meat Inspection Act* [Repealed, 2012, c 24, s 77], *Fish Inspection Act* [Repealed, 2012, c 24, s 76], *Canada Agricultural Products Act* [Repealed, 2012, c 24, s 78], and the *Consumer Packaging and Labelling Act*, RSC 1985, c C-38.
[97] RSC 1985, c F-27.
[98] SC 1995, c 40.
[99] SC 1990, c 22.
[100] RSC 1985, c F-9.
[101] RSC 1985, c S-8.
[102] See Canadian Food Inspection Agency, "List of Acts and Regulations", online: <http://www.inspection.gc.ca/about-the-cfia/acts-and-regulations/list-of-acts-and-regulations/eng/1419029096537/1419029097256> (last updated March 31, 2020).
[103] RSC 1985, c F-14.
[104] SC 2002, c 28.
[105] See *Governing Food*, *supra* note 1 at Appendix B.

and nutrition. There is little to no guidance as to how to coordinate and adjudicate competing claims among and within departments, leading to a regulatory landscape that has contributed to a serious lack of coherence, and a corresponding inability to govern effectively. As will be discussed in the following part, the national Food Policy for Canada marks a concerted effort to depart from this state of affairs, and it will be interesting to see if real gains can be made.

Provincial and territorial governments and municipal and local governments are also involved in food systems governance, often in overlapping ways.[106] Municipal and local government engagement in food law and policy, in particular, is attracting closer attention,[107] as "[c]ities now regulate key aspects of food production, processing, consumption and waste, and they are increasingly major players in purchasing and distributing healthy and sustainable foods."[108] Municipal engagement in food systems governance presents an opportunity to be nimbler and more innovative, and since municipalities are more affected by local consequences, policy can arguably be developed to be more responsive to local needs.[109] Thus, there are identifiable advantages to having multiple levels of government engaged in food systems governance. At the same time, multi-government engagement poses problems relating to

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106 For an overview of the division of powers when it comes to agri-food policy, see Donald E Buckingham, "It's Complicated: Food and Federalism in Canada" in Heather McLeod-Kilmurray, Angela Lee & Nathalie Chalifour, eds, *Food Law and Policy in Canada* (Toronto: Carswell, 2019) 55-72.
107 Rod MacRae & Kendal Donahue, *Municipal food policy entrepreneurs: A preliminary analysis of how Canadian cities and regional districts are involved in food system change* (Toronto Food Policy Council, Vancouver Food Policy Council & The Canadian Agri-Food Policy Institute, 2013), online: <http://tfpc.to/wordpress/wp-content/uploads/2013/05/Report-May30-FINAL.pdf>.
108 Jamie Baxter & Jessica Rose, "Cities in a Time of Uncertainty: Food and Canadian Municipal Law" in Heather McLeod-Kilmurray, Angela Lee & Nathalie Chalifour, eds, *Food Law and Policy in Canada* (Toronto: Carswell, 2019) 73 at 73.
109 See e.g. Halifax Regional Municipality, "Municipal Role in Supporting Food Security", Item No. 12.1.5, Community Planning and Economic Development (November 19, 2019), online: <https://www.halifax.ca/sites/default/files/documents/city-hall/standing-committees/191119cped1215r.pdf> at 2-3, recognizing that "[m]unicipalities are at the front lines, facing the consequences resulting from the loss of agricultural land, water and air pollution, and climate change. The struggles of fishers and farmers, the inequities that impact people's ability to afford food, and reduced employment and tax revenues from food businesses are significant challenges for municipalities. Addressing this complex issue requires a collective approach across all levels of government while recognizing that local action is particularly effective for community change."

constitutional uncertainty, jurisdictional authority, and potential conflict between initiatives at various levels of government.[110]

One area in which intergovernmental cooperation is evident is in promoting the growth of agriculture and agri-food sector under the mandate of AAFC. The *Canadian Agricultural Partnership* is the current policy framework in place to strengthen the agriculture and agri-food sector, developed and implemented by AAFC and governed by a joint federal-provincial-territorial agreement.[111] The Partnership, which came into force on April 1, 2018, replaced the previous agricultural policy framework, *Growing Forward 2* (GF2). The Partnership focuses on three key areas: (1) growing trade and expanding markets; (2) innovative and sustainable growth of the sector; and (3) supporting diversity and a dynamic, evolving sector.[112]

Evidence of intergovernmental cooperation can also be seen in national supply management initiatives in milk, egg, and poultry production,[113] as well as harmonization programs when it comes to things like food standards (e.g. the organic product regimes of several provinces, including Manitoba,[114] Nova Scotia,[115] and New Brunswick[116] enforce federal

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[110] Baxter & Rose, *supra* note 108 at 82-87.
[111] Agriculture and Agri-Food Canada, "Canadian Agricultural Partnership", online: <http://www.agr.gc.ca/eng/about-us/key-departmental-initiatives/canadian-agricultural-partnership/?id=1461767369849> (last updated December 16, 2019).
[112] Agriculture and Agri-Food Canada, "Canadian Agricultural Partnership: Building a Strong Agriculture and Agri-Food Sector", News Release (13 February 2018), online: <https://www.canada.ca/en/agriculture-agri-food/news/2018/02/canadian_agriculturalpartnershipbuildingastrongagricultureandagr.html>.
[113] See e.g. Khamla Heminthavong, *Canada's Supply Management System* (Background Paper), Publication No. 2018-42-E (Ottawa: Library of Parliament, 2018), online: <https://lop.parl.ca/staticfiles/PublicWebsite/Home/ResearchPublications/BackgroundPapers/PDF/2018-42-e.pdf>.
[114] *The Organic Agricultural Products Act*, SM 2007, c 15.
[115] NS Reg 340/2015, online: <https://novascotia.ca/just/regulations/regs/amorganic.htm> at s 2, where it notes that "Canadian Organic Standards" means the standards CAN/CGSB 32.310 and CAN/CGSB 32.311, as defined in the federal *Organic Products Regulations.*
[116] NB Reg 2014-50, online: <http://laws.gnb.ca/en/showfulldoc/cr/2014-50//20191210> at s 2, where it notes that "Canadian Organic Standards" means the standards CAN/CGSB 32.310 and CAN/CGSB 32.311, as defined in the Organic Products Regulations.

Canadian Organic Standards[117]). However, there is less intergovernmental cooperation visible when it comes to issues of food safety, information, and quality. Issues relating to food security, sovereignty, and justice are likewise neglected.

In addition to state actors, there are a variety of non-state actors that are involved in food law and policy. Food policy councils (FPCs), which are voluntary bodies comprised of stakeholders from across the food system, are among the most significant. Though their specific mandates vary, FPCs typically have four functions: (1) serve as a multi-stakeholder forum for discussing food issues; (2) foster coordination between sectors in the food system; (3) analyze, evaluate, and influence food policy; (4) create or support existing programs and services that address local needs.[118] In 1991, Toronto became the first municipality in Canada to create a FPC.[119] Since then, FPCs have formed in many other Canadian cities,[120] including Ottawa,[121] Vancouver,[122] and Edmonton.[123] While FPCs are generally struck at local and regional levels, they can also be assembled at larger scales.[124]

Numerous CSOs/NGOs operating at the federal, provincial/territorial, and local levels have missions that go specifically to food-related issues. One notable example at the federal level

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[117] See Part 13 of the *Safe Food for Canadians Regulations*, SOR/2018-108; Canadian Food Inspection Agency, "Regulating organic products in Canada", online: <https://www.inspection.gc.ca/food/requirements-and-guidance/organic-products/regulating/eng/1328082717777/1328082783032> (last updated November 8, 2019).

[118] Wendy Mendes, "Briefing Note: Food Policy Councils" (National Collaborating Centre for Healthy Public Policy, March 2011), online: <http://www.ncchpp.ca/docs/FoodPolicyCouncils-ConseilsPolitiqueAlimentaire_EN.pdf>.

[119] Toronto Food Policy Council, "About", online: <http://tfpc.to/about>.

[120] Celine Cooper, "The rise of food policy councils in Canada", *Policy Options* (13 February 2018), online: <https://policyoptions.irpp.org/magazines/february-2018/the-rise-of-food-policy-councils-in-canada/>. See also Sustain Ontario's Municipal Food Policy Network, online: <https://sustainontario.com/initiatives/foodpolicygroups/#!directory/map>.

[121] Ottawa Food Policy Council, online: <https://ofpc-cpao.ca/>.

[122] Vancouver Food Policy Council, online: <https://www.vancouverfoodpolicycouncil.ca/>.

[123] Edmonton Food Council, online: <https://edmontonfoodcouncil.org/>.

[124] A case has even been made for the creation of a National Food Policy Council: see Food Secure Canada, "The Case for a National Food Policy Council: Report by the *ad hoc* Working Group on Food Policy Governance" (October 2017), online: <https://foodsecurecanada.org/sites/foodsecurecanada.org/files/attached_files/the_case_for_a_national_food_policy_council_final.pdf>.

is Food Secure Canada (FSC), which defines itself as a “pan-Canadian alliance of organizations and individuals working together to advance food security and food sovereignty through three inter-locking goals: zero hunger, healthy and safe food, and sustainable food systems.”[125] For the past two decades, FSC has engaged in a range of activities that are intended to facilitate democratic debates on food policy; support research, learning, and collaboration on food-related projects and campaigns; and advocate for food policies at the federal level that reflect their core commitments.[126] FSC is part of an important cohort of CSOs whose work has significantly influenced the terms of food policy debates at the national level.[127]

Industry groups play important roles as well, several of which directly engage with sustainability concerns. For example, the Canadian Roundtable for Sustainable Crops (CRSC) is a national, industry-led forum comprised of grower, industry, customer and consumer organizations that was formed in 2013 “to facilitate cross-commodity collaboration on sustainable agriculture issues and opportunities facing grains sector participants.”[128] There is also a Canadian Roundtable for Sustainable Beef (CRSB), whose objective is to promote sustainability throughout the Canadian beef industry.[129] Other industry associations, like the Canadian Federation of Agriculture,[130] the Canadian Agri-Food Trade Alliance,[131] the Canadian Cattlemen’s Association,[132] the National Farmers Union,[133] and Farm Management Canada[134] have more general mandates.

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[125] Food Secure Canada, “Who We Are”, online: <https://foodsecurecanada.org/who-we-are>.
[126] Food Secure Canada, “What We Do”, online: <https://foodsecurecanada.org/who-we-are/what-we-do>.
[127] See e.g. Annette Aurélie Desmarais & Hannah Wittman, “Farmers, foodies and First Nations: getting to food sovereignty in Canada” (2014) 41:6 The Journal of Peasant Studies 1153.
[128] Canadian Roundtable for Sustainable Crops, online: <http://sustainablecrops.ca/about>.
[129] Canadian Roundtable for Sustainable Beef, “Our Work”, online: <https://crsb.ca/about-us/our-work/>.
[130] Canadian Federation of Agriculture, online: <https://www.cfa-fca.ca/>.
[131] Canadian Agri-Food Trade Alliance, online: <http://cafta.org/>.
[132] Canadian Cattlemen’s Association, online: <http://www.cattle.ca/>.
[133] National Farmers Union, online: <https://www.nfu.ca/>.
[134] Farm Management Canada, online: <https://fmc-gac.com/>.

Finally, there is another subset of organization that forges partnerships across sectors. To name just one, the Agri-Food Innovation Council (AIC) is an institution that brings together academic and industry stakeholders to collaborate on issues relating to agricultural research and innovation.[135] In 2017, AIC published *An Overview of the Canadian Agricultural Innovation System*.[136] The report advocates for "[a]n inclusive demand-driven innovation system supported by a science-based policy framework, an enabling regulatory environment, and governance structures that promote continuous technological progress while encouraging the adoption of innovations at the farm level."[137] Further mentioning that agricultural innovations have significantly contributed to the transformation of Canada's agriculture sector, the report posits that "[population] growth relies on agricultural innovation to drive productivity gains and provide a basis for building a more globally competitive and sustainable economy."[138] The AIC aims to make Canadian agriculture a "global leader in stewardship of our land through science",[139] including through investing in new technologies (such as artificial intelligence and robotics), disseminating research, and promoting collaboration between researchers, farmers, and industry.[140]

2.3.3 A Food Policy for Canada

As should be plain, bringing together all of the various groups operating in the agri-food sector, with all of their disparate missions, is no easy task. After decades of effort, largely by dedicated CSOs and individual activists, advocates, and academics, one of the most remarkable recent

[135] Agri-food Innovation Council, "About AIC", online: <http://www.aic.ca/about-aic/>. In 2019, the name of the organization changed from Agricultural Institute of Canada to the Agri-Food Innovation Council.
[136] Agricultural Institute of Canada, *An Overview of the Canadian Agricultural Innovation System* (Ottawa: AIC, 2017).
[137] *Ibid* at 7.
[138] *Ibid* at 9.
[139] Agri-food Innovation Council, "About AIC", *supra* note 135.
[140] Agricultural Institute of Canada, "Leading in Sustainability: An Agricultural Research, Innovation and Development Policy for the Future", online: <http://www.aic.ca/pdf/AIC_FINAL_ResearchPolicy.pdf>.

breakthroughs in Canadian food law and policy has been the development of a national food policy for Canada.[141] Several different proposals had been advanced for the creation of such a policy over the years, including by FSC,[142] the Canadian Agri-Food Policy Institute,[143] the Canadian Federation of Agriculture,[144] and the Conference Board of Canada.[145] This body of research and analysis was considered in the development of the final food policy.[146]

Many proponents see a national food policy as representing a vital first step in achieving an integrated approach to governing across the food system to achieve specific food-related

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141 In so doing, Canada joins a small cohort of other countries that have already established or proposed national food policies or strategies, including Australia (Australian Government, *The National Food Plan* (2013), online: <http://pandora.nla.gov.au/pan/141295/20130719-0940/www.daff.gov.au/nationalfoodplan/white-paper.html>), Ireland (Department of Agriculture, Food and the Marine, *Food Wise 2025: Local Roots, Global Reach—A 10 Year Vision for the Irish Agri-Food Industry* (2015), online: <https://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/report/FoodWise2025.pdf>), Scotland (Scottish Government, *Recipe for Success – Scotland's National Food and Drink Policy* (2009), online: <https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2009/06/recipe-success-scotlands-national-food-drink-policy/documents/0083283-pdf/0083283-pdf/govscot%3Adocument/0083283.pdf?forceDownload=true>), the United Kingdom (United Kingdom Department of Environment, Food and Rural Affairs, *Food 2030* (2010), online: <http://nourisheu.com/wp-content/uploads/2015/02/food2030strategy.pdf>), and Wales (Welsh Assembly Government, *Food for Wales, Food from Wales: Food Strategy for Wales 2010 to 2020* (2010), online: <http://www.physicalactivityandnutritionwales.org.uk/Documents/740/Food%20Strategy%202010-2020-eng.pdf>).

142 Food Secure Canada, *Resetting the Table: A People's Food Policy for Canada* (April 2011), online: <https://www.slideshare.net/FoodSecureCanada/a-peoples-food-policy-for-canada>; Food Secure Canada, *From Patchwork to Policy Coherence: Principles and Priorities of Canada's National Food Policy* (May 2017), online: <https://foodsecurecanada.org/sites/foodsecurecanada.org/files/201705-from-patchwork-to-policy-coherence-food_secure_canada-discussion-paper-v1.pdf>.

143 The Canadian Agri-Food Policy Institute, *Canada's Agri-Food Destination: A New Strategic Approach* (Ottawa: The Canadian Agri-Food Policy Institute, 2011), online: <https://capi-icpa.ca/wp-content/uploads/2011/02/Canada_s-Agri-Food-Destination-A-New-Strategic-Approach-2011.pdf>; The Canadian Agri-Food Policy Institute, *Achieving What's Possible for Canada's Agri-Food Sector* (Ottawa: The Canadian Agri-Food Policy Institute, 2016), online: <https://capi-icpa.ca/wp-content/uploads/2016/02/Achieving-What_s-Possible-for-Canada_s-Agri-Food-Sector-2016.pdf>.

144 The Canadian Federation of Agriculture, *Towards a National Food Strategy: A framework for securing the future of food* (2017), online: <https://www.cfa-fca.ca/wp-content/uploads/2017/07/National-Food-Strategy.pdf>.

145 Michael Bloom, *From Opportunity to Achievement: Canadian Food Strategy* (Ottawa: The Conference Board of Canada, 2014), online: <https://www.conferenceboard.ca/temp/4e9f4b10-19bc-44ac-b812-180f6efd2a37/6091_CanadianFoodStrat_CFIC.pdf>.

146 Government of Canada, "Learn more – Food Policy for Canada", online: <https://www.canada.ca/en/campaign/food-policy/learn-more.html> (last updated March 11, 2020).

objectives.[147] Food policy is intended "to help guide public, private, and non-profit sectors on food-related decisions and actions that can improve people's lives, their health, and the health of the environment and the economy."[148] In the words of the federal government, "[t]he first-ever Food Policy for Canada is a roadmap for a healthier and more sustainable food system for Canada."[149]

The development of the Policy involved numerous federal government departments and agencies, but the process was led by AAFC and the Minister of Agriculture and Agri-Food, who was charged with the task in the 2015 Mandate Letter from Prime Minister Justin Trudeau. Specifically, the Minister of Agriculture and Agri-Food was asked to develop "a food policy that promotes healthy living and safe food by putting more healthy, high-quality food, produced by Canadian ranchers and farmers, on the tables of families across the country."[150] The 2017 Mandate Letter to the Minister of Health also elaborates on various public health and nutrition initiatives first introduced in the 2015 Mandate Letter,[151] and instructs the Minister of Health to "[w]ork closely with the Minister of Agriculture and Agri-Food to align these regulatory initiatives with food policy. All of these initiatives should be based on high-quality scientific evidence and meaningful consultations with Canadians."[152] Notably, the Minister of

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[147] For more context, see Peter Andrée, Mary Coulas & Patricia Ballamingie, "Canada's National Food Policy: The Political Basis for Coordination and Integration" in Heather McLeod-Kilmurray, Angela Lee & Nathalie Chalifour, eds, *Food Law and Policy in Canada* (Toronto: Carswell, 2019) 13-36.

[148] Government of Canada, "Food Policy for Canada", online: <https://www.canada.ca/en/campaign/food-policy.html> (last updated June 2, 2017).

[149] *Ibid.*

[150] Justin Trudeau, "Minister of Agriculture and Agri-Food Mandate Letter" (November 12, 2015), online: <http://pm.gc.ca/eng/minister-agriculture-and-agri-food-mandate-letter>.

[151] Including the promotion of public health by introducing new restrictions on the commercial marketing of unhealthy foods and beverages to children; bringing in tougher regulations to eliminate trans fats and to reduce salt in processed foods; and improving food labels to give more information on added sugars and artificial dyes in processed foods. Justin Trudeau, "Minister of Health Mandate Letter" (October 4, 2017), online: <https://pm.gc.ca/eng/minister-health-mandate-letter>.

[152] Justin Trudeau, "Minister of Health Mandate Letter" (October 4, 2017), online: <https://pm.gc.ca/eng/minister-health-mandate-letter>.

Environment and Climate Change was omitted from the mandate letter's ambit, as was the Minister of Innovation, Science and Economic Development.

Consultations were a key part of the process of developing the Policy, and the government acknowledged that "collaboration that brings together a variety of experience and perspectives"[153] would be critical to its success. These consultations took place in the form of an online survey, "regional engagement sessions, a National Food Policy Summit, town halls hosted by members of Parliament, and other community-led engagement events held across the country."[154] Despite—or perhaps because of—the diversity of voices that were heard, the vision for the food policy that emerged after receiving input from more than 45,000 Canadians across the country is extremely general: "All people in Canada are able to access a sufficient amount of safe, nutritious and culturally diverse food. Canada's food system is resilient and innovative, sustains our environment, and supports our economy."[155]

The final policy, jauntily titled *Everyone at the Table,* was officially launched on June 7, 2019. Repeating familiar messaging, the accompanying News Release notes that "Canadian foods are recognized worldwide for the highest standards of quality and food safety. Responsible for one in eight jobs across the country, our food sector is a powerhouse of the economy, particularly in our rural communities. However, more needs to be done to improve our food system."[156] Thus, the policy defines long-term outcomes to achieve health, environmental, social,

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[153] Government of Canada, "Consulting with Canadians – Food Policy for Canada", online: <https://www.canada.ca/en/campaign/food-policy/consulting-with-canadians.html> (last updated September 25, 2019).
[154] *Ibid*.
[155] Agriculture and Agri-Food Canada, *Everyone at the Table: Food Policy for Canada* (2019), online: <https://www.canada.ca/content/dam/aafc-aac/documents/20190614-en.pdf> at 5 [*Food Policy for Canada*].
[156] Agriculture and Agri-Food Canada, ""Everyone at the Table!" Government of Canada announces the first-ever Food Policy for Canada", News Release (17 June 2019), online: <https://www.canada.ca/en/agriculture-agri-food/news/2019/06/everyone-at-the-table-government-of-canada-announces-the-first-ever-food-policy-for-canada.html>.

and economic progress relating to food, and measure results, while concomitantly identifying priority areas for short-term action.

Specifically, the priority areas identified for 2019-2024 are: 1) Help Canadian Communities Access Healthy Food; 2) Make Canadian Food the Top Choice at Home and Abroad; 3) Support Food Security in Northern and Indigenous Communities; and 4) Reduce Food Waste.[157] Guiding principles of inclusion and diversity, reconciliation, collaboration, innovation, sustainability, and evidence and accountability are to be considered "when designing and evaluating options for policies and programs with a direct impact on food issues."[158] The policy is also explicitly connected to existing government commitments, including the UN SDGs and the goals set by the Agri-Food Economic Strategy Table.[159] In terms of the SDGs, the policy makes specific reference to SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), SDG 12 (Responsible Production and Consumption), and SDG 13 (Climate Action).[160]

The six interconnected and mutually-reinforcing outcomes to address over the long-term are:[161]

1. Vibrant communities: Improved community capacity and resilience to food-related challenges
2. Increased connections within food systems: Increased governance spaces and partnerships that connect multiple sectors and actors across the food system
3. Improved food-related health outcomes: Improved health status of Canadians related to food consumption and reduced burden of diet-related disease, particularly among groups at higher risk of food insecurity
4. Strong Indigenous food systems: To be co-developed in partnership with Indigenous communities and organizations
5. Sustainable food practices: Improvements in the state of the Canadian environment through the use of practices along the food value chain that reduce environmental impact and that improve the climate resilience of the Canadian food system
6. Inclusive economic growth: Improved access to opportunities in the agriculture and food sector for all Canadians within a diversified, economically viable, and sustainable food system

[157] *Food Policy for Canada*, *supra* note 155 at 9.
[158] *Ibid* at 10.
[159] *Ibid* at 13.
[160] *Ibid* at 13.
[161] *Ibid* at 6-7.

To operationalize the policy, Budget 2019 pledges $134.4 million to support food policy priorities over five years, with $5.2 million ongoing in a suite of new measures, and an additional $100 million over five years earmarked from the Strategic Innovation Fund to support innovation in the food processing sector.[162] Some noteworthy initiatives under the policy include the creation of a National School Food Program, a Local Food Infrastructure Fund ($50 million over five years), a Buy Canadian Promotion Campaign ($25 million over five years), a Northern Isolated Community Initiatives Fund ($15 million over five years), and a Food Waste Reduction Challenge ($20 million over five years).[163] Through the Food Waste Reduction Challenge, "[f]unding will be awarded to those whose innovative solutions have the potential of reducing the most amount of food waste, with a focus on new innovators looking to accelerate and grow their solutions and who may not have the necessary resources."[164] There are currently two "Challenge Streams" open for applications, with a closing date of January 18, 2021, and "[t]he launch of two additional challenge streams focused on technological solutions to food waste is planned for spring 2021."[165]

Interestingly, the Food Policy also establishes a Canadian Food Policy Advisory Council, aiming to "incorporate diverse perspectives in its advice to contribute to building consensus on the nature of food challenges and solutions to address them, building greater trust among key food system stakeholders, and supporting the ability to collaborate across sectors. The Council

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[162] Government of Canada, *Budget 2019: Investing in the Middle Class* (March 19, 2019) (tabled in the House of Commons by the Honourable William Francis Morneau, PC, MP, Minister of Finance), online: <https://budget.gc.ca/2019/docs/plan/budget-2019-en.pdf> at 162-163 [*Budget 2019*].
[163] *Ibid* at 163.
[164] Agriculture and Agri-Food Canada, "Government of Canada launches Food Waste Reduction Challenge", News Release (19 November 2020), online: <https://www.canada.ca/en/agriculture-agri-food/news/2020/11/government-of-canada-launches-food-waste-reduction-challenge.html>.
[165] *Ibid*.

will also help identify data gaps and opportunities."[166] At the time of writing, the Council has not yet been formed,[167] but the membership will apparently be drawn from "individuals with experience and knowledge of food system issues, with backgrounds in the food and agriculture industry, members of academic and civil society, as well as members of Indigenous organizations and communities."[168] The creation of this Council seems to respond to critiques that policy-making in the agri-food sector is neither adequately inclusive nor accountable to a specialized agency with relevant expertise. The creation of the Council also responds to calls for "a governance structure that will make adaptive changes to policies, programs and regulations at different levels, over time, and that recognizes the need for a process that goes beyond the initial launch of *A Food Policy for Canada*."[169]

In terms of reporting, the Policy promises that a cross-government reporting framework will "measure and track progress towards priority long-term outcomes, holding the government accountable for results and ensuring transparent reporting to Canadians. It will also support decision-making that is based on evidence of effective approaches to tackling food system issues."[170] Given the newness of the Policy, it remains to be seen what such reporting will look like in practice. However, the commitment to accountability and reporting is a positive sign, as are numerous other dimensions of the food policy in its entirety.

[166] *Food Policy for Canada*, *supra* note 155 at 8.
[167] "Applications to the Council were accepted between August 9, 2019 and September 20, 2019." Government of Canada, "The Canadian Food Policy Advisory Council", online: <https://www.canada.ca/en/campaign/food-policy/thecanadianfoodpolicyadvisorycouncil.html> (last updated October 2, 2019).
[168] *Food Policy for Canada*, *supra* note 155 at 8.
[169] Food Secure Canada, "The Case for a National Food Policy Council", *supra* note 124 at 3.
[170] *Food Policy for Canada*, *supra* note 155 at 8.

2.4 Conclusion

Agri-food law and policy in Canada is a messy affair that has developed in fits and starts, and has a long way left to go if it is to provide an effective governance framework that speaks to a multiplicity of objectives. It has already been well-established in the literature that both horizontal (across sectors, ministries, and departments) and vertical (between all levels of government and policy-making) coordination and coherence is required for robust food systems governance that links "food system function and behaviour to the higher order goals or health promotion and environmental sustainability."[171] Given the challenges associated with this endeavour, some of which have been sketched out in this chapter, continual, reflexive efforts along this vein are needed, in an iterative process that accounts for changing circumstances and the urgent need for creative, feasible, and effective solutions to the problems at hand.

Though long-standing critiques of the state of Canadian agri-food law and policy are now being better addressed, there are still distinct gaps left to be filled, especially in terms of developing a robust legal and policy framework within which just, sustainable, and equitable agri-food technologies can emerge. It is not self-evident that more efficient production, spurred on by technological advances, will work to the benefit of all. As will be expanded on in the next two chapters, more nuanced understandings of the role that science and technology and law and policy have to play in contributing to more sustainable food systems, both individually and in tandem, will be a fundamental part of improving the environmental and food security outcomes of the Canadian agri-food sector.

The National Food Policy is certainly an important development, but the degree to which economic considerations remain central is a significant cause for concern. For example, Budget

[171] Rod MacRae & Mark Winfield, "A little regulatory pluralism with your counter-hegemonic advocacy? Blending analytical frames to construct joined-up food policy in Canada" (2016) 3:1 Canadian Food Studies 140 at 141.

2019 explicitly states that the Food Policy for Canada will "set out a coordinated and collaborative approach to addressing food-related issues while ensuring that Canada's agriculture and agri-food sector continues to succeed and help grow the economy as a trusted global source of healthy food."[172] Until the normative connection between economic growth and social/environmental progress in Canada's agri-food sector is broken, a more authentic, inclusive, and sober dialogue about the problems and solutions cannot truly develop. Thus, we need to find a way of turning the spotlight on the structural inequalities that channel power and resources in particular ways, because "the possibility of achieving a more equitable path of development and the social stability that only greater equity can secure requires a successful challenge of the powerful interests that have captured the economic and political agenda."[173]

The current state of agri-food law and policy in Canada presents a unique chance to consciously reframe the parameters of the discourse to reflect a more measured account of the limitations of existing ways of thinking about and governing food, and a collective commitment to grappling with alternatives and the attendant difficulties. As we confront a future involving steady population growth, unprecedented impacts of climate change, and mounting social and economic instability, we would do well to take this opportunity seriously.

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[172] *Budget 2019*, *supra* note 162 at 162.
[173] Winson, *supra* note 38 at 213.

3. The Fallacy of the Technological Fix

In recent years, the ambition of using science and technology to further develop the agri-food sector, whilst making it more sustainable, has galvanized a growing number of stakeholders from both the public and private sectors. At the same time, the apparent commitment to technological palliatives on the part of influential actors has been a source of mounting unease for multiple and differently situated groups.[1] As many have observed, the visibility of technologies does not necessarily translate into effectiveness, and longstanding social and ethical issues frequently remain unresolved in the wake of rapid and/or sweeping technological "revolutions". Thus, the issue to confront is not only that technological solutions seem to be, in and of themselves, insufficient to achieve broader social, ethical, and environmental goals, but also that there might be something about the very nature of technological solutions that obstructs more fundamental change.

Critiques of technology and technoscientific rationality, often rooted in political philosophy, are hardly new. Far from being a rare or radical take, countless authors have penned incisive and prescient accounts of the darker side of science and technology over the years. However, despite concerns raised about the troubling ways in which a wholesale embrace of technological fixes can impinge on society and the environment, the continual expenditure of time, energy, and resources in researching and developing new and emerging technologies has largely proceeded unchecked.

Drawing on insights from STS, I interrogate the dominant discourse around new and emerging technologies in the agri-food sector that frames them as win-win solutions that will simultaneously "save the planet" and "feed the people". The narratives that we weave about

[1] See e.g. ETC Group, online: <http://www.etcgroup.org/>.

technologies, their possibilities, and their limitations play a significant role in how their trajectories play out, including in terms of the legal and policy interventions (or lack thereof) that can serve to cement the courses they take. By turning to wisdom from the past, and using different paradigms, this chapter problematizes the technological tyranny of the present in order to lay the groundwork for an exploration of alternative pathways for the future in later chapters.

It is important to note, however, that technologies are not monolithic, and should not be treated as such. In particular, there is a distinction to be drawn between "high technologies,"[2] which are advanced technologies at the cutting edge, as contrasted with so-called "low technologies", which are simpler and often more traditional.[3] The favouring of high technologies fails to acknowledge the drawbacks associated with many characteristics of high technology, including that it is often large-scale, industrial, centralized, resource-intensive, and carries a relatively high degree of risk. At the same time, the spurning of low technologies, especially in the agri-food sector, represents a missed opportunity to make use of technological innovation in a different way.[4]

In sum, I do not seek to reject high technology outright, but rather, to interrogate "the habitual way of thinking that sees technological fixes as *the* dominant way to solve our most urgent problems."[5] In pointing to some of the fallacies associated with an overreliance on specific kinds of technological fixes for what are often very complex underlying problems, I

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[2] The Cambridge Dictionary defines "high-tech" as "using the most advanced and developed machines and methods": Cambridge Dictionary, "high-tech", online: <https://dictionary.cambridge.org/us/dictionary/english/high-tech>.
[3] The Cambridge Dictionary defines "low-tech" as "not using the most recent equipment or methods": Cambridge Dictionary, "low-tech", online: <https://dictionary.cambridge.org/us/dictionary/english/low-tech>.
[4] See e.g. Hartmut Hirsch-Kreinsen, "'Low-Tech' Innovations" (2008) 15:1 Industry and Innovation 19; Hartmut Hirsch-Kreinsen, "'Low-Technology': A Forgotten Sector in Innovation Policy" (2008) 3:3 J Technol Manag Innov 11; Sandro Mendonça, "Brave old world: Accounting for 'high-tech' knowledge in 'low-tech' industries" (2009) 38 Research Policy 470.
[5] Dane Scott, "The Technological Fix Criticisms and the Agricultural Biotechnology Debate" (2011) 24 J Agric Environ Ethics 207 at 215.

hope to espouse a more critical approach to applying science and technology to realize collective environmental and social goals. The aim is to position science and technology as neither miracle nor menace, but as something in between, with much turning on how law and policy is used to guide scientific and technological research, development, and application.

3.1 Understanding Science, Technology, and Innovation

An ongoing challenge in discussing issues relating to science and technology is defining the terms and the scope of the conversation. As with the concept of "sustainability" introduced in Chapter 2, the terms "science" and "technology" can be understood broadly or narrowly. Broad definitions, while being the most inclusive, run the risk of being so expansive as to be rendered vacuous. Meanwhile, narrow definitions benefit from pithiness, but often come at the cost of oversimplification.

On one hand, choices about what kind of definitions of key terms to deploy are often made very deliberately, as they can serve to delineate the parameters of the debate in a manner favourable to specific sets of interests. On the other, there can be a surprising lack of attention paid to how key terms are being utilized by different actors. Without a common understanding of where conversations about a given problem are starting from, individuals and groups can end up talking past one another instead of talking to one another, which multiplies the difficulty in coming to a consensus about solutions. Consequently, in understanding the roles of science, technology, and innovation in society more generally—and in particular, understanding their allure—it is useful to survey a range of definitions of these terms.

Starting from the most basic, the Oxford English Dictionary defines science as "[t]he intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment",[6] and technology as "[t]he application of scientific knowledge for practical purposes, especially in industry."[7] Based on this interpretation, science is considered to be a formal knowledge-seeking activity conducted and tested through specific methods (namely, the scientific method[8]), with technologies being the practical result of applying the knowledge gained through science. Understood thusly, the relationship between science and technology is such that scientific knowledge, in many ways, informs the boundaries of technological possibility.

Meanwhile, the concept of "innovation" speaks to the sequence in which scientific and technological activities are seen to proceed, ultimately culminating in some measurable contribution or improvement to society (economic or otherwise). Jakob Edler and Jan Fagerberg define innovation as "the introduction of new solutions in response to problems, challenges, or opportunities that arise in the social and/or economic environment."[9] According to this model, technology acts, in part, as an expected bridge between a problem and its solution (or at least one potential solution). As Sergio Sismondo similarly explains, "[w]e can imagine a linear model of innovation, from basic science through applied science to development and production. Technologists identify needs, problems, or opportunities, and creatively combine pieces of knowledge to address them."[10]

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[6] Oxford English Dictionary, "Science", online: <https://en.oxforddictionaries.com/definition/science>.
[7] Oxford English Dictionary, "Technology", online: <https://en.oxforddictionaries.com/definition/technology>.
[8] See Fritjof Capra & Ugo Mattei, *The Ecology of Law: Toward a Legal System in Tune with Nature and Community* (Oakland, CA: Berrett-Koehler Publishers, Inc., 2015) at 23-25: "The scientific method represents a particular way of gaining knowledge about natural and social phenomena that occurs in several stages. First, the phenomena being studied are systematically observed, and the observations are recorded as evidence, or scientific data. … Next, scientists attempt to connect the data in a coherent way, free of internal contradictions. The resulting representation is known as the scientific model. … Finally, the theoretical model is tested by further observations and, if possible, additional experiments. If the model is found to be consistent with the results of these tests, and especially if it is capable of predicting the results of new experiments, it eventually becomes accepted as a scientific theory."
[9] Jakob Edler & Jan Fagerberg, "Innovation policy: what, why, and how" (2017) 33:1 Oxford Review of Economic Policy 2 at 4.
[10] Sergio Sismondo, *An Introduction to Science and Technology Studies*, 2d ed (Malden, MA: John Wiley & Sons, Ltd, 2010) at 8.

David Feige also connects these notions relationally when he writes that, "*science* is the systematic search for new knowledge. *Technology* is the application of that knowledge to the production process. *Innovation* can be distinguished from technology by understanding that technology is only one way to innovate."[11] In other words, it is not the form of innovation that is determinative, but the intent. Edler and Fagerberg extend this point, noting that "innovation is not primarily about generation of new ideas, the traditional focus of science and research policies, but about trying to exploit such ideas in practice in order to enhance competitiveness and respond to problems or challenges that arise."[12] Accordingly, innovation is not merely about spawning ideas for knowledge's sake; rather, it is about applying certain kinds of research to meet desired ends.

Though the above definitions are useful for grounding any further analysis, they are also wanting for the purposes of thinking about how best to govern and regulate technologies and their impacts. Attempting to define science, technology, and the related concept of innovation in purely descriptive or instrumental terms serves to flatten their normative effects, as well as the complex ways in which they interrelate.

For one thing, technology is about more than machines, in the sense that it is not just about software or hardware, but also about knowledge, agency, and power. Indeed, according to Richard Li-Hua, technology is comprised of four interlinked elements: technique, knowledge, the organization of production, and the product itself.[13] He further adds that technology is a "strategic instrument", and "[t]he effective use of technology is perhaps the most important issue

[11] David Feige, "Fundamentals of Innovation Policy for Growth and Development" in Nicholas S Vonortas, Pheobe C Rouge & Anwar Aridi, eds, *Innovation Policy: A Practical Introduction* (New York: Springer, 2015) 5 at 5 [emphasis in original].
[12] Edler & Fagerberg, *supra* note 9 at 16.
[13] Richard Li-Hua, "Definitions of Technology" in Jan Kyrre Berg Olsen, Stig Andur Pedersen & Vincent F Hendricks, eds, *A Companion to the Philosophy of Technology* (Malden, MA: Blackwell Publishing Ltd, 2009) 18 at 19.

faced by both developing and developed countries, and will undoubtedly become even more critical in years to come."[14] Critical socio-legal understandings of technologies and technological systems must be cognizant of the intricate matrices they are embedded within, and the significance of elucidating the functions to which they are being put, by whom, and in the service of whom.

Without descending too deeply down a definitional rabbit hole, I adopt the idea developed by STS scholars that science, technology, and innovation are best understood as contingent processes situated within particular historical, environmental, social, cultural, economic, ethical, and legal contexts. The implications of this starting point are twofold. First, I do not position technoscientific approaches to problem solving to be inherently more legitimate or optimal than those turning on collective or individual behavioural or attitudinal changes, for example. Second, I contend that adopting the false premise of the primacy of technoscientific approaches leads to a favouring of certain kinds of interests and groups, which concomitantly harms others.

This line of reasoning contrasts with the view that "equates knowledge with science and accordingly claims that only science and science-based technology can bring us material and social progress."[15] Accepting, *prima facie*, that science, technology, and social progress are necessarily connected is not only inaccurate, but also can be actively damaging. It is therefore imperative that we are intentional about the ends to which science and technology are being devoted, and the role of law in directing that process. The following sections elaborate on some

[14] *Ibid* at 18.
[15] Hans Radder, "Science and Technology: Positivism and Critique" in Jan Kyrre Berg Olsen, Stig Andur Pedersen & Vincent F Hendricks, eds, *A Companion to the Philosophy of Technology* (Malden, MA: Blackwell Publishing Ltd, 2009) 61 at 61.

insights derived from STS, which will be used to inform a closer analysis of the relationships between science, technology, the environment, justice, and the law in Chapter 4.

3.2 Science and Technology Studies (STS)

In response to a growing awareness of the complexity of the science-technology-society-environment nexus, many notable critiques of science and technology began to emerge in the 1970s and 1980s,[16] eventually coalescing into an identifiable field of study now known as STS. STS is characterized by both its dynamism and its interdisciplinarity, drawing on research from political scientists, sociologists, historians, philosophers, anthropologists, and others to provide "an integrative understanding of the origins, dynamics, and consequences of science and technology."[17] STS therefore encompasses an enormous diversity of perspectives and approaches,[18] although some authoritative and influential threads have remained relatively stable over time.

Moving beyond a rigid, formalistic understanding of science and technology as being neutral and objective fields of study and practice, STS proceeds from an assumption that science and technology are social processes that are constantly being constructed, acted out, and reproduced. In other words, the interactions between science, technology, and society (including society's legal codes, structures, and institutions) are not unidirectional. Rather, science and

[16] Rachel Carson's *Silent Spring* and Thomas Kuhn's *The Structure of Scientific Revolutions*, both published in 1962, are credited by some as marking the beginning of STS: Topi Heikkerö, *Ethics in Technology: A Philosophical Study* (Toronto: Lexington Books, 2012) at 2. See also Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: The MIT Press, 1978) [*Autonomous Technology*]; Albert Borgmann, *Technology and the Character of Contemporary Life: A Philosophical Inquiry* (Chicago: The University of Chicago Press, 1984); Langdon Winner, *The Whale and the Reactor: The Search for Limits in an Age of High Technology* (Chicago: University of Chicago Press, 1988); Frederick Ferré, *Philosophy of Technology* (Athens, GA: The University of Georgia Press, 1995); Neil Postman, *Technopoly: The Surrender of Culture to Technology* (New York: Vintage Books, 1993).
[17] Edward J Hackett et al, "Introduction" in Edward J Hackett, et al, eds, *The Handbook of Science and Technology Studies*, 3d ed (Cambridge, MA: The MIT Press, 2008) 1 at 1.
[18] See e.g. Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2017).

technology are co-produced with society. The idea of co-production can be seen "as a critique of the realist ideology that persistently separates the domains of nature, facts, objectivity, reason and policy from those of culture, values, subjectivity, emotion and politics."[19] Thus, taking a view of technology informed by STS and the notion of co-production helps to articulate the ethical assumptions, social outcomes, and political properties embedded in scientific knowledge, technological artifacts, and how they are governed.

The anti-essentialist position espoused by many STS scholars means that there is no overall consensus on *how* scientific ideas or particular technologies reflect social interests. Indeed, "[a] signal feature of much current STS research is an aversion to universalistic claims about science, knowledge, or STS itself."[20] Nevertheless, there are some core ideas that emerge in the literature, including

> that technological choices can have unequal effects, benefitting some people to the exclusion of others and promoting some values or knowledge systems at the expense of others, and that the consequences of technologies can only be understood by examining how technologies are inextricably intertwined with social and political institutions in what have been called "sociotechnical systems".[21]

Over and above a mere acknowledgment that all knowledge production and application is political, then, STS says something about the implications of this contingency for differently situated groups. As Langdon Winner and others have argued, "the machines, structures, and systems of modern material culture can be accurately judged not only for their contributions of

[19] Sheila Jasanoff, ed, *States of Knowledge: The Co-production of Science and Social Order* (New York: Routledge, 2004) at 3.
[20] Michael Lynch, "Ideas and Perspectives" in Edward J Hackett, et al, eds, *The Handbook of Science and Technology Studies*, 3d ed (Cambridge, MA: The MIT Press, 2008) 9 at 9.
[21] Gwen Ottinger, Javiera Barandiarán & Aya H Kimura, "Environmental Justice: Knowledge, Technology, and Expertise" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2017) 1029 at 1042.

efficiency and productivity, not merely for their positive and negative environmental side effects, but also for the ways in which they can embody specific forms of power and authority."[22]

The thesis that science and technology are a means of channeling power in particular ways—and an examination of the role that state institutions and non-state actors play in this process—establishes groundwork for more critical assessments of science and technology to develop. Macro-level appraisals, as well as more specific micro-level investigations into particular sectors, technologies, and so on are both important to this endeavour. Beyond its critical stance, STS (and scholarship informed by STS) also undertakes a more constructive project of thinking about how science, technology, and society could be reshaped to improve outcomes for people and the planet.

3.2.1 Sub-fields within STS

Various sub-fields within STS have developed since its inception, each of which have contributed new layers of understanding to the ways in which societies and their technosciences are mutually constituted. Many of these offshoots have engaged more directly with social justice outcomes than the original core of STS. For example, feminist branches of STS were among the first to highlight the relationships between gender, inequality, and power that permeate scientific and technological knowledge and practices.[23]

When it comes to science, gender comes into play at several different levels. For one, an androcentric bias can be seen in the processes of a male-dominated research agenda, as the current system emphasizes "disciplinary research over interdisciplinary investigations; reductionist approaches over synthetic ones; natural sciences over social and behavioral sciences;

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[22] Langdon Winner, "Do Artifacts Have Politics?" (1980) 109:1 Daedalus 121 at 121.
[23] See e.g. Lucy Suchman, "Feminist STS and the Sciences of the Artificial" in Edward J Hackett, et al, eds, *The Handbook of Science and Technology Studies*, 3d ed (Cambridge, MA: The MIT Press, 2008) 139-163.

individuality over collaboration."[24] The fact that the dominant approach to modern science is visibly gendered is not surprising because, as feminist scholars have pointed out, the scientific research system that exists today "was designed by and for men, and therefore it is men who have established its operations, priorities, standards, and objectives. Men have overwhelmingly made the decisions that determine which equations are solved and which hypotheses are tested."[25] Since men are often treated as the default or the norm against which everything else is measured, the problem of science's typical male focus is compounded by the fact that there is a significant data gap when it comes to the differential experiences of women.[26] Under the prevailing model, women, and women's concerns, are systematically devalued in the scientific way of thinking, and in the results that science produces.

Additionally, the practice of science itself is profoundly gendered at every level. Science, technology, engineering, and mathematics (STEM) fields have historically been predominantly populated by men. While there are increasing numbers of women in STEM today,[27] there are pervasive and deeply entrenched barriers that continue to block women's progress in these areas.[28] For one, "teaching, research, and practice in most areas of science and technology follow

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[24] Daniel Sarewitz, *Frontiers of Illusion: Science, Technology, and the Politics of Progress* (Philadelphia: Temple University Press, 1996) at 43.
[25] *Ibid* at 46. See also Sandra Harding, *The Science Question in Feminism* (Ithaca: Cornell University Press, 1986).
[26] See generally Caroline Criado Perez, *Invisible Women: Exposing Data Bias in a World Designed for Men* (New York: Abrams Press, 2019) (highlighting how, in settings and circumstances ranging from healthcare to the workplace, city planning, and disaster relief, the data that is used to allocate resources and make decisions does not adequately account for the complexities of gender, which leads to a "one-size-fits-men" approach that perpetuates bias and disadvantages women in numerous ways).
[27] "In 2016, women made up 34% of STEM bachelor's degree holders and 23% of science and technology workers among Canadians ages 25 to 64": Katherine Wall, "Persistence and representation of women in STEM programs", (May 2019) Statistics Canada, Insights on Canadian Society, online: <https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2019001/article/00006-eng.pdf?st=8U3-KYGx> at 1.
[28] See e.g. Catherine Hill, Christianne Corbett & Andresse St. Rose, *Why So Few? Women in Science, Technology, Engineering and Mathematics* (Washington, DC: AAUW, 2010), online: <https://www.aauw.org/aauw_check/pdf_download/show_pdf.php?file=why-so-few-research> (attributing the underrepresentation of women in STEM fields, in part, to unconscious beliefs about gender that begin at the earliest stages of children's education).

essentially male patterns by being basically hierarchical, authoritarian, competitive, and exclusive."[29] These persistent gendered biases and hierarchies in science and technology reflect self-reinforcing influences and practices that continue to create cumulative advantages for men while making it disproportionately difficult for women to enter, stay, and make an impact in science and technology-related fields.[30]

Technology suffers from many of the same deficits as science when it comes to accounting for—or more accurately, failing to account for—gender. Wendy Faulkner has tidily summarized technology's numerous gendered aspects, including that key specialist actors are predominantly men (gender *in* technology), cultural images of technology are strongly associated with hegemonic masculinity, and that technology is an important element in the gender identities of the men who work and play with them (gender *of* technology).[31] The tendency to conceptualize technology primarily "in terms of industrial machinery and cars" clearly reflects a male bias,[32] one which obfuscates the plethora of contributions to technology that have been made by women, particularly in what has typically been construed as the "domestic" or "private" sphere.[33] As one scholar puts it, "[w]hile men tend to be associated with technologies like spacecraft, fast cars and advanced computing, the technologies associated with women are things

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[29] Ursula M Franklin, *The Real World of Technology*, Revised Edition (Toronto: House of Anansi Press Inc, 2004) at 102.
[30] See e.g. Mark Frank Fox, Kjerston Bunker Whittington & Marcela Linková, "Gender, (In)equity, and the Scientific Workforce" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2017) 701-731; Sismondo, *supra* note 10 at 36-46 and 72-80.
[31] Wendy Faulkner, "The Technology Question in Feminism: A View from Feminist Technology Studies" (2001) 24:1 Women's Studs Int'l Forum 79 at 89-90.
[32] Judy Wajcman, *Feminism Confronts Technology* (University Park, PA: The Pennsylvania State University Press, 1991) at 137.
[33] According to Arnold Pacey, "[n]early all women's work … falls within the usual definition of technology. What excludes it from recognition is not only the simplicity of the equipment used, but the fact that it implies a different concept of what technology is about. Construction and the conquest of nature are not glorified, and there is little to notice in the way of technological virtuosity. Instead, technique is applied to the management of natural processes of both growth and decay": Arnold Pacey, *The Culture of Technology* (Cambridge, MA: The MIT Press, 1983) at 104. However, caution must be taken so as not to essentialize all women, or all women's work, as representing this idealized conception of the relationship between technology and gender.

like kitchen tools",[34] which often are not attributed the same kind of legitimacy or value. This does not reflect some *a priori* demarcation, but instead, represents a symbolic link between gender conventions and assumptions about technologies.

Meanwhile, postcolonial STS "focuses on colonialisms, their aftermaths, and how these are co-produced with a diversity of technoscience projects".[35] Like feminist STS, postcolonial STS observes that science is not neutral, and that alternative ways of knowing should be recognized and better valued. However, in so doing, it pays primary attention to the legacies of colonialism and imperialism, and for good reason: science and technology formed a central component of the production of the settler colonial state.[36] Throughout the process of making and unmaking statehood in Canada and other settler colonial nations, science and technology played a crucial role in perpetuating the violence of Othering.[37]

The very notion of "modernity" turns on exploitation in that it "requires and in turn supports civilizational hierarchies of bodies and their knowledges with [I]ndigenous peoples being viewed as primitive, albeit sometimes the noble savage".[38] Postcolonial STS brings this reality to the foreground, as well as its historical erasure. Recently, a more forward-looking thread of Indigenous STS has also emerged, which is "committed to building and supporting

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[34] Elisabeth K Kelan, "The Politics of Gender and Technology" in Jan Kyrre Berg Olsen, Stig Andur Pedersen & Vincent F Hendricks, eds, *A Companion to the Philosophy of Technology* (Malden, MA: Blackwell Publishing Ltd, 2009) 338 at 338.
[35] Banu Subramaniam et al, "Feminism, Postcolonialism, Technoscience" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 407 at 409. See also Sandra Harding, *Is Science Multicultural? Postcolonialisms, Feminisms, and Epistemologies* (Bloomington, IN: Indiana University Press, 1998); Sandra Harding, *Sciences from Below: Feminisms, Postcolonialities, and Modernities* (Durham, NC: Duke University Press, 2008); Sandra Harding, ed, *The Postcolonial Science and Technology Studies Reader* (Durham, NC: Duke University Press, 2011).
[36] Subramaniam et al, *ibid* at 410.
[37] For example, Harriet Washington's book *Medical Apartheid* presents a detailed account of the racist origins of medical technologies in the US: Harriet A Washington, *Medical Apartheid: The Dark History of Medical Experimentation on Black Americans from Colonial Times to the Present* (New York: Harlem Moon, 2006).
[38] Subramaniam et al, *supra* note 35 at 419.

techno-scientific projects and ways of thinking that promote Indigenous self-determination."[39] Endeavouring to think about how renewed understandings and applications of science and technology might support the flourishing of Indigenous peoples—or at the very least, not actively disadvantage them—is but one component of the broader project of reconciliation,[40] both in Canada and beyond.

Although the development of various sub-fields within STS has been helpful in articulating the concerns of differently situated groups, this fractioning also comes with drawbacks. Namely, in focusing attention primarily on one specific ground of oppression, the risk is that the impacts of intersectionality may go under-considered or unacknowledged. As contemporary STS scholars have pointed out, "a singular focus on gender, race, coloniality or [I]ndigeneity alone leaves numerous gaps in our understanding of the co-constitution of science and society."[41] Accordingly, it is no longer enough to consign them to the peripheries: "questions of gender, race, coloniality, and [I]ndigeneity are not optional variables or analytics that each field can choose whether to consider."[42] Even while acknowledging the significance of considering each of these variables independently, we need to remain cognizant of and alert to the ways in which multiple oppressions operate intersectionally and in different ways, depending on the type of technologies and interests that are involved or at stake.

Further, relegating these contributions to separate silos of "feminist STS", "postcolonial STS", or "Indigenous STS", rather than integrating them within the broader body of STS as a

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[39] Indigenous Science, Technology, and Society, online: <http://indigenoussts.com/>. Indigenous Science, Technology, and Society is a research and teaching hub based out of the University of Alberta that is devoted to developing the sub-field of Indigenous STS.
[40] Truth and Reconciliation Commission of Canada, *Honouring the Truth, Reconciling for the Future: Summary of the Final Report of the Truth and Reconciliation Commission of Canada* (Winnipeg: Truth and Reconciliation Commission of Canada, 2015).
[41] Subramaniam et al, *supra* note 35 at 407.
[42] *Ibid* at 422.

whole, comes with its own downsides. Despite the range of perspectives that have emerged in STS scholarship over the years, the voices that have been the loudest or most influential do not necessarily represent this plurality. It is relatively easy to conclude from a cursory scan of the relevant literature that many of the most prominent ideas have been established by, or are attributed to men. An edited volume, titled *Philosophy, Technology, and the Environment*,[43] published as recently as 2017, exemplifies this conspicuous disparity. Of the 18 contributors, all of whom boast an impressive list of qualifications, only one is a woman (and indeed, she is a co-author of a chapter as opposed to a sole contributor). The concerns and perspectives of women, racialized persons, and Indigenous people are not niche, and should not be treated as such if the default mode of thinking and acting in our society is to shift away from a white male norm. Given the historic underrepresentation of peoples who have been marginalized, ensuring that their voices are included in mainstream conversations, moving forward, will take concerted effort.

That being said, the undertaking is an important one. Feminist and other critical perspectives that are attentive to intersecting oppressions are integral to a fulsome understanding of the limitations of current approaches to thinking about science and technology, as well as their impacts and how these are regulated. Limiting the kinds of questions we ask and the lenses through which we ask them puts us in a position of myopia that can cause us to lose out on potentially transformative insights. At the same time, continuous attention needs to be paid to the long-standing and enduring barriers to participation in science and technology faced by marginalized groups, whether this takes the form of overt discrimination or otherwise.[44]

[43] David M Kaplan, ed, *Philosophy, Technology, and the Environment* (Cambridge, MA: The MIT Press, 2017).
[44] David J Hess et al, "Structural Inequality and the Politics of Science and Technology" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 319-347.

Structural inequality (i.e. inequalities of opportunity) and substantive inequality (i.e. inequalities of outcome) are closely connected, and one cannot be effectively addressed without the other.

3.2.2 Technoscience and Ideology

Construing science and technology as an amalgam helps to sharpen the connection between one's position and one's perspective. According to some, the boundary between scientific and technological activity has become progressively more blurred, such that "[i]t is more appropriate to regard science and technology as one enterprise with a spectrum of interconnected activity than to think of two fields of endeavour – science as one, and applied science and technology as the other."[45] Science and technology can be understood as being "mutually interacting disciplines, or as two components of a single discipline; reliance on science for solving technical problems; the application of technological knowledge to solving scientific problems".[46] The term "technoscience" reflects the interactive relationship between the two, whereby they are engaged in a specific kind of entanglement.

A technoscientific approach to problem solving tends to fixate on the promissory potentials of science and technology, without a critical appreciation of the specific epistemic assumptions, value systems, and power structures that are often being imported in turn. In part, this is due to the political and economic dimensions that come together when the processes of science and technology are alchemized in a particular way. Jutta Weber defines "technoscience" as marking "the merging of science, technology, industry, and the military, as well as the intensified amalgamation of science and technology, of society fusing with the technological, and of a new efficiency in industrial technologies which refigures the organic in a new and most

[45] Franklin, *supra* note 29 at 30.
[46] Oxford English Dictionary, "Technoscience", online: <https://en.oxforddictionaries.com/definition/technoscience>.

efficient way."[47] This hybridization having been established, it is easier "to acknowledge that science and technology, deeply intermeshed in culture, are central sites for the production of ideology."[48] The ideologies that we adopt regarding technologies consequently influence their adoption and consumption at the individual and societal levels.[49]

The ways in which science and technology are deployed can have demonstrable, symbiotic impacts on a country's geopolitics, economy, and environment. For example, the military-industrial complex,[50] which flourished in the US in the post-Cold War era, served to institutionalize continual innovation in the defense economy.[51] This mutual dependence between a nation's industrial base and its military structure was made possible, in part, by a new procurement paradigm that involved strategic public sector investment in research and development.[52] As economist Ann Markusen has argued, increasing state support for research and development in certain industries not only favoured certain kinds of technologies, but also stoked the emergence and expansion of new industrial spaces.[53] The growth of these spaces then impelled further investment into military and defence technologies, creating a positive feedback loop between specific kinds of technologies and the infrastructures that support them. Economic incentive structures, physical and informational infrastructures, and spatial dynamics are part and parcel of modern scientific and technological regimes.

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[47] Jutta Weber, "From Science and Technology to Feminist Technoscience" in Kathy Davis, Mary Evans & Judith Lorber, eds, *Handbook of Gender and Women's Studies* (London: SAGE, 2006) 397 at 407.
[48] *Ibid*.
[49] Robert V Kozinets, "Technology/Ideology: How Ideological Fields Influence Consumers' Technology Narratives" (2008) 34:3 Journal of Consumer Research 865.
[50] For a discussion of the origins of the military-industrial complex, see Bruce Brunton, "An Historical Perspective on the Future of the Military-Industrial Complex" (1991) 28:1 The Social Science Journal 45 at 46-48.
[51] A Markusen, "The Military-Industrial Divide" (1991) 9 Environment and Planning D: Society and Space 391 at 396.
[52] See generally Katherine C Epstein, *Torpedo: Inventing the Military-Industrial Complex in the United States and Great Britain* (Cambridge, MA: Harvard University Press, 2014).
[53] Markusen, *supra* note 51.

Thus, in contrast with the straightforward understanding of technology as the application of scientific knowledge to material problems and processes, technology is better seen as a system that "entails far more than its individual material components. Technology involves organization, procedures, symbols, new words, equations, and, most of all, a mindset."[54] In other words, technologies operate at two different levels: the instrumental and the imaginary.

At the instrumental level, technologies generate material impacts, including in social, economic, cultural, ethical, and environmental domains. These impacts are mediated by law and politics in both obvious and non-obvious ways. At the imaginary level, technologies enter "the public sphere in a cloud of hope, imagination, and anticipation",[55] and are "saturated with expectations, promises, and prospective claims."[56] It is at this level that the ideology underlying technoscientific approaches to problem solving is most apparent and most problematic, in that it relies on a set of values that privileges a particular worldview (i.e. white, (neo)liberal, masculine, reductive)[57] and, under a guise of neutrality, obscures its oppressive and contradictory structures.[58]

This understanding of science and technology as ideology can also be extended to popular framings of innovation. Superficial definitions of innovation as little more than new methods or ideas glosses over the ideological assumptions that can be retrenched, intentionally or otherwise, at the policy level. As Johan Schot and W Edward Steinmueller put it, "[s]cience,

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[54] Franklin, *supra* note 29 at 2-3.
[55] *Ibid* at 101.
[56] Kornelia Konrad et al, "Performing and Governing the Future in Science and Technology" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 465 at 465.
[57] See e.g. Faulkner, *supra* note 31; Wajcman, *supra* note 32; Carolyn Merchant, *The Death of Nature: Women, Ecology and the Scientific Revolution* (Toronto: Harper & Row, 1983).
[58] See generally Andrew Feenberg, *Questioning Technology* (New York: Routledge, 1999). For an exploration of the relationship between ideology and law, see Christine Sypnowich, "Law and Ideology" in Edward N Zalta, ed, *The Stanford Encyclopedia of Philosophy* (Summer 2019 Edition), online: <https://plato.stanford.edu/archives/sum2019/entries/law-ideology/>.

technology and innovation policies are based on the assumption that innovation is a force for creating a better world."[59] Going further, Helga Nowotny, Peter Scott and Michael Gibbons write that "[i]nnovation has acquired an urgent, even quasi-moral, stridency … it is viewed as the crucial process for propelling a country, an industry, a company, a laboratory, a research field, a university or a national science system from its present state into the future."[60] As elaborated on in Chapter 2, the rhetoric surrounding innovation in the Canadian agri-food sector frequently proceeds in this tenor, illustrating both the force and the embeddedness of this narrative.

The concern is that prevailing attitudes towards science, technology, and innovation can amount to a kind of tunnel vision that "extends far beyond those who have had specialized training; it also affects policy-making, and influences popular expectations."[61] The unalloyed conviction that scientific and technological development is, more often than not, a public good, is further undergirded by a subsidiary set of beliefs, including that scale is correlated to significance, with bigger ultimately being better. Moreover, "in the current age, in order for a technology to be considered as an innovation it ultimately needs to generate commercial value."[62]

Yet, when anchored to explicitly social, environmental, and ethical goals, as opposed to purely economic ones, innovation in the agri-food sector can take the form of not only large-scale technological developments like precision genetic modification, but also in the form of small-scale interventions like farm-level breeding practices. Considered in this way, a humble household can opener is as novel and important a technology as the machinery necessary to

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[59] Johan Schot & W Edward Steinmueller, "Three frames for innovation policy: R&D, systems of innovation and transformative change" (2018) 47 Research Policy 1554 at 1561.
[60] Helga Nowotny, Peter Scott & Michael Gibbons, *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty* (Malden, MA: Blackwell Publishers Inc, 2001) at 67.
[61] Pacey, *supra* note 33 at 10.
[62] Lucien von Schomberg & Vincent Blok, "Technology in the Age of Innovation: Responsible Innovation as a New Subdomain Within the Philosophy of Technology" (2019) Philosophy & Technology 1 at 7.

manufacture a can. Broadening our conceptions of what constitutes technology, and what innovation looks like, will be an important part of expanding our approaches to problem solving beyond technological solutionism alone.

3.3 Technological Solutionism and its Shortfalls

Adopting a coherent approach to coping with the problems we face is a core part of making sense of the world. As the world has changed, so too have our collective strategies for managing new and ongoing threats. Legal scholars David Grant and Lyria Bennett Moses contend that technology is central to the next phase (after theological/deity, political/state, and economic/market solutions) in the Western world's efforts to assuage its existential concerns.[63] Despite the failure of each prior myth to "deliver on the claim to deal with our existential concerns[,] … our disposition to mythologise continues in the form of the imagining of a new myth."[64]

There is a strong case to be made that the role of technology has taken on myth-like status. The media—which is presumably something of a touchstone for the major issues facing society—has frequently invoked technology as a cure-all, while simultaneously dismissing the reservations expressed by some environmentalists, for example, as little more than regressive technophobia. The author of a 2003 article in *The Atlantic*, provocatively titled "Will Frankenfood Save the Planet?" concludes, in no uncertain terms, that "[b]iotechnology will transform agriculture, and in doing so will transform American environmentalism."[65] As evidenced by a much more recent headline proclaiming that "The Vegan Meat Revolution Could

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[63] David Grant & Lyria Bennett Moses, *Technology and the Trajectory of Myth* (Northampton, MA: Edward Elgar Publishing, Inc., 2017) at 22.
[64] *Ibid* at 23.
[65] Jonathan Rauch, "Will Frankenfood Save the Planet?", *The Atlantic* (October 2003), online: <https://www.theatlantic.com/magazine/archive/2003/10/will-frankenfood-save-the-planet/302806/>.

Help Save the Planet",[66] the theme of technological "revolutions" in the agri-food sector "saving the planet" is alive and well.

The tone of such headlines, which extoll the emancipatory potentials of many technologies, chimes closely with the concept of the "technological fix", which can be defined as "the use of technology to respond to certain types of human social problems that are more traditionally addressed via political, legal, organizational, or other social processes."[67] For some, the value and appeal of technological fixes are self-evident. Technologies have unquestionably brought about significant and measurable improvements for large swaths of humankind, and given immediate concerns about planetary boundaries, climate change, and runaway demand, scientific and technological innovations undoubtedly have a role to play in any vision of a sustainable food future, especially if they can act as a bridge between the status quo and more transformational paradigm shifts in the future.

That being said, appropriate cautions are warranted before rushing to adopt technological palliatives and a technocratic approach to addressing vexing social and environmental problems. Accurately grasping the nature of the underlying problems is important, because "[t]echnologies are most useful for solving specific, well-defined, and stationary problems … In contrast, social problems … are broad, ill-defined, and constantly evolving."[68] When technological solutions are

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[66] Malte Rödl, "The Vegan Meat Revolution Could Help Save the Planet – and Fast-Food Chains are Finally Taking Notice", *The Independent* (28 June 2019), online: <https://www.independent.co.uk/life-style/food-and-drink/vegan-impossible-burger-food-waste-environment-animal-rights-climate-change-fast-food-a8968656.html>. There are numerous other examples of similar headlines that have appeared over the years, e.g. Grant Burningham, "Lab-Grown Beef Will Save the Planet—and Be a Billion-Dollar Business", *Newsweek* (28 February 2016), online: <https://www.newsweek.com/lab-grown-beef-will-save-planet-and-be-billion-dollar-business-430980>.
[67] Byron P Newberry, "Technological Fix" in Carl Mitcham, ed, *Encyclopedia of Science, Technology, and Ethics*, Vol. 4 (Detroit, MI: Macmillan Reference USA, 2005) 1901 at 1902. See also Alvin M Weinberg, "Can Technology Replace Social Engineering?" (1966) 22:10 Bulletin of the Atomic Scientists 4.
[68] Newberry, *ibid* at 1902.

mismatched with the social problems they attempt to target, as they so often are, their effectiveness is fundamentally limited.

Moreover, even as technological fixes can and do address some problems, they also can and often do generate others, with much turning on how the issue is framed. Dane Scott explains that "[i]f a problem is narrowly framed as an engineering puzzle, then a technological fix can be said to solve *that* problem. However, from the perspective of the long-term environmental problems, it would be much harder to judge these fixes as successes … [W]hen one takes a wider and longer view, technological fixes generally delay, relocate, or create new problems."[69]

History is marked with numerous examples of scientific and technological developments that were accompanied by a host of ancillary costs,[70] many of which were underconsidered or undervalued at the outset. The checkered past of industrial agriculture alone reveals that the application of science and technology to the domain of food and agriculture is by no means uncontentious, with continuing debates about the relative costs and benefits of genetically modified organisms (GMOs) being highly illustrative.[71]

The technological fix approach can be seen as part of a broader ethos of technological solutionism. Drawing on the work of design theorist Michael Dobbins, Evgeny Morozov explains that technological solutionism "presumes rather than investigates the problems that it is trying to solve".[72] Technological solutionism legitimizes and sanctions the will to recast "all complex social situations either as neatly defined problems with definite, computable solutions

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[69] Scott, *supra* note 5 at 216.
[70] Edward Tenner, *Why Things Bite Back: Technology and the Revenge of Unintended Consequences* (New York: Alfred A Knopf, Inc, 1996).
[71] See generally Vandana Shiva, *Stolen Harvest: The Hijacking of the Global Food Supply* (Cambridge: South End Press, 2000); Danny Hakim, "Doubts About the Promised Bounty of Genetically Modified Crops", *The New York Times* (29 October 2016), online: <http://www.nytimes.com/2016/10/30/business/gmo-promise-falls-short.html?_r=0>.
[72] Evgeny Morozov, *To Save Everything, Click Here: The Folly of Technological Solutionism* (New York: PublicAffairs, 2013) at 6.

or as transparent and self-evident processes that can easily be optimized".[73] The problems raised by such an approach should be readily apparent from a methodological perspective alone, insofar as it begins from the solution and works backward to the problem, and can therefore be seen as a case of the tail wagging the dog.

Solutionism has other implications for governance as well. For one, "the quick fixes [solutionism] peddles do not exist in a political vacuum. In promising almost immediate and much cheaper results, they can easily undermine support for more ambitious, more intellectually stimulating, but also more demanding reform projects."[74] A narrow focus on technological solutions both shuts down other avenues of possibility, including those that are potentially more realistic—or alternatively, more challenging—and greases a groove that further reinforces a singular mode of action.

Relatedly, solutionism is profoundly problematic from a democratic perspective, because in believing that "technology will replace politics, for it will sidestep questions of distribution and allocation and replace them with questions of production and application", the goals and ends to which new knowledge and its applications are devoted are less and less explicitly articulated or decided on by way of consensus.[75] To the contrary, within the current milieu, there is very little public, collective discussion about the objectives of innovation and the form such innovation takes. Instead, those who have the power to set the agenda *de facto* have the ability (though not necessarily unfettered) to impose their preferences and priorities on those who do not. Faith in progress via technology becomes "a substitute for questions, a type of consent in advance for objectives and consequences that remain unknown and unmentioned."[76] This

[73] *Ibid* at 5.
[74] *Ibid* at 9.
[75] *Ibid* at 131-132.
[76] Ulrich Beck, *Risk Society: Towards a New Modernity* (London: SAGE, 1992) at 214.

approach not only presumes that citizens are incapable of understanding or weighing in on topics relating to technology and innovation, but can have the effect of persuading them of the very same. Such a model flies in the face of what true democracy and informed consent demand.

Technological solutions can also reflect cognitive biases like the sunk cost fallacy, whereby an endeavour is continued on the basis of previously invested resources, as opposed to because it remains the best choice.[77] In a similar vein, technological solutions can lead to reverse adaptation, which is defined as "the adjustment of human ends to match the character of the available means", or more significantly, "the state of affairs in which people come to accept the norms and standards of technical processes as central to their lives as a whole."[78] As Winner contends, with the ascendance of technology, "[e]fficiency, speed, precise measurement, rationality, productivity, and technical improvement become ends in themselves applied obsessively to areas of life in which they would previously have been rejected as inappropriate."[79] Technology facilitates, whether consciously or unconsciously, increasing concealment, abstraction, and separation. The effects of these kinds of biases include generating inefficiencies (somewhat counterintuitively), perverting intentions, and propping up the status quo. It is therefore crucial that social institutions do not "lose the ability to consider their fundamental commitments" by becoming "locked into an attachment to instruments and instrumentalities".[80]

Technology, in and of itself, should not be given primacy in problem solving unless there is a valid reason to do so, and it certainly should not be the presumed solution around which all

[77] Hal R Arkes & Catherine Blumer, "The psychology of sunk cost" (1985) 35:1 Organizational Behavior and Human Decision Processes 124.
[78] Winner, *Autonomous Technology*, *supra* note 16 at 229.
[79] *Ibid*.
[80] *Ibid* at 233.

other considerations are pivoted. Troublingly, once a technology is adopted, a reaction can be set into motion that makes it increasingly difficult to switch gears later on down the line. The idea of a "technological imperative" refers to a chaining of technologies, whereby the "introduction of one technology easily entails imperatives for introducing others, both through new needs and through new possibilities. The introduction of electrical lighting, for instance, creates the need for power supply; and the power creates a possibility of introducing air conditioning."[81] Likewise, "path dependence" occurs when "early events shape later outcomes through creating or removing alternatives … or altering the costs and benefits of later alternatives".[82] Ultimately, technological systems can generate a process of "lock-in". Pamela Mason and Tim Lang note that

> lock-in happens when forces supporting the status-quo are stronger than those pushing for change. Lock-ins can take many forms: technological (for example, consumers lack equipment for home cooking) or political (for example, they are relatively powerless) or cultural (for example, consumer understanding is shaped by marketing) or economic (for example, cheap prices entice them) or ideological (for example, they cannot conceive of eating a simpler diet, let alone of why they should).[83]

In the context of industrial agri-food systems in particular, much of their power can be ascribed to "technological momentum and deeply entrenched structures and processes that reinforce one another, thereby locking human societies into productivist methods."[84] Put differently, industrial agriculture and industrial food systems are symbiotic, and "have shaped and been shaped by each other."[85] More specifically, the International Panel of Experts on

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[81] Heikkerö, *supra* note 16 at 170, fn 82.
[82] Henrich R Greve & Marc-David L Seidel, "The thin red line between success and failure: path dependence in the diffusion of innovative production technologies" (2015) 36 Strategic Management Journal 475 at 476.
[83] Pamela Mason & Tim Lang, *Sustainable Diets: How Ecological Nutrition Can Transform Consumption and the Food System* (New York: Earthscan, 2017) at 275.
[84] Alastair Iles et al, "Agriculture Systems: Co-producing Knowledge and Food" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 943 at 965.
[85] IPES-Food, *From Uniformity to Diversity: A Paradigm Shift from Industrial Agriculture to Diversified Agroecological Systems* (Brussels: International Panel of Experts on Sustainable Food Systems, 2016), online: <http://www.ipes-food.org/_img/upload/files/UniformityToDiversity_FULL.pdf> at 6.

Sustainable Food Systems (IPES-Food) has identified at least eight "lock-ins" that sustain industrialized models of agriculture relating to the political structures governing food systems, the economic organization of agricultural markets, and conceptual barriers to how questions and issues are framed: (1) path dependency; (2) export orientation; (3) the expectation of cheap food; (4) compartmentalized thinking; (5) short-term thinking; (6) 'feed the world' narratives; (7) measures of success, and; (8) concentration of power.[86] Though this list is not exhaustive, it highlights the key cyclical mechanisms locking industrial agriculture in place and that "will need to be broken if a transition towards diversified, agro-ecological systems is to be achieved."[87]

The cracks that are forming with alacrity in the current system presents a series of openings to break out of these powerful feedback loops. However, to do so, we must grapple with different ways of thinking and doing that are premised on more authentic evaluations of technologies, their limitations, and their consequences.

3.4 The Logic of Technology and Technological Determinism

Within current Western epistemological, legal, political, and economic paradigms, there is often a culturally specific logic underlying the ways in which technologies unfold. There are several identifiable features of scientific and technological development and change, including its opposition to nature and the limitations of natural systems, its optimism and self-augmentation,[88] and its hyper-focus on efficiency and rationality, whereby "[e]very intervention of technique is, in effect, a reduction of facts, forces, phenomena, means, and instruments to the schema of logic."[89] Rather than allowing for the consideration of other kinds of solutions, the logic of

[86] *Ibid* at 43-58.
[87] *Ibid* at 45.
[88] "Modern men [*sic*] are so enthusiastic about technique, so assured of its superiority, so immersed in the technical milieu, that without exception, they are oriented toward technical progress": Jacques Ellul, *The Technological Society*, trans. John Wilkenson (New York: Knopf, 1964) at 85.
[89] *Ibid* at 79.

technology maintains that improved techniques will eventually transcend all previous complications.

In many ways, the distinctive relationship between conventional legal liberalism, the drive for profit and power within capitalist economist systems, and Western views of science and technology has contributed to a specific worldview that has led to the current state of environmental and social crisis. Fritjof Capra and Ugo Mattei explain the link thusly: "Through science, humans could understand nature; through technology, we could transform it; and through the legal institutions of property and sovereignty, nature's essence could be transformed into a commodity, a physical object that humans could exploit or "improve.""[90] It is within this context that we can understand the "logic of technology" as "a framework that tells us how technology is structured and operates in the world."[91]

This logic not only shapes our expectations of science and technology, but also favours particular approaches to problem solving that may be counterproductive in their disembodied focus on technologies and resultant failure to sufficiently account for social and behavioural factors. For example, the "rebound effect", whereby making a process more efficient can paradoxically lead to increased consumption, can serve to offset any environmentally beneficial effects of a new technology.[92] In the context of food, the industrialization of meat production made meat cheaper, which then increased demand, which justified increasing industrialization in

[90] Capra & Mattei, *supra* note 8 at 7.
[91] W Brian Arthur, *The Nature of Technology: What It Is and How It Evolves* (Toronto: Free Press, 2009) at 87.
[92] See e.g. Mathias Binswanger, "Technological progress and sustainable development: what about the rebound effect?" (2001) 36:1 Ecological Economics 119; Edgar G Hertwich, "Consumption and the Rebound Effect: An Industrial Ecology Perspective" (2005) 9:1-2 Journal of Industrial Ecology 85; Horace Herring & Robin Roy, "Technological innovation, energy efficient design and the rebound effect" (2007) 27:4 Technovation 194. This idea is also referred to as the Jevons paradox; see e.g. John M Polimeni & Raluca Iorgulescu Polimeni, "Jevons' Paradox and the myth of technological liberation" (2006) 3:4 Ecological Complexity 344.

turn.[93] However, technologies that make existing processes more efficient are not the only ones that can fall victim this phenomenon. New technologies can create the same kind of effects when supply works to create its own demand, as evidenced by the explosive growth in the consumer electronic sector in recent years. Even as the manufacturing, use, and disposal of many technologies has significantly contributed to environmental degradation and decline through overharvesting of so-called "natural resources", the generation of emissions, and the release of toxic compounds,[94] new technologies—like more "energy-friendly" models of earlier applications—continue to be presented as apposite solutions to messy problems that previous technologies have wrought.

The logic of technology is not to be confused with the concept of technological determinism. At its most simplistic, the notion of technological determinism contends that "technological artifacts, knowledge, and systems have complete laws of development, which give little room for human freedom, and that technological development greatly steers other social and cultural development."[95] The concept of "autonomous technology" is another way of

[93] See e.g. William Boyd, "Making Meat: Science, Technology, and American Poultry Production" (2001) 42:4 Technology and Culture 631.

[94] See e.g. Edward L Golding, *A History of Technology and Environment: From stone tools to ecological crisis* (New York: Routledge, 2017).

[95] Heikkerö, *supra* note 16 at 152. The concept of technological determinism has several variations. Some scholars make a distinction between "soft determinism" and "hard determinism", with one definition of "soft determinism" holding that: "technologies may be seen as embedded in a particular 'technological frame' which serves to guide (configure) future actions and relationships with those technologies, their users, and their subjects." Arthur Cockfield & Jason Pridmore, "A Synthetic Theory of Law and Technology" (2007) 8:2 Minn JL Sci & Tech 475 at 492. Sally Wyatt goes further with her taxonomy, outlining four different types of technological determinism: justificatory, descriptive, methodological, and normative: "Technological Determinism is Dead; Long Live Technological Determinism" in Edward J Hackett, et al, eds, *The Handbook of Science and Technology Studies*, 3d ed (Cambridge, MA: The MIT Press, 2008) 165 at 167, 174-175. For some of the dominant strands of thought with respect to technological determinism, see generally Merritt Roe Smith & Leo Marx, eds, *Does Technology Drive History?: The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

expressing the idea that technology has "a life of its own" that develops independently of human intentions and plans.[96]

Though the concept of technological determinism has been greatly problematized, including for its lack of attention to human agency,[97] traces of it are still discernible in the public and the policy discourse. The imprints of technological determinism are especially visible "in the justifications of actors who are keen to promote a particular direction of change, … as a heuristic for organizing accounts of technological change, and … as part of a broader public discourse which seeks to render technology opaque and beyond political intervention and control."[98]

In other words, technological determinism "serve[s] a political purpose. When people think that the development of technology follows a smooth path of advance predetermined by the logic of science and technique, they are more willing to accept the advice of 'experts' and less likely to expect public participation in decisions about technology policy."[99] This is perhaps especially the case with high-technology industries like energy that laypeople are less likely to understand or feel qualified to question. However, as STS scholarship has shown, a unilateral understanding of the relationship between technology and society is seriously incomplete. Emphasizing the co-production of technology and society and the contingency of technological trajectories is vital to improving democratic debate and decision-making about the difficult problems we face.

Another major flaw in the idea of technological determinism is the way in which it equates technological progress with social progress, thereby imputing a specific kind of

[96] Wha-Chul Son, "Autonomous Technology" in Carl Mitcham, ed, *Encyclopedia of Science, Technology, and Ethics*, Vol. 1 (Detroit, MI: Macmillan Reference USA, 2005) 152 at 152. Son notes that "[t]he clear ethical connotation of autonomous technology marks its difference from the notion of technological determinism, with which it is often associated." See also Winner, *Autonomous Technology, supra* note 16.
[97] See e.g. Wyatt, *supra* note 95.
[98] *Ibid* at 175-176.
[99] Pacey, *supra* note 33 at 26.

directionality. As Ernest Braun put it, "[i]t is widely believed that technological progress leads to economic growth and that economic growth causes social progress. Thus technological progress is regarded as the cause of, and condition for, social progress."[100] The pervasive conflation of innovation with the "myth of progress"[101] has profoundly influenced the preconditions for scientific and technological development, as well as the shape such development takes. Reliance on technological solutions is therefore a symptom of a much deeper underlying problem that is then expressed through various channels, including through the law.

Technological determinism must also be rejected on the ground that, in denying the full scope of human intervention in technological trajectories, it "absolves us from responsibility for the technologies we make and use."[102] Technologies are not only potential tools of domination and control, but can also act as potent reminders of our ethical and reciprocal responsibilities to one another, to all living and non-living things, and to the Earth as a whole. These responsibilities can find expression through law and policy. However, as Frank Pasquale observes, "any hope of an egalitarian program depends on some coherent and durable store of human values capable of guiding our regulation of technology."[103] Accordingly, contemplation of ethical questions of what kind of world we want to inhabit, and what kind of relationships such a world demands, must be a fundamental part of our thinking about and regulating technologies.

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[100] Ernest Braun, "Can technological innovation lead us to utopia?" (1994) 26:8 Futures 852 at 852.
[101] John Michael Greer summarizes the myth of progress as encompassing "the belief that all human history is a linear trajectory that has risen up from the squalor and misery of the prehistoric past through ever-ascending stages of increased knowledge, prosperity, enlightenment, and technological sophistication, and will inevitably continue to do so into a limitless future": John Michael Greer, *Not the Future We Ordered: Peak Oil, Psychology, and the Myth of Progress* (London: Karnac, 2013) at 30.
[102] Wyatt, *supra* note 95 at 169.
[103] Frank Pasquale, "Technology, Competition, and Values" (2007) 8:2 Minn JL Sci & Tech 607 at 618.

3.5 Thinking Ethically about Technology

Ethics, which Patrick Curry defines as "the question of how one should best live and act",[104] has been a subject of scholarly inquiry for centuries, and philosophers and political scientists have often pointed to the importance of ethics and values in influencing behaviour. For example, how society views and values the environment significantly shapes the "design, purpose, and extent of the laws and the entire governance response"[105] associated with it. In addition to their import when it comes to the environment, ethics are also highly relevant when it comes to designing, using, and governing science and technology.

Technological artifacts themselves "structure the world and the human being-in-the-world in such ways that it is impossible to consider them morally neutral means."[106] However, ethical questions and concerns are dispersed beyond technological artifacts alone. Every stage in the process of researching, developing, and regulating technologies reflects certain kinds of individual and societal values, and there is a growing recognition that engineers make moral choices in picking solutions to design problems.[107]

Unfortunately, importing ethical considerations into formal decision-making about science and technology has proven difficult. This disinclination is attributable to a confluence of factors that have resulted in "technoscientific rationality becoming the measure of reason. Ethics as a normative discourse on human affairs appears unscientific, unmeaningful, and without a proper foundation when measured by scientific criteria."[108] Indeed, the technological imperative has become conflated with moral imperatives to such an extent that "all too frequently what is

[104] Patrick Curry, *Ecological Ethics*, 2d ed (Malden, MA: Polity Press, 2011) at 1.
[105] Louis J Kotzé, *Global Environmental Governance: Law and Regulation for the 21st Century* (Cheltenham: Edward Elgar, 2012) at 293.
[106] Heikkerö, *supra* note 16 at 204.
[107] See e.g. Wade L Robinson, *Ethics within Engineering: An Introduction* (New York: Bloomsbury, 2017).
[108] Heikkerö, *supra* note 16 at 201.

efficient is seen as the right thing to do. Conversely, when something is perceived to be wrong, it tends to be critiqued in practical terms as being inefficient or counterproductive (a significant term in its own right)."[109]

Further, a technocentric worldview not only elevates the importance of machinery, but it simultaneously devalues the ethical or spiritual principles that challenge it.[110] As such, in order to question and challenge technological practices on a more principled basis, the minimum task for an ethics of technology is "to reveal where ethical questions have been ignored, suppressed, or covered over by technical questions."[111]

Over the years, various attempts have been made to devise methods for thinking ethically about technology. In the US, the Ethical, Legal, and Social Implications (ELSI) Research Program founded in 1990 as part of the Human Genome Project was one of the first efforts to institutionalize such considerations as part of a major research endeavour.[112] By its very nature, genetic and genomic research is a prime candidate for ethical scrutiny, and similar programs have been instituted in other countries, including Canada.[113] Beyond specific research projects or programs, there are also some more overarching frameworks that have emerged that try to systematically infuse a broader range of considerations into technological research, development, and assessment. Several of these frameworks are briefly discussed below, along with some of their weaknesses and limitations.

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109 Franklin, *supra* note 29 at 124-125.
110 Lee Worth Bailey, *The Enchantments of Technology* (Chicago: University of Illinois Press, 2005) at 9.
111 Heikkerö, *supra* note 16 at 182.
112 Elinor J Langfelder & Eric T Juengst, "Ethical, Legal, and Social Implications (ELSI) Program" (1993) 12:2 Politics and the Life Sciences 273.
113 Genome Canada, "GE^{3}LS Research", online: <https://www.genomecanada.ca/en/programs/ge3ls-research>. GE^{3}LS stands for Genomics and its Ethical, Environmental, Economic, Legal, and Social Aspects. This program was funded in 2000.

3.5.1 Appropriate Technology

The concept of appropriate technology (AT) first gained currency in the 1970s, perhaps most notably after the publication of the economist Ernst Schumacher's book *Small is Beautiful: Economics as if People Mattered*.[114] The AT movement generally acknowledged the positive value of technology, but drew attention to the political dimensions and choices inherent in technology design: "In contrast to crude judgements as to whether or not technology should be developed, the concept of Appropriate Technology attempts to discriminate between different technologies according to their relative suitability for specific purposes or situations."[115]

In particular, the scale of technologies is seen to be a significant factor that determines their impacts. Large-scale, capital-intensive technologies are considered to be especially problematic, to the extent that they

> are controlled by large corporations and/or bureaucracies, which seldom give priority to human needs. Being large scale and usually resource intensive, they tend to have a massive impact on natural ecosystems. Their scale and mode of organization similarly militate against creativity and meaningful participation by workers. These technologies often are very complex and poorly understood by the public, so that crucial decisions may be made by a small group of technical experts. In addition, the centralized character of a technology and the magnitude of the risks involved encourage hierarchical organization and the centralization of control.[116]

In sum, many of the worst harms relating to technologies can be attributed to the scale at which they are deployed.

Responding to these kinds of concerns, AT promotes applications of technology that are smaller-scale, labour-intensive, relatively simple, decentralized, environmentally compatible, and locally autonomous.[117] The terms "intermediate technology" or "alternative technology" are also

[114] EF Schumacher, *Small is Beautiful: Economics as If People Mattered* (New York: Harper and Row, 1973).
[115] Kelvin W Willoughby, *Technology Choice: A Critique of the Appropriate Technology Movement* (New York: Routledge, 2019) at 6.
[116] Ian G Barbour, *Technology, Environment, and Human Values* (New York: Praeger, 1980) at 296.
[117] See e.g. *ibid* at 294-304.

sometimes used to emphasize different aspects of smaller-scale technologies.[118] There is clearly a normative evaluation embedded in this idea; according to Ian Barbour, "the designation 'appropriate' is a favorable judgment of the effects of a technology in a social, cultural, and environmental setting."[119]

The concept of AT is closely linked to development and poverty-reduction agendas. AT is situated within a broader social movement that "critiqued the Western development model based on reductionist science and complex, expensive technology manufactured in industrialized countries and exported to former colonies hungry for jobs and growth."[120] In the context of the agri-food sector in particular, "the legacy of the appropriate technology movement today is, in developing countries, one of low-tech, locally controlled development projects, and, in wealthy countries, advocacy around renewable energy and sustainable agriculture."[121] Though many of the central ideas of AT still resonate today, it does not seem to have gained traction as a guiding framework within mainstream technology or development policy.

3.5.2 Responsible Research and Innovation

The concept of responsible research and innovation (RRI), or simply responsible innovation (RI), acknowledges that innovation invokes ethical questions and concerns, and emphasizes "the need to ensure the ethical acceptability and societal desirability of emerging technologies in an inclusive and democratic way".[122] The central concern of RRI is the "appropriate (and

[118] See e.g. *ibid* at 296-297.
[119] *Ibid* at 296.
[120] Steve Breyman et al, "STS and Social Movements: Pasts and Futures" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2017) 289 at 291.
[121] David Hess et al, "Science, Technology, and Social Movements" in Edward J Hackett et al, eds, *The Handbook of Science and Technology Studies* (Cambridge, MA: The MIT Press, 2007) 473 at 483.
[122] von Schomberg & Blok, *supra* note 62 at 2. See generally Jack Stilgoe & David H Guston, "Responsible Research and Innovation" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2017) 853-880; Richard Owen, John Bessant & Maggy Heintz, eds, *Responsible Innovation: Managing the responsible emergence of science and innovation in society* (West Sussex, UK: John Wiley & Sons, Ltd, 2013).

proportionate) oversight and stewardship of the processes of science and innovation" under conditions of uncertainty and imperfect foresight.[123] There is no authoritative definition of RRI, but one scholar posits that it is:

> a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).[124]

Thus, without prescribing any singular tool or suite of tools, RRI is broadly concerned with the direction and purpose of technological innovation.

Theories of RRI have attained greater cachet in both academic and policy circles in recent years. Indeed, as Richard Owen et al point out, "[f]ew would disagree that science and innovation should be undertaken responsibly."[125] However, if it is to be useful as a practical reality, the concept of RRI requires more substance than simply a vague commitment to thoughtful stewardship of the processes of research and innovation. Consequently, various frameworks of RRI have emerged, many of which feature "the importance of four dimensions: anticipation, reflexivity, inclusion, and responsiveness."[126] Contemporary framings of RRI also stress the importance of the use of technology assessment and technology foresight, application of the precautionary principle, normative/ethical principles to design technology, innovation

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[123] Richard Owen et al, "A Framework for Responsible Innovation" in Richard Owen, John Bessant & Maggy Heintz, eds, *Responsible Innovation: Managing the responsible emergence of science and innovation in society* (West Sussex, UK: John Wiley & Sons, Ltd, 2013) 27 at 28.
[124] René von Schomberg, "The Quest for the 'Right' Impacts of Science and Technology: A Framework for Responsible Research and Innovation" in Jeroen van den Hoven et al, eds, *Responsible Innovation 1: Innovative Solutions for Global Issues* (New York: Springer, 2014) 33 at 39.
[125] Owen et al, *supra* note 123 at 27.
[126] von Schomberg & Blok, *supra* note 62 at 2. See also Owen et al, *ibid* at 38.

governance models and multi-stakeholder involvement, and public engagement and public dialogue.[127]

3.5.3 Value Sensitive Design

Value sensitive design (VSD) is a methodology of systems design that begins from the premise that "articulation and transparency concerning values are important to innovation processes", and thus makes "social and moral values central to the design and development of new technology".[128] Over and above the claim that values can be and are embedded in technologies, thereby demanding conscious reflection, VSD approaches emphasize the fact that "moral considerations need to be articulated early on in the process, at the moment of the design and development when value considerations can still make a difference."[129]

In particular, VSD "draws attention to the impact technologies have on human well-being and the quality of human lives."[130] According to Batya Friedman and David Hendry, the definition of human values adopted by VSD is: "*what is important to people in their lives, with a focus on ethics and morality.* Work to date has emphasized human well-being, dignity, and justice."[131] Thus, as opposed to approaches that focus on functional and instrumental values (e.g. speed, capacity, cost, durability, robustness, reliability, affordability, user-friendliness),[132] VSD

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[127] René von Schomberg, "A Vision of Responsible Research and Innovation" in Richard Owen, John Bessant & Maggy Heintz, eds, *Responsible Innovation: Managing the responsible emergence of science and innovation in society* (West Sussex, UK: John Wiley & Sons, Ltd, 2013) 51-74.
[128] Jeroen van den Hoven, "Value Sensitive Design and Responsible Innovation" in Richard Owen, John Bessant & Maggy Heintz, eds, *Responsible Innovation: Managing the responsible emergence of science and innovation in society* (West Sussex, UK: John Wiley & Sons, Ltd, 2013) 75 at 78.
[129] *Ibid* at 79.
[130] Jeroen Van Der Hoven & Noemi Manders-Huits, "Value-sensitive Design" in Jan Kyrre Berg Olsen, Stig Andur Pedersen & Vincent F Hendricks, eds, *A Companion to the Philosophy of Technology* (Malden, MA: Blackwell Publishing Ltd, 2009) 477 at 478.
[131] Batya Friedman & David G Hendry, *Value Sensitive Design: Shaping Technology with Moral Imagination* (Cambridge, MA: The MIT Press, 2019) at 4 [emphasis in original].
[132] Van Der Hoven & Manders-Huits, *supra* note 130 at 478.

"focuses *primarily* on addressing values of *moral* import, such as privacy, trust and autonomy."[133]

Though early work on VSD focused primarily on computing and information technology, the concept is now considered to be "technology agnostic … in principle the theory, method, and practice of value sensitive design are not tied to any specific technology."[134] VSD has been differentiated from other approaches to computer technology, values, and design (such as Computer Ethics and Participatory Design) in that it: seeks to be proactive; enlarges the arena in which values arise; enlarges the scope of human values considered; employs an integrative methodology that involves conceptual, empirical, and technical investigations; is an interactional theory; draws on moral epistemology to offer a principled approach to design, and; maintains that certain values are universally held.[135] Nowadays, VSD relies on conceptual, empirical, and technical investigations and analyses that "are intended to form an integrative and iterative methodological framework for embodying human and moral values into the design of technology."[136]

3.5.4 Limitations of Existing Approaches

I make no attempt to thoroughly analyze all of the various approaches to broadening the range of considerations involved in designing, developing, and governing science and technology, each of which use "different methods, with different intentions, and with different theoretical departure points".[137] Nor am I claiming to pass conclusive judgment on their relative merits. Rather, I want

[133] *Ibid* at 477 [emphasis in original].
[134] Friedman & Hendry, *supra* note 131 at 21.
[135] Batya Friedman, Peter H Kahn, Jr & Alan Borning, "Value Sensitive Design: Theory and Methods", UW CSE Technical Report 02-12-01 (December 2002), online: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.11.8020&rep=rep1&type=pdf> at 1-2.
[136] Van Der Hoven & Manders-Huits, *supra* note 130 at 479.
[137] Konrad et al, *supra* note 56 at 479.

to recognize both the existence of these efforts, as well as some of their apparent limitations. In so doing, I hope to establish a foundation for my discussion of the concept of technology justice in Chapter 5, which offers another way of connecting our technologies with our values in the context of food and agriculture.

While frameworks like ELSI, AT, RRI, and VSD have sought, to varying degrees, to inject ethical deliberation into our thinking about technology, each has been vulnerable to critique on theoretical, political, and practical grounds. Not all of these critiques are necessarily persuasive,[138] and these frameworks have also all undergone processes of evolution, with their more modern articulations responding to previously identified deficiencies. For example, "[i]n contrast with the older division in technology studies between innovation clusters focused on national industrial development and low-tech appropriate technology for the rural poor," more recent work in AT has "demonstrated that high-technology innovation can also be reshaped to address the pervasive problem of poverty in less developed countries."[139] However, engaging with these critiques can help uncover common fault lines, thereby revealing how ethical frameworks for governing science and technology might be strengthened.

For one, the boundaries of existing approaches to linking technology and ethics and/or justice-related concerns can suffer from being too narrow, too ambiguous, or too difficult to define. VSD focuses on the design aspect of technology, without necessarily carrying through its critique into the later parts of a technology's life cycle. Meanwhile, the definition and application of RRI is "often loosely articulated",[140] and can serve competing purposes. Each of the variables of "responsible", "research", and "innovation" is provisional, as is the public or publics to whom

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[138] See e.g. Willoughby, *supra* note 115 at 223-263 (surveying criticisms of AT, and offering some rejoinders).
[139] Hess et al, "Structural Inequality and the Politics of Science and Technology", *supra* note 44 at 331.
[140] Barbara E Ribeiro, Robert DJ Smith & Kate Millar, "A Mobilising Concept? Unpacking Academic Representations of Responsible Research and Innovation" (2017) 23 Sci Eng Ethics 81 at 82.

responsibility is owed. As a result, "[d]ifferent uses of the term 'RRI' are therefore intentionally or implicitly performative."[141]

Additionally, it is insufficient to simply "add ethics and stir" without a more critical take on what adding ethics really means in the context of governing technology, and who gets to participate in that process. Questions of power and agency must be a central part of this line of inquiry. Such an analysis ideally includes considerations of scale (i.e. how impacts of a new technology might differ and multiply if widespread usage is adopted), considerations of human use (i.e. how the experiences of downstream users and consumers might be overlooked by top-down processes of innovation, leading to a poor fit between a product or service and the requirements at the local, household, or individual level), as well as the broader structural and systemic implications of new and emerging technologies (i.e. what kind of direct and indirect impacts might occur if an existing technological system is displaced). Significantly, such an analysis cannot be properly conducted within the same ideological parameters that caused the problems in the first place.

To this end, existing frameworks do not necessarily go far enough in terms of striking at the tangled political, economic, and social roots of our current technoscientific paradigms. As Lucien von Schomberg and Vincent Blok argue in the context of RI, "in the attempt to steer innovation, frameworks of RI are in fact steered by the techno-economic paradigm inherent in the presupposed concept of innovation."[142] They conclude that "even though RI provides a critical analysis of innovation at the ontic level (i.e., concerning the introduction and usage of particular innovations), it still lacks a critical analysis at the ontological level (i.e., concerning the

[141] *Ibid*.
[142] von Schomberg & Blok, *supra* note 62 at 3.

techno-economic paradigm of innovation)."[143] Therefore, to truly open up the possibility of other ways of thinking about innovation, we need to confront the underlying techno-economic paradigm and the tenets to which it adheres.

This means that several different kinds of expansion are called for in the process of bringing ethics into technology. First, we need to expand the ambit of our ethical sensibilities beyond the anthropocentric. For example, Aldo Leopold's land ethic "enlarges the boundaries of the communities to include soils, water, plants, and animals, or collectively: the land."[144] Relatedly, we must expand our conceptions of epistemology, law, and governance. In particular, "Indigenous legal traditions contain broad strands of authority that are generally attentive to the environment. They embody rich and vibrant insights and include deep intellectual and social resources that can help us care for the natural world."[145] Growing attention—rightfully so—is being paid to the proper respect to be afforded to Indigenous peoples, worldviews, and contributions and their role in helping restore ecological balance, among other goals. Ultimately, what is needed is "to move beyond the standard dichotomies of developed/developing, modern/traditional, global north/global south, and West/East. This sensibility, in turn, opens up a broad and novel range of strategies for intervention toward effecting social change."[146]

Humans, our institutions, and our technologies are all fallible, and "[s]imply because the future is represented in a certain way, it does not follow that techno-social arrangements will

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[143] *Ibid* at 13.
[144] Aldo Leopold, *A Sand County Almanac: With Essays on Conservation from Round River* (New York: Ballantine Books, 1966) at 239.
[145] John Borrows, "Earth-Bound: Indigenous Resurgence and Environmental Reconciliation" in Michael Asch, John Borrows & James Tully, eds, *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (Toronto: University of Toronto Press, 2018) 49 at 49.
[146] Aalok Khandekar et al, "STS for Development" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 665 at 682.

uniformly concur with the futures idealized for them."[147] Thus, any kind of future-oriented inquiry and engagement with new and emerging technologies must proceed with an understanding of the limitations of such a venture. At the same time, this inherent uncertainty need not lead to analysis paralysis, or to a cynical appraisal of the value of the exercise. Rather, we need to come together to find productive ways to "build more flexibility, resilience, and responsiveness to social priorities into institutions, laboratories, and communities."[148] To this end, the concept of technology justice that I develop in Chapter 5 seeks to counter the "various pathologies of innovation that are conventionally realized only with hindsight"[149] by making central "the enforcement of limits to power."[150]

3.6 Conclusion

Choices about technology have to be made one way or another, and there will always be a path not taken. Though environmentalists and others with reservations about new and emerging technologies are often derided for voicing concerns that are dismissed as merely hypothetical, a commitment to technological fixes is also, in many cases, predicated on conjecture. When presented with a choice between adopting technologies based on speculative benefits or rejecting technologies based on speculative harms, we need to have some means of cutting through the "what if's" and coming to a collective consensus about how to move forward in the face of uncertainty, in a manner that appropriately balances competing concerns.

While an optimistic view positions advances in science and technology as the cure for contemporary challenges like the hunger crisis and the environmental degradation associated

[147] Nik Brown & Mike Michael, "A Sociology of Expectations: *Retrospecting Prospects* and *Prospecting Retrospects*" (2003) 15:1 Technology Analysis & Strategic Management 3 at 7.
[148] Konrad et al, *supra* note 56 at 479.
[149] Stilgoe & Guston, *supra* note 122 at 856.
[150] Franklin, *supra* note 29 at 5.

with industrial food production, a more cautious take sees the ideology underlying science and technology as part of their cause. In the case of agricultural biotechnologies, for example, the push for more research and development "may be more the result of entrenched habits of thought and institutional momentum rather than a rigorous and self-critical science and philosophy."[151] Interrupting the established patterns of thinking that continue to reinforce more science as the solution to problems wrought by reductively scientific methodologies, and more technology as the solution to problems wrought by technological fixes, is an important first step in inculcating a greater degree of reflexivity within science, technology, and law.

There is, without question, space for science and technology to play a positive role in effecting food systems transformations. Indeed, "the transition to sustainability is not necessarily a zero-sum game. This is so because new radical technology also offers significant opportunities."[152] So-called "redemptive" technologies can be developed that are less damaging to the environment and society, or existing technologies could be retooled to "use existing technical knowledge in a changed structure and for a changed task."[153] However, in order for such technologies to emerge, an enabling environment is required, which means that the role of law and policy in guiding strategic investments, creating supportive institutions, enforcing ecological boundaries, and redefining research priorities is crucial. As will be elaborated on in the following chapter, this calls for a re-examination of the very foundations of modern law in light of the vastly altered social and environmental circumstances in which we now find ourselves.[154]

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[151] Scott, *supra* note 5 at 224.
[152] Jan Fagerberg, "Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy" (2018) 47 Research Policy 1568 at 1574.
[153] Franklin, *supra* note 29 at 130.
[154] As Sean Coyle and Karen Morrow point out, "the failure of the seventeenth century writers to spot the negative environmental implications of their theories is in part a product of social and technological development at the time at which they wrote. Technology was seen by ancient cultures as a means to come to know and understand the

world, through the study of mathematics and astronomy; by the seventeenth century, man's interests in pursuing society and technology were perceived as coinciding with the preservation and cultivation of the natural world. The point at which human needs, and the means of achieving them, develop in ways destructive to the natural environment was simply not considered." Sean Coyle & Karen Morrow, *The Philosophical Foundations of Environmental Law: Property, Rights and Nature* (London: Hart Publishing, 2004) at 40.

4. Law's Boundaries and Intersections

Law is, without question, a vital part of contemporary life. Among its numerous functions, law enacts and enforces rules that contribute to social order, provides an official process for adjudicating and resolving disputes between parties, and outlines and protects individual and collective rights and liberties. Over and above its prescriptive and procedural roles, the institution of law also exerts normative force on society and its endeavours, while simultaneously being shaped by social influences.

Due to its multifaceted character, law intersects with the environment, science, technology, and justice in various ways. In effect, law formalizes the creation of social and/or ethical boundaries that can restrain and/or redirect scientific and technological developments, as well as establishing consequences for the breach of those boundaries. Legal frameworks governing technologies thus serve as an acknowledgment that ecological limits in some absolute sense are not the only possible checks on human activities. Further, legal rules and remedies play an essential role in determining how the harms and benefits arising from new and emerging technologies are allocated among members of a society. In this way, law can help ameliorate some of the worst failures of so-called "free markets".

However, law can also play a role in perpetuating environmental and social injustices. As the work of existing social movements has revealed, there are substantive, procedural, and structural/systemic barriers to justice that law both creates and reproduces, often in insidious ways. The pervasive liberal bias of Western law, and its particular assumptions about human reason and historical progress, is deeply implicated in this process.[1] Because law is frequently

[1] Michael J Sandel, *Liberalism and the Limits of Justice* (New York: Cambridge University Press, 1982); Peter Fitzpatrick, *The Mythology of Modern Law* (New York: Routledge, 1992); Uday Singh Mehta, *Liberalism and Empire: A Study in Nineteenth-Century British Liberal Thought* (Chicago, IL: University of Chicago Press, 1999).

cast as something that is neutral, rational, and concerned primarily with protecting the individual as opposed to the collective, it can serve to assimilate patterns of thinking and action that normalize patterns of inequality, thereby making them more difficult to notice, articulate, and challenge.

This chapter opens with a consideration of Western law's boundaries in the discrete areas of property law, environmental law, and technology law. As will be shown, each of these areas is germane to a broader inquiry into the development, application, and regulation of technologies in the agri-food sector. Intentionally or not, each of these areas espouses specific ideas about property, the environment, and technology that warrant questioning. In exposing the limitations of the way in which law is currently oriented, I emphasize the benefits of taking a more relational approach, and seeing law as enshrining a "bundle of relations" rather than merely a "bundle of rights",[2] a theme that will be picked up again in later chapters.

After this boundary-drawing exercise, this chapter then goes on to muddy those very boundaries. Specifically, I explore some of the intersections between law and society, law and science, law and technology, and law and justice to expose their porousness and the importance of considering the ways in which our constructions and understandings of society, technology, and justice are each mutually constituted with our constructions and understandings of law. The final section of this chapter provides a brief introduction to some existing justice movements, in order to establish a foundation for my elaboration of a vision for technology justice in the following chapter.

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[2] For an expanded discussion of the "bundle of rights" analogy, see JE Penner, "The 'Bundle of Rights' Picture of Property" (1996) 43:3 UCLA L Rev 711.

4.1 Law's Boundaries

4.1.1 Property Law

Property law regimes have profoundly influenced the way we relate to the planet, as well as the ways in which we conceptualize and carry out our relationships with each other, with nonhuman animals and non-living entities, and with material things. Indeed, "[i]t is often the rules of property law, modified by planning and resource management regulation, that most directly govern human interaction with the natural environment."[3] In addition to their direct impacts, "property laws are the legal concepts that most strongly enshrine the view that economic wealth, freely pursued through the free use and enjoyment of natural resources, will provide for both individual and the so-called net social benefit, or common good."[4] In this way, the organizing principles of modern property law exert significant ideological force.[5]

According to the classical conception, "[p]roperty is conventionally understood as comprising a bundle of rights, including the right to use the property, the right to exclude nonowners, the power to transfer it, and absolute, or almost absolute, control over the thing that is owned."[6] Despite the preponderance of this model, many scholars have outlined the shortcomings of commonly accepted ideas about property. For example, as with other areas that are seen to fall within the domain of "private" law, modern property rights turn on an artificial distinction between "public" and "private" that fails to account for the reality that "[p]rivate

[3] Prue Taylor & David Grinlinton, "Property Rights and Sustainability: Toward a New Vision of Property" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 1 at 9.
[4] *Ibid* at 10.
[5] Michael Robertson, "Property and Ideology" (1995) 8:2 Can JL & Jur 275.
[6] Joseph William Singer, "Property" in David Kairys, ed, *The Politics of Law: A Progressive Critique*, 3d ed (New York: Basic Books, 1998) 240 at 241.

rights, far from comprising a realm distinct from public value, are in fact comprehensively and pervasively shaped by the latter."[7]

A number of further dichotomies flow from the public/private distinction, including subject versus object, corporeal versus noncorporeal, individual versus community, rights versus responsibilities, and privatization of profits versus socialization of costs.[8] These binaries do not follow some kind of natural order of things, but rather, reflect specific kinds of power relations, values, and assumptions, all couched within a particular cultural and historical context.[9]

In its particular characterization of what can be "owned", who can be an "owner", and what protection is afforded by "ownership", the classical property paradigm has generally served to advantage dominant groups, while disenfranchising others. To reimagine a more equitable conception of property, the first task is thus to probe the provisional and problematic views underlying influential Eurocentric ideas and ideals. In the case of land law, the fact that the export of English concepts of private property to settler colonies depended upon beliefs of European racial superiority to legitimize the violent colonial appropriation of Indigenous lands regularly goes unacknowledged and unchallenged by dominant scripts.[10] As contemporary clashes exemplify, such as in the case of the Wet'suwet'en resistance to the Coastal GasLink pipeline project in British Columbia,[11] both human and environmental injuries have been and

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[7] Sean Coyle & Karen Morrow, *The Philosophical Foundations of Environmental Law: Property, Rights and Nature* (London: Hart Publishing, 2004) at 172. For a detailed history of the public/private distinction in law, see Morton J Horwitz, "The History of the Public/Private Distinction" (1982) 130:6 U Pa L Rev 1423.
[8] Klaus Bosselmann, "Property Rights and Sustainability: Can They be Reconciled?" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 23 at 25.
[9] For a feminist critique, see Jeanne L Schroeder, "Chix Nix Bundle-O-Stix: A Feminist Critique of the Disaggregation of Property" (1995) 93:2 Mich L Rev 239.
[10] Brenna Bhandar, *Colonial Lives of Property: Law, Land, and Racial Regimes of Ownership* (Durham, NC: Duke University Press, 2018) (examining the ways in which modern property law has contributed to racial discrimination in settler colonies).
[11] See e.g. Amber Bracken & Leyland Cecco, "Canada: protests go mainstream as support for Wet'suwet'en pipeline fight widens", *The Guardian* (14 February 2020), online: <https://www.theguardian.com/world/2020/feb/14/wetsuweten-coastal-gaslink-pipeline-allies>; Joan Bryden,

continue to be generated by the strength of legal protection accorded to colonial property rights, which "continues to facilitate and incentivize forms of economic activity that cause widespread ecological harm."[12] When it comes to food law, in addition to inequalities resulting from the privatization and enclosure of land,[13] the corporatization and ownership of food and agricultural components like seeds is also another example that is of major concern.[14]

Moreover, egalitarianism does not appear to be at all a core concern of the classical property paradigm, which "concentrates on protecting those who *have* property. It addresses the conditions under which people *get* property but does not include the premise that such conditions must be structured so that everyone has the *right to get* property."[15] As a consequence, Michael Robertson has argued that "a flawed conceptual framework used in making sense of and justifying property relationships … produce[s] an unequal distribution of wealth, status, and power, as well as reduced opportunities for autonomy and self-development."[16]

Similarly, Terry Frazier has contended that "concentrations of property, wealth, and power were made possible by the government's laissez-faire approach to property rights."[17] This outcome is especially insupportable in a changed socio-economic milieu, as "[m]anagerial or corporate capitalism is able to shelter behind the property rights and justifications developed in the context of family or entrepreneurial capitalism, even though it involves fundamentally

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"Wet'suwet'en protests: Violent ends to past confrontations haunt Trudeau's government", *Global News* (23 February 2020), online: <https://globalnews.ca/news/6585837/indigenous-protests-trudeau-violence/>; Jillian Kestler-D'Amours, "Understanding the Wet'suwet'en struggle in Canada", *Al Jazeera* (1 March 2020), online: <https://www.aljazeera.com/news/2020/03/understanding-wet-struggle-canada-200301200921070.html>.

[12] Taylor & Grinlinton, *supra* note 3 at 9.

[13] See e.g. Darcy Lindberg, "Transforming Buffalo: Plains Cree Constitutionalism and Food Sovereignty" in Heather McLeod-Kilmurray, Angela Lee & Nathalie Chalifour, eds, *Food Law and Policy in Canada* (Toronto: Carswell, 2019) 37 at 43-47.

[14] See e.g. Susan K Sell, "Corporations, Seeds, and Intellectual Property Rights Governance" in Jennifer Clapp & Doris Fuchs, eds, *Corporate Power in Global Agrifood Governance* (Cambridge, MA: The MIT Press, 2009) 187-223.

[15] Singer, *supra* note 6 at 249 [emphasis in original].

[16] Robertson, *supra* note 5 at 275.

[17] Terry W Frazier, "The Green Alternative to Classical Liberal Property Theory" (1995) 20:2 Vt L Rev 299 at 299.

different kinds of property relationships."[18] Instead of a paradigm featuring an individual entrepreneur and an individual owner/manager, the rise of large, multinational corporations has fundamentally altered many aspects of our societies, economies, and politics, insofar it has been one of the main drivers behind the chasm between the classes significantly widening and only continuing to grow.

The extension of principles governing "real" property to intangibles, like intellectual property (IP), is a more recent cause for concern.[19] The expansion of protection for intellectual property rights (IPRs) may be problematic for several reasons, including that it: tends to undervalue a robust public domain of ideas and materials; allows for censorship and suppresses free speech by adhering to a private property model; negatively impacts our capacity for democracy; and raises troubling international human rights and distributive issues.[20] While the uncritical acceptance of a "rights" discourse in the context of IP has contributed to both market and legal failures, new technological developments can compel re-evaluations of dominant explanatory models and their underlying tenets.

Despite the longstanding acceptance of dominant models of property and ownership, alternative conceptions are available to us. Indeed, "[r]ather than viewing property as equivalent to ownership, we can view it as defining a setting for human life. Property institutions create multiple settings to situate human relationships."[21] In particular, non-Western frameworks can "help us investigate different notions of 'relationship' between persons and nature", and can

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[18] Robertson, *supra* note 5 at 288.
[19] See e.g. James Boyle, *Shamans, Software and Spleens: Law and the Construction of Information Society* (Cambridge, MA: Harvard University Press, 1996); Julie Cohen, "Lochner in Cyberspace: The New Economic Orthodoxy of 'Rights Management'" (1998) 97:2 Mich L Rev 463; Carys J Craig, "Critical copyright law and the politics of 'IP'" in Emilios Christodoulidis, Ruth Dukes & Marco Goldoni, eds, *Research Handbook on Critical Legal Theory* (Northampton, MA: Edward Elgar Publishing, Inc., 2019) 301-323.
[20] Keith Aoki, "The Stakes of Intellectual Property Law" in David Kairys, ed, *The Politics of Law: A Progressive Critique*, 3d ed (New York: Basic Books, 1998) 259 at 260.
[21] Singer, *supra* note 6 at 256.

thereby "provide us with models for reshaping Western concepts of property."[22] To this end, greater recognition is being afforded to various Indigenous governance systems,[23] which often "embody a politics of responsibility, not rights, that affirm relationships between people, the land, and the cosmos."[24] Embracing an evolution of our ideas, including becoming more comfortable with a pluralistic approach to law, will be fundamental to the project of restructuring our relationships in a less damaging formulation.

4.1.2 Environmental Law

Although our treatment of the environment is closely tied up with our notions of property, in the present day, the two are usually treated as distinct and separate areas of legal analysis. Notable jurist CG Weeramantry has identified "the comparative blindness of conventional property law discourse and analysis to environmental issues" as being one of the fulcrums of our environmental crisis.[25] Upon closer examination, both property law and environmental law discourses are predicated on a shared set of assumptions about rights, ownership, and nature, and reflect a particular social and economic value system.

Current conceptions of property are difficult to reconcile with aspirations toward greater sustainability. One of the main hitches is that "the present definition of 'property rights' as an individual entitlement is detached from collective responsibilities."[26] Though property rights are fettered, to some extent, by legal limitations, property "owners" are not framed as "citizens of

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[22] Taylor & Grinlinton, *supra* note 3 at 7.
[23] Angela Cameron, Sari Graben & Val Napoleon, eds, *Creating Indigenous Property: Power, Rights, and Relationships* (Toronto: University of Toronto Press, 2020).
[24] Peter Horsley, "Property Rights Viewed from Emerging Relational Perspectives" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 87 at 106.
[25] Judge CG Weeramantry, "Foreword" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) xv at xv.
[26] Bosselmann, "Property Rights and Sustainability: Can They be Reconciled?", *supra* note 8 at 25.

ecological communities and social communities, who share interests and responsibilities in the objects of their property rights."[27] Attempts to move away from "starkly instrumental perspectives on environmental protection … are hampered by the fact that they still conceive of property in terms of patterns and rights and duties and the concept of a just distribution."[28] In this way, "[t]he emerging discourse of sustainability seems to attach itself to, rather than depart from, the discourse of property rights."[29]

In terms of its relationship to property law, one view is that environmental law emerged "as a set of restraints and limitations on the freedom of individuals to use property in ways that can result in ecological harm (private individuals vs. the state). It can be viewed as a body of law that attempts to remedy some of the failings of property law by challenging the scope of rights and duties created by property law."[30] Put differently, environmental law can be characterized "as a set of policy-driven, statutory limitations on the exercise of private entitlements".[31]

While some might contend that the growth of environmental law represents an unwelcome incursion into private freedoms, another perspective suggests that environmental law has not gone far enough to check the consequences that a warped understanding of personal entitlements in an interconnected world can produce. As Prue Taylor and David Grinlinton muse, "if we pay serious attention to the continued and accelerating decline of Earth's ecological systems (across multiple scales) … we would have to conclude that environmental law is failing

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[27] Craig Anthony (Tony) Arnold, "Sustainable Webs of Interests: Property in an Interconnected Environment" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 167 at 176.
[28] Coyle & Morrow, *supra* note 7 at 7.
[29] Nichole Graham, "The Mythology of Environmental Markets" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 149 at 151.
[30] Taylor & Grinlinton, *supra* note 3 at 11.
[31] Coyle & Morrow, *supra* note 7 at 2.

to meet society's objectives, particularly when viewed from the perspective of intra and intergenerational equity."[32]

One of the biggest problems with environmental law is that it does not move far enough away from the "logic of individual rights deprived of inherent duties [that] is the hallmark of all classical liberal thinkers."[33] Yet, tracing the threads that bind our ideas about property and the environment reminds us that "the form of modern property, both legally and in our moral life, is neither historically nor conceptually inevitable."[34] Law is not a static entity. It has demonstrably evolved over time, and it is capable of evolving further. In order to make environmental law more robust, we need to start with—or perhaps, return to—an alternative conception of property that draws on discourses of responsibilities and not just rights, and calls for us "to address environmental problems in collective rather than purely individualistic terms."[35]

Environmental law is a relatively modern development, only having crystallized in the twentieth-century,[36] and its scope is difficult to delimit with precision. At a very general level, environmental law can be defined as "the law relating to environmental problems."[37] Efforts to explain what environmental law entails with greater specificity can take three different approaches: descriptive (i.e. equating it with the laws relating to environmental protection), purposive (i.e. defining it in terms of the purpose the law is designed or desired to achieve), or jurisprudential (i.e. seeing it as a body of legal principle).[38] Regardless of which approach is

[32] Taylor & Grinlinton, *supra* note 3 at 11.
[33] Bosselmann, "Property Rights and Sustainability: Can They be Reconciled?", *supra* note 8 at 31.
[34] Coyle & Morrow, *supra* note 7 at 10.
[35] *Ibid* at 206.
[36] Richard J Lazarus, *The Making of Environmental Law* (Chicago: University of Chicago Press, 2004).
[37] Elizabeth Fisher, Bettina Lange & Eloise Scotford, *Environmental Law: Text, Cases, and Materials* (Oxford: Oxford University Press, 2013) at 6.
[38] *Ibid* at 6-13.

taken, environmental law can be seen as a cross-cutting field that seeks to protect the environment and establish legal consequences for environmental harms.

In Canada, environmental law has undergone a series of evolutionary phases since its inception in the 1960s. These can be seen as being marked, respectively, by common law actions in tort and property law; waste control and cleanup laws to regulate air, water, and land pollution; tightening control over the regulation of toxic substances; anticipatory and preventative approaches to environmental problems in the form of environmental assessment requirements and planning and management regimes; and, most recently, mounting commitments to sustainable development.[39] As the field continues to mature, it will ideally be better able to safeguard the environment in a more holistic and less haphazard manner.

While environmental law, to date, may not have been successful in preventing the extensive environmental degradation that we are now confronted with, it has real value to contribute in our efforts to do better: "[a]lthough the role of law in achieving sustainability is limited, it is important because only through law can we actually *coerce* ourselves."[40] To prove the point, environmental law has led to some real successes, such as recovery of the ozone hole that is attributable to actions taken under the Montreal Protocol on Substances that Deplete the Ozone Layer.[41]

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[39] Paul Muldoon et al, *An Introduction to Environmental Law and Policy in Canada* (Toronto: Emond Montgomery Publications Limited, 2009) at 45-57.

[40] Bosselmann, "Property Rights and Sustainability: Can They be Reconciled?", *supra* note 8 at 26 [emphasis in original].

[41] The Montreal Protocol is a global, multi-lateral agreement, signed in 1987 and in force in 1989, that aimed to protect the ozone layer by phasing out both the production and consumption of ozone-depleting substances. UN Environment Programme, Ozone Secretariat, "The Montreal Protocol on Substances that Deplete the Ozone Layer", online: <https://ozone.unep.org/treaties/montreal-protocol>; World Meteorological Organization, *Scientific Assessment of Ozone Depletion: 2018*, Global Ozone Research and Monitoring Project—Report No. 58 (Geneva, Switzerland: WMO, 2018), online: <https://library.wmo.int/doc_num.php?explnum_id=5704>.

Nevertheless, there is clearly room to strengthen environmental law's capacity. While some scholars argue for reforms to environmental law and governance on more limited grounds, or point to circumscribed "root problems",[42] others insist that the problem is more invidious. For those who believe the latter, the solutions they propose are more radical, in the sense that they more profoundly challenge deeply ingrained ways of thinking and acting, both at the individual and institutional level. Suggestions for novel ways of going about environmental governance have spawned a plethora of new nomenclature, including sustainability law,[43] the principle of sustainability,[44] wild law,[45] ecological law,[46] ecological governance,[47] and green governance.[48]

Michael M'Gonigle and Louise Takeda suggest that the dilemma with environmental law in its current configuration is that it does not address what they call the underlying environmental "problematic", but rather, operates within it.[49] Pointing to the complex regimes of power and law, they argue that within the Western liberal political economy, the state's dual commitments to economic development and environmental protection are essentially conflicting, such that "from the state's perspective, environmental law is essentially self-regulation, providing environmental protection only to the extent that, like any industry, it does not seriously interfere

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[42] See e.g. Jason MacLean, "Striking at the Root Problem of Canadian Environmental Law: Identifying and Escaping Regulatory Capture" (2016) 29 JELP 111.
[43] David R Boyd, "Sustainability Law: (R)evolutionary Directions for the Future of Environmental Law" (2004) 14 JELP 357.
[44] Klaus Bosselman, *The Principle of Sustainability: Transforming Law and Governance*, 2d ed (New York: Routledge, 2017) [1st ed Burlington, VT: Ashgate, 2008].
[45] Cormac Cullinan, *Wild Law: A Manifesto for Earth Justice*, 2d ed (White River Junction, VT: Chelsea Green Pub., 2011).
[46] Geoffrey Garver, "The Rule of Ecological Law: The Legal Complement to Degrowth Economics" (2013) 5:1 Sustainability 316.
[47] Olivia Woolley, *Ecological Governance: Reappraising Law's Role in Protecting Ecosystem Functionality* (Cambridge, UK: Cambridge University Press, 2014).
[48] Burns H Weston & David Bollier, *Green Governance: Ecological Survival, Human Rights, and the Law and the Commons* (New York: Cambridge University Press, 2013).
[49] Michael M'Gonigle & Louise Takeda, "The Liberal Limits of Environmental Law: A Green Legal Critique" (2013) 30:3 Pace Envtl L Rev 1005 at 1020.

with its economic priorities."[50] Consequently, they recommend a move towards a Green Legal Theory, which "seeks to re-orient the attention now directed to *downstream* 'legal laws' to develop a new understanding of the *upstream* constitutive 'dynamics' of material and cultural production that today lie largely undisturbed behind the environmental law paradigm."[51]

Similarly, Geoffrey Garver identifies "a need for change in the legal and governance systems that support the dominant economic regime."[52] A key flaw of contemporary environmental law that he identifies is "its reductionist tendency to focus on environmental problems as discrete and isolated, which impedes the full integration of a systems-based ecological approach into the entire legal infrastructure."[53] Accordingly, he proposes what he calls "the rule of ecological law", which would operate as a legal complement to ecological or degrowth economics and serve as the basis for establishing alternative governance structures that account for ecological limits.[54] Put simply, "[t]he rule of ecological law combines the notion of ecological law with the notion of the rule of law."[55] This means that legal institutions and norms "should provide a coherent, reliable, fair and just framework for managing human affairs", and that "the scientific laws that govern how the Earth works necessarily constrain the legal architecture for ecological law."[56] Essentially, ecological sustainability would become the bedrock under such an approach, as opposed to being simply an aspiration towards which to strive.

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[50] *Ibid* at 1054.
[51] *Ibid* at 1059.
[52] Geoffrey Garver, "Moving from environmental law to ecological law: Frameworks, priorities and strategies" in Laura Westra et al, eds, *Ecological Integrity, Law and Governance* (New York: Routledge, 2018) 141 at 141.
[53] Garver, "The Rule of Ecological Law", *supra* note 46 at 320.
[54] *Ibid*.
[55] *Ibid* at 318.
[56] *Ibid* at 319.

Regardless of the differences in the terminology that is employed, all of the ideas enumerated above echo the sentiment that a significant reconfiguration of environmental law is needed. Again, non-Western paradigms can be of great value here, because "European values, principles, and rules are not universally applicable either in their perception of the environment, in their portrayal of nature, or in their view of optimal human-environment relationships."[57] Hence, drawing on alternative legal orders can prove that radical revisions of the world are actually possible, and not merely idealistic fantasy.

Indigenous legal orders and knowledge systems have a lot to offer when it comes to the task of repairing our relationships with each other and with the land. As John Borrows has written, "Indigenous inclusion and involvement in existing institutions potentially facilitates sustainability by suggesting important reconnections of biological relationships within ecosystems."[58] However, as he cautions, "[w]hile very instructive, Indigenous knowledge is imperfect and only one of many sources to consult in working through our environmental challenges."[59] There is no obvious "right" way to cultivate ecological well-being, but shifting legal structures and systems away from a view of humans as being anything other than inextricably embedded in ecological relationships is a promising place to start.

4.1.3 Technology Law

According to the most general approach, technology law can be seen as the area of law that governs the use of technology and its consequences. Much of the existing scholarship on law and technology has tended to focus on either identifying potential impacts and concerns with a given

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[57] Nin Tomas, "Maori Concepts of Rangatiratanga, Kaitiakitanga, the Environment, and Property Rights" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 219 at 219.
[58] John Borrows, "Living Between Water and Rocks: First Nations, Environmental Planning and Democracy" (1997) 47 UTLJ 417 at 428.
[59] *Ibid* at 424.

technology, such that appropriate remedial action might be taken, or looking more directly at the impacts of technologies and considering how law could work, in practice, to mitigate controversies and resolve conflicts.[60]

Thus, one view of law in relation to technology is to see it as "human-made rules and practices and institutions to regulate (enable, channel, control) humans in their experimenting with, and their inventing, deploying, financing, ownership, registration, licensing, transfer, and uses of, particular 'technologies'."[61] This view encapsulates the sentiment that law both can and ought to regulate technology.[62] As with property law and environmental law, this positivist conception of technology law reflects a particular set of assumptions, including what kinds of outcomes to which our technologies should be directed, and how those outcomes should be facilitated.

Doctrinally, many areas of law are relevant when it comes to regulating technologies, including corporate and commercial law, consumer law, trade law, and tax law. Within the ambit of technology law, "[d]ifferent kinds of legal regimes, such as health law, environmental law and intellectual property law, attend to the specific properties of its matters in different ways. This difference is due to their very highly specific representational requirements that are not only

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[60] Milton R Wessel, "What is "Law, Science and Technology" Anyway?" (1989) 29:3 Jurimetrics 259. See also Gary E Marchant, "Science, Technology, and Law" in Carl Mitcham, ed, *Encyclopedia of Science, Technology, and Ethics*, Vol. 4 (Detroit, MI: Macmillan Reference USA, 2005) 1707 at 1701, dividing the field into three strands: "The first concerns the role of law in managing the impacts of science and technology, including controlling the risks, promoting the benefits, and addressing ethical implications. The second concerns the institutions of law and science, examining how law affects the practice of scientific research, as well as the reciprocal relationship of how science and technology influence the law. The third involves a more generic inquiry into the problems and tensions that arise from the intersection of law with science and technology."
[61] Benedict Kingsbury, "Infrastructure and InfraReg: on rousing the international law 'Wizards of Is'" (2019) 8:2 Cambridge Int'l LJ 171 at 176.
[62] David Grant & Lyria Bennett Moses, *Technology and the Trajectory of Myth* (Northampton, MA: Edward Elgar Publishing, Inc., 2017) at 200.

politically or ethically, but also historically and structurally, shaped."[63] Given the expansive scope of technology, it is somewhat self-evident that technologies have diverse characteristics that generate varying outcomes and require different kinds of considerations (e.g. some technologies, like nuclear power, have far higher degrees of risk and associated emotional responses).

That being said, law in a general sense can impinge on technology in significant ways. Legal rules and principles can foster or impede the development of technologies, promote the mass adoption of technologies, shape the contours of how technologies are used, and modify or limit the consequences of technologies. It is also possible to identify some common considerations that the law should rightfully address in relation to any technology introduced to society; for example, ensuring that there are mechanisms in place to identify real or potential risks arising (including social, environmental, and ethical), as well as procedures in place to manage said risks as they materialize.

Given its complexities, technology law raises a number of unique and difficult questions, such as whether new technologies require new laws, or whether existing legal frameworks are adequate.[64] For example, in the context of grappling with the intersections of constitutional law and patent law, the exercise involves "trying to understand terms established at a different time in a different context and apply that understanding to new facts."[65] Despite the novelty of new and emerging technologies and the questions that they engender for the law, Robin Feldman has made the point that "[l]aws related to technology … are no different from any other areas of law.

[63] Hyo Yoon Kang, "Law's materiality: Between concrete matters and abstract forms, or how matter becomes material" in Andreas Philippopoulous-Mihalopoulous, ed, *Routledge Handbook of Law and Theory* (New York: Routledge, 2019) 453 at 456.
[64] See e.g. David Friedman, "Does Technology Require New Law?" (2001) 25:1 Harv JL & Pub Pol'y 71.
[65] Robin Feldman, *The Role of Science in Law* (New York: Oxford University Press, 2009) at 91.

They require the same tools and proceed by the same interpretive methods that we employ throughout law as we interpret precedent."[66] Legal theory plays a crucial role in addressing the resulting challenges.[67] Therefore, understanding and improving technology law is as much a jurisprudential task as it is a practical one.

Much of the contemporary literature has imagined law "either as an instrument to enable and maximize the potential of a technology, or as something that is needed to ban or discourage a technology, towards optimizing stated goals like effectiveness, efficiency or even institutional legitimacy."[68] Thus, law is seen to function as a kind of technology that enables particular outcomes and visions for society: "If every technology is defined as an instrument that can improve the conditions of human life (i.e.: means to an end), the emphasis placed on the law as a tool to satisfy human needs and to solve problems lends credit to the idea that law itself may be regarded as a technology."[69]

However, the relationship between law and technology is not unidirectional. Technologies also exert an influence on law, and can themselves function as a kind of law. Lawrence Lessig's well-known thesis that "code is law"[70] posits that "code and other technical artefacts (like enacted law, markets and social norms) influence the behaviour of people in a society. In other words, people do things or refrain from doing things not only because law requires it of them, but also because physical or virtual architecture enables or prevents particular

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[66] *Ibid* at 90.
[67] *Ibid* at 94.
[68] Naveen Thayyil, "Claiming the Social: Beyond 'Law as Technology'" (2015) 11:2 Socio-Leg Rev 1 at 3.
[69] Giovanni Pascuzzi, "Cognitive Techniques of Legal Innovation" in Giuseppe Bellatuono & Fabiano Teodoro Lara, eds, *Law, Development and Innovation* (New York: Springer International Publishing, 2016) 15 at 20.
[70] Lawrence Lessig, *Code and Other Laws of Cyberspace* (New York: Basic Books, 1999).

actions."[71] Hence, technology increasingly "enforces or supplements law as an important regulatory instrument."[72]

Technologies can function as law at several levels. For example, Benedict Kingsbury draws our attention to infrastructure in particular, and how infrastructural choices can operate as regulation: "Thinking infrastructurally typically entails understanding infrastructure not simply as a thing, but as a set of relations, processes, and imaginations."[73] Thus, Kingsbury offers an idea of "infrastructure-as-regulation ('infra-reg')" premised on the condition that "infrastructure can (and often does) operate in some significant relation to law."[74] In other words, infrastructure can be, *inter alia*, a means of implementing law, a means of enabling law, a substitute for law, or a way to displace or obstruct law.[75] Moreover, infrastructure can shape "juridical relations and imaginaries. Infrastructure may create dependencies, engender cooperation, or structure conflict."[76] For example, community gardens and urban agriculture can enhance the nutritional health of a community by acting as a source of both food supply and income. Urban agriculture also offers a number of benefits over and above simply contributing to the food supply, including creating jobs, enriching education, promoting environmental sustainability, community-building, and neighbourhood beautification. However, Nathan McClintock has argued that urban agriculture can actually function as a form of neoliberalism, by shifting the burden of food production and provisioning healthy food in low-income areas from the state to non-profits and

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[71] Grant & Bennett Moses, *supra* note 62 at 196.
[72] Bert-Jaap Koops, "Criteria for Normative Technology: The Acceptability of 'Code as Law' in Light of Democratic and Constitutional Values" in Roger Brownsword & Karen Yeung, eds, *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Oxford: Hart Publishing, 2008) 157 at 157.
[73] Kingsbury, *supra* note 61 at 177.
[74] *Ibid* at 181-182.
[75] *Ibid* at 181-182.
[76] *Ibid* at 182.

community-based organizations.[77] Whether urban agricultural initiatives are a net positive may depend to a large extent on their siting and design.

Relatedly, Langdon Winner has famously observed that technology both *requires* legislation and *is* legislation, in the sense that "technical forms do, to a large extent, shape the basic pattern and content of human activity in our time."[78] Put differently, technical ensembles often demand particular kinds of routinized behaviour insofar as technologies contain specific forms and processes, such that "people are not at liberty to 'use' the instruments in an arbitrary manner but must see to it that the appropriate operating procedures and techniques are followed and that all of the material conditions for operations are met."[79] Under such conditions, "[t]he direction of governance flows from the technical conditions to people and their social arrangements, not the other way around."[80] Consequently, attention needs to be paid not just to technologies as subjects of regulation, but also the ways in which technologies themselves can function as objects of regulation.

4.2 Law's Intersections

4.2.1 Law and Society

Socio-legal scholars, who can be found in a number of different disciplines, are generally interested in the study of legal systems as social phenomena.[81] Several different theoretical and methodological approaches to socio-legal scholarship have evolved over the years. A forbearer of the modern law and society movement, Legal Realism served to expand "an awareness of the

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[77] Nathan McClintock, "Radical, reformist, and garden-variety neoliberal: coming to terms with urban agriculture's contradictions" (2014) 19:2 Local Environment 147.
[78] Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: The MIT Press, 1978) at 323.
[79] *Ibid* at 198.
[80] *Ibid* at 202.
[81] See Austin Sarat & Patricia Ewick, eds, *The Handbook of Law and Society* (Malden, MA: Wiley-Blackwell, 2015).

flaws, limitations, and openness of law", primarily in the context of judge-made law.[82] Reacting to the formalism of the late 19th and early 20th century, Legal Realists emphasized the indeterminacy of laws and precedents, which are capable of supporting multiple interpretations, partly due to the limits of language.[83] This critique extended beyond doctrine, and focused particular attention on the process of judicial decision-making. As Legal Realists contended, since judges, as human beings, inescapably operate in the context of their own perspectives and prejudices, real-world influences invariably have an effect on the outcomes of cases coming before the courts.[84]

Legal Realism has left an indelible mark on legal theory, especially in terms of its embrace of social scientific perspectives on law. More recently, so-called New Legal Realism has undertaken a renewed version of the project in its effort "to find successful ways to translate between law and social science."[85] Though the concept is "contested and in the process of development",[86] its big tent goal is to "work across the boundaries of diverse fields to create a genuinely interdisciplinary form of legal knowledge, with careful attention to the epistemological and normative questions involved."[87] Putting law in its broader context is key to "begin[ning] to produce a more accurate picture of the actual operation of the legal system" that does not turn on "ideological claims based on idealistic images of law."[88]

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82 Brian Z Tamanaha, "Understanding Legal Realism" (2009) 87 Texas L Rev 731 at 732. My focus here is particularly on the American legal realism that emerged as an identifiable movement in the 1920s.
83 See generally Brian Leiter, "American Legal Realism" in Dennis Patterson, ed, *A Companion to Philosophy of Law and Legal Theory*, 2d ed (Malden, MA: Blackwell Publishing Ltd, 2010) 249 at 262-263.
84 *Ibid*.
85 Elizabeth Mertz, "Introduction – New Legal Realism: Law and Social Science in the New Millennium" in Elizabeth Mertz, Stewart Macaulay & Thomas W Mitchell, eds, *The New Legal Realism: Translating Law-and-Society for Today's Legal Practice*, Volume 1 (New York: Cambridge University Press, 2016) 1 at 2.
86 *Ibid* at 4.
87 *Ibid*. See also Stewart Macaulay, "New Legal Realism: Unpacking a Proposed Definition" (2016) 6 UC Irvine L Rev 149.
88 Stewart Macaulay, "A New Legal Realism: Elegant Models and the Messy Law in Action" in Elizabeth Mertz, Stewart Macaulay & Thomas W Mitchell, eds, *The New Legal Realism: Translating Law-and-Society for Today's Legal Practice*, Volume 1 (New York: Cambridge University Press, 2016) 29 at 44.

Though there are many areas of distinction, the contemporary law and society movement, in a general sense, "depends on two rather modern ideas. The first is that legal systems are essentially man-made objects—social creations, in other words. The second … is the idea of cultural relativity. Law varies in time and space, according to the conditions of the culture in which it is embedded."[89] Based on these premises, law and society research is interested in studying the production or shaping of law within a given society, the impacts of laws, and feedbacks within the legal system.[90]

Law and society scholarship is particularly alert to the attenuating effects of culture and context. For example, Lawrence Friedman has argued that the lionization of the right to freedom to make individual choices has become a cornerstone of contemporary Western legalism.[91] This fixation on individualism has shaped the development of the modern legal system that reflects a particular set of values and norms. Though Friedman claims that his account aims to be descriptive, as opposed to evaluative,[92] there is often a critical thread underlying law and society scholarship, which seeks not only to identify the social systems and structures that are reflected in and through law, but also to delegitimize mainstream liberal legal thought and doctrine.

In particular, Critical Legal Studies and its various offshoots pushed back against a way of thinking and speaking about the law that reflected a "deep complacency about the current forms of liberal-democratic capitalism".[93] According to the dominant message of orthodox legal training, "'private ordering' in markets usually led to free and fair outcomes; if not, the problems were correctable through legislatures presumed to represent the relevant interest groups and

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[89] Lawrence M Friedman, "The Law and Society Movement" (1986) 38:3 Stanford L Rev 763 at 764.
[90] *Ibid* at 772-773.
[91] Lawrence Friedman, *The Republic of Choice: Law, Authority, and Culture* (Cambridge, MA: Harvard University Press, 1990).
[92] *Ibid* at 194.
[93] Robert W Gordon, "Some Critical Theories of Law and Their Critics" in David Kairys, ed, *The Politics of Law: A Progressive Critique*, 3d ed (New York: Basic Books, 1998) 641 at 642.

agencies presumed to possess technical expertise; the functions of law were the largely technical ones of proper interpretation and application of rules and principles."[94] By contrast, critical legal scholarship attempted to both map and resist the belief systems suffused within law that "convince people that all the many hierarchical relations in which they live and work are natural and necessary."[95]

Socio-legal scholarship usefully supplements the insights offered by STS, as discussed in Chapter 3, "by highlighting law as a bounded and distinct technique of social ordering, with its own particular processes, techniques, modes of socialization, culture, and belief systems."[96] In seeking to understand the intersections between law, science, technology, and society, my analysis hinges on the recognition that "[l]egal institutions cannot be understood without seeing the entire social environment".[97] Attention to science and technology within a socio-legal framework therefore recognizes that "the law today not only interprets the social impacts of science and technology but also constructs the very environment in which science and technology come to have meaning, utility, and force."[98]

4.2.2 Law and Science

Science is important to law in many ways. Scientific information "pre-figures and subsequently sets a role in shaping regulatory regimes, grounding standard-setting, and guiding the application of the law in licensing systems. It also plays a key substantive role when regulatory decisions are

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[94] *Ibid*.
[95] *Ibid* at 648.
[96] Alex Faulkner, Bettina Lange & Christopher Lawless, "Introduction: Material Worlds: Intersections of Law, Science, Technology, and Society" (2012) 39:1 JL & Soc'y 1 at 8.
[97] Susan S Silbey & Austin Sarat, "Critical Traditions in Law and Society Research" (1987) 21:2 Law & Soc'y Rev 165 at 165.
[98] Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (Cambridge, MA: Harvard University Press, 1995) at 16.

challenged."[99] Notwithstanding these intersections, it is straightforward enough to state that law and science are conceptually distinct fields. For one, law and science have different methods, as well as different goals. Because "the legal system in general is a problem-solving system … [it] must produce answers, right or wrong, to the questions and issues raised. Science or philosophy can dismiss a problem as currently insoluble; the law cannot."[100]

There are numerous other contrasts that can be struck between law and science, often in binary terms. As Sheila Jasanoff summarizes:

> science seeks truth, while the law does justice; science is descriptive, but law is prescriptive; science emphasizes progress, whereas the law emphasizes process. These simplified characterizations restate in varying ways the insight that fact-finding in the law is always contingent on a particular vision of (and mechanism for) delivering social justice. Scientific claims, by contrast, are thought to lack such contingency.[101]

Despite the durability of this view, Jasanoff and others in the STS tradition have worked to elucidate the many ways in which this crude portrayal is wanting. Studying the interplay between law and science brings to the fore how "the cultures of law and science are … mutually constitutive … Understanding how these institutions *jointly* produce our social and scientific knowledge, and our relationships with technological objects, is indispensable to any effective attempt at policy reform."[102]

The relationship between law and science is an innately uneasy one:[103] "science as a discipline is, in many ways, more comfortable with risk and uncertainty than law, and one result

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[99] Karen Morrow, "Genetically Modified Organisms and Risk" in Luc Bodiguel & Michael Cardwell, eds, *The Regulation of Genetically Modified Organisms: Comparative Approaches* (New York: Oxford University Press, 2010) 54 at 67.
[100] Friedman, "The Law and Society Movement", *supra* note 89 at 775.
[101] Jasanoff, *Science at the Bar, supra* note 98 at 7.
[102] *Ibid* at 8.
[103] See e.g. Margaret A Berger & Lawrence M Solan, "The Uneasy Relationship between Science and Law: An Essay and Introduction" (2008) 73:3 Brooklyn L Rev 847.

of this is that the status of science as a co-traveller with law has become ever more strained."[104] Law and policy also faces disconnects with science when it comes to time frames, standards of proof, and ethical obligations.[105] Yet, law and science have long joined forces in the project of truth-finding.[106] This can be partially attributed to the fact that science is seen to be a salve for "the experience of uncertainty and the discomfort of difficult legal decisions."[107]

Feldman has argued that law's faith in science takes two forms: in one, legal actors "try to adopt the mantle of science", and in the other, law simply defers to scientists and scientific expertise.[108] Regardless of the form that is taken, "[w]hat unites all of these attempts to reach for science is the view that science … can solve the problems of law."[109] Though science has been and can continue to be of real use to the law, efforts to bring the perceived clarity of science into the messy arena of the law fail to account for the value choices that are made during every step of the scientific process. They also do a disservice to the law's task of determining *legal* legitimacy, as opposed to *scientific* legitimacy.

Questions and considerations about epistemology are crucial for teasing out the ways in which the legitimacy of science and law are constructed and upheld in society. Epistemology can be defined as the study of knowledge, including its sources, its structure, and its limits.[110] Epistemological considerations are relevant to the study of law and science insofar as they are

[104] Karen Morrow, "Genetically Modified Organisms and Risk" in Luc Bodiguel & Michael Cardwell, eds, *The Regulation of Genetically Modified Organisms: Comparative Approaches* (New York: Oxford University Press, 2010) 54 at 57.
[105] Jonathan W Moore et al, "Towards linking environmental law and science" (2018) 3 FACETS 375.
[106] Jasanoff, *Science at the Bar*, *supra* note 98 at 42.
[107] Feldman, *supra* note 65 at 1.
[108] *Ibid* at 19-21.
[109] *Ibid* at 118.
[110] Matthias Steup, "Epistemology", *The Stanford Encyclopedia of Philosophy* (Winter 2018 Edition), Edward N Zalta, ed, online: <https://plato.stanford.edu/archives/win2018/entries/epistemology/>.

among the most powerful truth-producing and truth-adjudicating institutions in our society,[111] and therefore wield considerable authority, especially in dominant, positivist incarnations that turn on a stark bifurcation between so-called “facts” (that are knowable and true in some absolute sense) and “values” (that are subjective and personal).

The fact-value dichotomy rests on an assumption that it is possible to separate the objective from the subjective, and that certain actors are best positioned to carry out this filtering. However, “[t]here is no way for the law to access a domain of facts untouched by values or social interests. Scientific claims that are imported into the legal process are colored not only by the interests of the offering parties but also by the social, cultural, and political commitments of other actors in society”.[112] The production and reception of knowledge are decidedly not apolitical: indeed, recent research has found that political orientation can affect belief in scientific and unscientific statements, with one study finding a correlation between liberal ideology, a general increase in belief of facts, and greater agreement with truth-promoting values.[113]

Beyond individual actors, there are significant structural implications of the ways in which power is channeled through epistemology. Epistemic authority, which “is conferred in a social context”,[114] grants license to make important decisions (for oneself and for others) based on a certain degree of perceptual and intellectual competence. Epistemic authority “is conferred on persons or groups through social, political, and economic practices, as well as through sexist,

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[111] Simon A Cole & Alyse Bertenthal, “Science, Technology, Society, and Law” (2017) 13 Ann Rev L & Social Science 351 at 352.
[112] Jasanoff, *Science at the Bar, supra* note 98 at 207.
[113] Mary M Medlin, Donald F Sacco & Mitch Brown, “Political Orientation and Belief in Science in a U.S. College Sample” (2019) Psychological Reports, DOI: <10.1177%2F0033294119889583>.
[114] Marianne Janack, “Standpoint Epistemology Without the ‘Standpoint’?: An Examination of Epistemic Privilege and Epistemic Authority” (1997) 12:2 Hypatia 125 at 133.

racist, and classist assumptions about reliability, intelligence, and sincerity."[115] Consequently, in addition to the disciplines of science and law holding a higher degree of epistemic authority, there are conscious and unconscious biases operating within these disciplines that advantages some individuals and disadvantages others.[116] In this way, "[e]pistemological choices about whom to trust, what to believe, and why something is true are not benign academic issues."[117]

The danger of privileging certain kinds of expertise and perspectives is compounded by the fact that "[e]xpertise has historically served class power. The bias in favor of representing the interests of a narrow ruling group is strongly entrenched."[118] In drawing connections between the contingency of scientific knowledge and the implications for environmental justice, Ottinger, Barandiarán and Kimura write that often, science

> reflects the interests of the political and economic elite and the worldviews of Western scientists in two ways that are particularly consequential for environmental justice. … [T]he procedural and interpretive choices involved in scientific research itself necessarily entail value judgments that scientists too often make without an understanding of how their values might differ from those of marginalized communities.[119]

Indeed, this unfortunate reality is reflected in the fact that despite a growing acknowledgement of Indigenous Traditional Knowledge and its benefits, it remains subordinate to Western scientific knowledge in many ways. As Borrows puts it, "[Indigenous] knowledge has often been delegitimated and thus concealed from wider public view. So-called 'democratic' institutions

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[115] *Ibid* at 130.
[116] "People who appear to be white, male, upper middle or middle class, and well educated generally carry more epistemic authority on their shirtsleeves. While those of us who are not upper-middle-class white men may be epistemic authorities in some circumstances (with respect to our children, for example), our authority is usually trumped by 'experts'—who are often upper-middle-class white men." *Ibid* at 132.
[117] Patricia Hill Collins, *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*, 2d ed (New York: Routledge, 2000) at 252.
[118] Andrew Feenberg, *Questioning Technology* (New York: Routledge, 1999) at 143.
[119] Gwen Ottinger, Javiera Barandiarán & Aya H Kimura, "Environmental Justice: Knowledge, Technology, and Expertise" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2016) 1029 at 1032 [references omitted].

repress Indigenous participation, degrade their environments, and thereby hinder the extension of knowledge about how to coexist with the environment."[120]

Ultimately, the conditions of knowledge production, advancement, and negotiation have a profound impact on what kind of information is available, to whom, and for what purposes. Scientific and technical knowledge is increasingly treated not only as a resource, but as a resource to be commercialized and controlled for certain ends.[121] As such, better understandings of the epistemic dimensions of justice-related concerns arising from science and technology must begin with an acknowledgment that "moral and epistemic discourses are *not* easily disentangled; that the moral order and the cognitive order of society are not two distinct aspects of society, but are rather intimately intertwined and perhaps even one and the same thing."[122]

When it comes to law, "legal principles and arguments structure the basic interpretive framework within which courts decide which forms of institutionalized expertise they will defer to and which not."[123] The example of expert evidence is instructive here, as the "inflationary use" of expert advice has had the paradoxical effect of producing more uncertainty by fueling battles between experts and counter-experts.[124] The proliferating quantity of expert evidence is not necessarily correlated to quality, and a related concern is that "[i]n the commodity market of expertise, persuasiveness more than raw scientific credentials determines a witness's worth."[125] In something of a reverse *ad hominem* effect, various markers that are unrelated to the legal questions to be determined, such as race or class, may accord some experts an advantage over

[120] Borrows, *supra* note 58 at 425.
[121] Sergio Sismondo, *An Introduction to Science and Technology Studies*, 2d ed (Malden, MA: John Wiley & Sons, Ltd, 2010) at 189-204.
[122] Janack, *supra* note 114 at 136 [emphasis in original]. See also Theodore L Brown, *Imperfect Oracle: The Epistemic and Moral Authority of Science* (University Park, PA: Pennsylvania State University Press, 2009).
[123] Jasanoff, *Science at the Bar*, *supra* note 98 at 212.
[124] Karin Bäckstrand, "Civic Science for Sustainability: Reframing the Role of Experts, Policy-Makers and Citizens in Environmental Governance" (2003) 3:4 Global Environmental Politics 24 at 30.
[125] *Ibid* at 46.

others. Meanwhile, the use of expert evidence in and of itself can put a gloss of certainty on issues that are, in reality, far more indeterminate.

The Supreme Court of Canada has recognized that "there is a danger that expert evidence will be misused and will distort the fact-finding process. Dressed up in scientific language which the jury does not easily understand and submitted through a witness of impressive antecedents, this evidence is apt to be accepted by the jury as being virtually infallible and as having more weight than it deserves."[126] However, judges, too, are not immune from this risk. Thus, we need to promote clear and plain communication from scientific actors engaging in the legal process, with the goal being "to encourage translation of scientific terms into understandable concepts" that are not only comprehensible, but useful for the tasks that the legal system is designed to accomplish.[127]

More broadly, legal processes shape "which kinds of knowledge are either accepted as 'evidence' or labelled as 'biased'. Thus 'science' and 'knowledge' come to be constructed (and legitimized and de-legitimized) in particular ways when put to work as legal evidence."[128] The mutable role of knowledge comes into stark relief in the case of new and emerging technologies, where there are multiple known unknowns and unknown unknowns, rendering epistemological reflections a crucial part of examining contemporary relationships between science, technology, and legal processes.[129] As Jasanoff puts it, "[i]f legally relevant knowledge is always interest-laden, then the choice between alternative scientific accounts necessarily involves normative, even political, judgments. Willingness to accept a particular knowledge claim amounts to an

[126] *R v Mohan*, [1994] 2 SCR 9, 89 CCC (3d) 402 (SCC).
[127] Feldman, *supra* note 65 at 194.
[128] Melissa Leach, Ian Scoones & Andy Stirling, *Dynamic Sustainabilities: Technology, Environment, Social Justice* (Washington, DC: Earthscan, 2010) at 147.
[129] Emilie Cloatre & Martyn Pickersgill, "Introduction" in Emilie Cloatre & Martyn Pickersgill, eds, *Knowledge, Technology and Law* (New York: Routledge, 2015) 1 at 1.

expression of confidence in the institutions and practices that produced it."[130] The basis of this confidence needs to be continually interrogated to ensure that it is well founded.

Against this backdrop, the growth of "knowledge politics" as its own field of political activity can be seen as "a response to growing public concerns about and objections to the use of new scientific and technical knowledge in modern societies."[131] Though science and law are not coterminous, the ways in which they overlap and intersect are highly significant: scientific research establishes the grounds for technological innovations, and affects the ways their resulting consequences are measured and understood by the law. As the gap between the perceived benefits and burdens of technological capacities grows, so too will calls for more proactive regulation that is more attentive to the problematic, uncertain, and conflicting nature of scientific and technical knowledge and its applications.[132] Consequently, "[w]hat is needed is not merely a transmission of knowledge from scientists to policymakers, but rather a multi-directional flow of knowledge between the worlds of science, policy and practice, with each part of this nexus informed by the other two."[133]

4.2.3 Law and Technology

While the products and processes of science and technology are important to consider in their own respects, it is also imperative to consider them more broadly in terms of their abilities to "order and govern society",[134] as well as the complex and myriad ways in which they interact with law. The law "not only protects and propertizes innovation but also revises, in ways that are

[130] Jasanoff, *Science at the Bar, supra* note 98 at 209.
[131] Nico Stehr, *Knowledge Politics: Governing the Consequences of Science and Technology* (New York: Routledge, 2016) at 5.
[132] *Ibid* at 13.
[133] IPES-Food, *The New Science of Sustainable Food Systems: Overcoming Barriers to Food Systems Reform* (Brussels: International Panel of Experts on Sustainable Food Systems, 2015), online: <http://www.ipes-food.org/_img/upload/files/NewScienceofSusFood.pdf> at 8.
[134] Sheila Jasanoff, *The Ethics of Invention: Technology and the Human Future* (New York: W.W. Norton & Company, 2016) at 9.

as problematic as they are intriguing, what counts as nature, that is, where we draw the ever-contestable line between nature and technology, discovery and invention."[135] As such, "[l]egal rules and principles have an interactive, dynamic and complex relationship with technological developments."[136]

Because it directly affects both specific and systemic forms of human conduct, "[t]echnology can be seen to be both an object of law, and as a means (sometimes unintended) of engendering new laws and legislative understandings."[137] In either of these forms, law can serve to both establish and restrain power, and technologies can shift power relationships in "subtle and often contradictory ways."[138] A fulsome grasp of the relationship between technology and law should therefore include an awareness of the unpredictable outcomes that can arise due to technological change, and the legal shifts that can follow.

All legal institutions—legislatures, regulatory agencies, and the courts—are implicated in shaping technological trajectories, though not necessarily in a predictable order or with foreseeable outcomes. It is not simply the case that legislatures make rules, regulatory agencies apply them, and courts resolve any disputes that arise. Often, "[d]isputes come to the courts before, not after, other governmental institutions have had the opportunity or shown the inclination to consider them. Judges therefore have a particularly authoritative voice in shaping social policies for new technologies."[139] In many instances, it is judges, rather than legislatures, who first weigh in on how and why new and emerging technologies are to be regulated. However, "[e]ven before technology arrives at moments of formal construction in judicial

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135 Mario Biagioli & Marius Buning, "Technologies of the law/ law as a technology" (2019) 57:1 History of Science 3 at 7.
136 Arthur J Cockfield, "Towards a Law and Technology Theory" (2003) 30:3 Manitoba LJ 383 at 400.
137 Faulkner, Lange & Lawless, *supra* note 96 at 16.
138 Bert-Jaap Koops, "Law, Technology, and Shifting Power Relations" (2010) 25:2 BTLJ 973 at 978.
139 Jasanoff, *Science at the Bar, supra* note 98 at 180.

opinions or legislation, researchers, judges, and policy-makers come to the technology with some sense-making apparatus at work."[140] Thus, there is no point at which any given technology can be said to be operating outside of the social processes of constructing meaning.

In surveying the existing scholarship to date, it appears that the development of comprehensive theories about the relationship between law and technology has been given short shrift. Attention has instead been devoted to more specialized investigations into areas like intellectual property law,[141] cyberlaw,[142] robotics law,[143] entertainment law,[144] and surveillance studies.[145] Although technology-specific inquiries are certainly useful, efforts at articulating more coherent explanatory models for the relationship between law and technology are clearly needed, because "technological developments can undermine important interests and values that the law seeks to protect. A better understanding of the ways that the law reacts to and provokes technological change could promote more informed policy analysis."[146] This is not just a descriptive endeavour, but also a constructive one, as "[a]n appropriate treatment of technology within a law and society tradition … requires academics to transcend thinking of their task as of identifying gaps in the law and suggesting ways to plug them."[147]

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[140] Meg Leta Jones, "Does Technology Drive Law? The Dilemma of Technological Exceptionalism in Cyberlaw" (2018) 2 Journal of Law, Technology & Policy 101 at 136.
[141] See e.g. Michele Boldrin & David K Levine, *Against Intellectual Monopoly* (New York: Cambridge University Press, 2008).
[142] See e.g. Frank H Easterbrook, "Cyberspace and the Law of the Horse" (1996) 11 U Chi Legal F 207; Lawrence Lessig, "The Law of the Horse: What Cyberlaw Might Teach" (1999) 113 Harvard L Rev 501; Daniel J Ryan et al, "International Cyberlaw: A Normative Approach" (2011) 42 Geo J Int'l L 1161.
[143] See e.g. M Ryan Calo, "Open Robotics" (2011) 70:3 Md L Rev 571; Jack M Balkin, "The Path of Robotics Law" (2015) 6 Cal L Rev 45.
[144] See e.g. William W Fisher III, *Promises to Keep: Technology, Law, and the Future of Entertainment* (Stanford, CA: Stanford University Press, 2004).
[145] See e.g. Arthur J Cockfield, "Who Watches the Watchers? A Law and Technology Perspective on Growing Government and Private Sector Surveillance" (2003) 29 Queen's LJ 364.
[146] Cockfield, "Towards a Law and Technology Theory", *supra* note 136 at 383.
[147] Thayyil, *supra* note 68 at 2.

There are several notable problems observable at the intersection of law and technology that would benefit from elaboration. For one, law, in many ways, has struggled to contend with the rapidity of technological change, which has led many to claim that law either fundamentally cannot or has failed in its efforts to try to keep up with technology. By its very nature, the binding nature of precedent within the common law system means that law is much slower to evolve than technology, which faces no analogous internal constraints.[148] Case law advances "incrementally and gradually, and legislation … only sporadically."[149]

This gap between technologies and legal/ethical oversight has been referred to as "the pacing problem".[150] The pacing problem is said to have at least two dimensions: first, existing legal frameworks being based on a static view of society and technology; and second, the full range of legal institutions (legislatures, regulatory agencies, and the courts) slowing down with respect to their capacity to respond to technological change.[151] More specifically, Lyria Bennett Moses has identified four potential legal problems that frequently follow technological change, including: "(1) the potential need for laws to ban, restrict, or, alternatively, encourage a new technology; (2) uncertainty in the application of existing legal rules to new practices; (3) the possible overinclusiveness or under-inclusiveness of existing legal rules as applied to new practices; and (4) alleged obsolescence of existing legal rules."[152] In all of these situations, resolving the question of how the law *should* respond to technological change often depends on

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[148] Feldman, *supra* note 65 at 89: "law is fundamentally anchored in the past through precedent and limited in its movement by the need for acceptance, defined only by the prevailing moral structures of the relevant society."
[149] Marchant, "Science, Technology, and Law", *supra* note 60 at 1712.
[150] See generally Gary E Marchant, Braden R Allenby & Joseph R Herkert, eds, *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem* (New York: Springer, 2011).
[151] Gary E Marchant, "The Growing Gap Between Emerging Technologies and the Law" in Gary E Marchant, Braden R Allenby & Joseph R Herkert, eds, *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem* (New York: Springer, 2011) 19 at 23.
[152] Lyria Bennett Moses, "Recurring Dilemmas: The Law's Race to Keep Up With Technological Change" (2007) U Ill JL Tech & Pol'y 239 at 243.

what one considers to be the desired outcome, or what one understands the law's purpose to be in this context.

The potential for a lag between law and technology to result in impediments to research and innovation is a source of acute frustration for technological optimists, who believe that technological progress and social progress are strongly correlated, and should therefore be pursued bullishly. However, this lag can also "permit more analysis and sober thought prior to policy implementation. Moreover, the unpredictable nature of technological developments suggests that, in many circumstances, legal reform may not be suitable, at least not until the implications of the technological changes can be better understood."[153] In between these two ends of the spectrum, there are situations where "law must struggle with technological indeterminacy as best as it can and move forward to protect interests and values."[154]

Ascertaining which tack to take in a given circumstance is complicated by the fact that there are normative implications evident when it comes to both the timing of decision-making and the scale of technologies, with faster and bigger often assumed to be better than slower and smaller. Scientific and technological research and development is often presented as a "race", either against the law and other regulatory processes, against research and development taking place in other countries, or against the problems that new and emerging technologies are intended to solve. As a case in point, the federal government announces unambiguously on ISED's website that: "The innovation race is on!"[155]

The race metaphor can be objected to on numerous grounds. For one, "[n]ot only does law not linearly follow technology, a great deal of legal work shapes technology and the way in

[153] Cockfield, "Towards a Law and Technology Theory", *supra* note 136 at 403.
[154] *Ibid*.
[155] Government of Canada, "Innovation for a Better Canada", online: <https://www.ic.gc.ca/eic/site/062.nsf/eng/home> (last updated March 20, 2019).

which it will be understood in the future."[156] The characterization of the relationship between law and technology as some kind of contest misconstrues the ways in which their paths are intertwined, as opposed to parallel.

Further, law and technology are not commensurable. As David Grant and Lyria Bennett Moses put it, "although law and technology both change over time, there is no sense in which one can measure their relative 'speed' … The differences [between law and technology] mean that 'speed' cannot be measured in common 'units', and thus the two are non-comparable."[157] Thus, the "implied assertion that speed equates to victory"[158] fundamentally misapprehends the function of law in relation to technology. Accordingly, "[t]he inability of law to perfectly influence technology is not a failure of law and does not mean that it has not 'kept up' with Technology. It is an inevitability. However, that does not mean that we cannot conceive of better ways to use law to influence technological development and design."[159] In order for this to be the case, we must dispense with the notion that law can win a race against technology, or that it would be desirable to do so.[160]

That being said, it is clear that the pacing problem is very real. Increasingly, we are seeing technological changes affect existing configurations of values and interests in novel ways. Arthur Cockfield suggests that when confronted with such situations, courts and regulators can adopt one of two approaches. The first is a "liberal" approach that is more flexible and forward-looking, where legal analysis

> (a) explores the complex interplay between law and technology; (b) recognizes that the law should respond directly to technology developments that threaten values and interest ("law is technology"); (c) acknowledges situations where the law can encourage uses of technologies that protect interests ("technology is law"); and (d) promotes

[156] Leta Jones, *supra* note 140 at 130.
[157] Grant & Bennett Moses, *supra* note 62 at 195.
[158] *Ibid* at 195.
[159] *Ibid* at 218.
[160] *Ibid* at 195.

> consequential analysis that strives to fit policy developments within current and anticipated technological environments ("is the legal rule scientific?").[161]

This approach, in its various forms, "calls for more technologically sensitive ways of looking at the law",[162] despite the uncertainty that might be engendered in the process.

The second approach is a more "conservative" one that rigidly emphasizes the need to follow precedent and traditional doctrine, and is "more closely aligned with the instrumental theory of technology that views technological development as separated from economic, political, cultural and social processes."[163] Though the conservative approach may be more readily associated with the safeguarding of existing interests, Cockfield concludes that by starting from the interests that the law currently protects and then seeking legal analysis and solutions that could support the protection of those interests, it is in fact "the liberal approach, in a seeming paradox, [which] better protects traditional interests."[164] Thus, the issue of whether or not "a legal rule, given a current or anticipated technological environment, will promote a desired policy outcome"[165] needs to first address the question of whether or not the traditional interest at stake is one that should be protected. Cockfield uses examples involving contract, tax, and privacy law to show that "well-meaning reform efforts could lead to adverse social consequences when policy-makers do not take into account how a legal rule will 'fit' within a given technological environment."[166]

Careful reflection on whose interests and values are being considered and prioritized (and what kind of scales, metrics, and perspectives are being used for evaluation) in carving out law's response to technological developments in any given context is imperative, because the

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[161] Cockfield, "Towards a Law and Technology Theory", *supra* note 136 at 399-400.
[162] *Ibid* at 414.
[163] *Ibid* at 399.
[164] *Ibid* at 399.
[165] *Ibid* at 407.
[166] *Ibid* at 395.

sheltering of traditional interests has obvious potential to create or preserve (un)favourable outcomes for some groups over others. Here, I draw on Reva Siegel's notion of "preservation-through-transformation", used to characterize a dynamic in which "elements of continuity *and* change are at stake in the process".[167] As Siegel explains, "[a] status regime is modernized (or deformalized) when, despite changes in its rules and rhetoric, it continues to distribute material and dignitary privileges ("social goods") in such a way as to maintain the distinctions that comprise the regime (e.g., constitute "race" or "gender") in relatively continuous terms."[168]

Among other examples that can be drawn on, the case studies in Chapter 6 demonstrate that technologies that seemingly operate to enable emancipatory possibilities can actually serve as unexpected sites of neoliberalization, especially if they remain shackled to existing structures of power. The illusion of change through technology can undermine a program of change through law, the latter of which may be more impactful when it comes to attaining certain kinds of social goals and broader structural reforms. In undertaking such a project, "[m]ultiple intellectual resources and avenues are necessary to make sense of the interface between law and technology, and to understand how categories of law, technology and society construct and shape each other."[169] Thus, STS, critical socio-legal studies, and conclusions derived from empirical awareness rather than simply idealized models can all contribute to the goal of "a legal system that continues to treat different technologies fairly and effectively as technology evolves."[170]

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[167] Reva B Siegel, ""The Rule of Love": Wife Beating as Prerogative and Privacy" (1996) 105:8 Yale LJ 2117 at 2184. I thank Jessica Eisen for bringing my attention to this work.
[168] *Ibid*.
[169] Thayyil, *supra* note 68 at 21.
[170] Bennett Moses, "Recurring Dilemmas", *supra* note 152 at 239.

4.2.4 Law and Justice

Philosophers and jurists have ruminated on the question about what the appropriate relationship between justice and the law is for centuries.[171] This question is complicated, to say the least—if only because, despite its centrality as a moral, political, and legal concept, discussions of what justice means in theory and/or entails in practice remain far from settled. Major conceptual contrasts exist in the debate, including "between conservative and ideal justice, between corrective and distributive justice, between procedural and substantive justice, and between comparative and non-comparative justice."[172] This is not a philosophical treatise, and I do not aim to delve deeply into the quagmire created by scrutinizing all of these possible distinctions. For my own purposes, it suffices to acknowledge, at this stage, that these complexities exist.

Although I make no effort to conclusively say what justice is, I can make some tentative comments on what justice is not. For one, justice is not the same thing as ethics. Laura Mamo and Jennifer Fishman explain that "[e]thics and justice have different theoretical traditions, goals, and domains of practice. The theoretical tradition of ethics is tied primarily to western moral philosophy and refers to a rational and methodical application of values or principles for creating rules of conduct and moral courses of action."[173] Given this orientation, considerations of ethics, in a very practical sense, have permeated discrete professional domains, including science, technology, business, and law, requiring that their actors adhere to at least a minimum threshold

[171] See e.g. Julius Stone, *The Province and Function of Law: Law as Logic Justice and Social Control: A Study in Jurisprudence* (Cambridge, MA: Harvard University Press, 1950); Anthony D'Amato, "On the Connection Between Law and Justice" (1993) 26 UC Davis L Rev 527; Robin West, *Caring for Justice* (New York: New York University Press, 1997).
[172] David Miller, "Justice" in Edward N Zalta, ed, *The Stanford Encyclopedia of Philosophy* (Fall 2017 Edition), online: <https://plato.stanford.edu/archives/fall2017/entries/justice/>.
[173] Laura Mamo & Jennifer R Fishman, "Why Justice?" Introduction to the Special Issue on Entanglements of Science, Ethics, and Justice" (2013) 38:2 Science, Technology & Human Values 159 at 161.

of behaviour in carrying out their roles. Ethics, in this way, can be seen as pertaining to behaviour at micro-levels.

Conversely, justice "is a public matter focused on common human interests, equitable distribution of social goods, resources, and opportunities, and a commitment to fostering empowered political participation."[174] Justice is not simply about determining whether an individual decision is "good" or "bad". Justice has a notably cultural component, and is often associated with punishments, rewards, fairness, and equality at the societal level.

Most people would agree that justice is an ideal worth striving for, but it has been much more challenging to find common ground on the issue of what justice ultimately looks like, and how justice can be expressed through the law. Based on one understanding, "the legal system is a system of the application of justice to human conflicts."[175] However, this statement leaves vague what kinds of results law, policy, and judicial decision-making should seek to produce. When it comes to redressing social and economic inequalities through the law, the demands of justice can take very different shapes.[176] For those who take a formalistic approach, all citizens are seen as equal before the law, and legal principles should be applied impartially to all similarly situated cases.[177] Indeed, the maxim that "like cases should be treated alike",[178] or that the "law must be applied equally to everyone" is one of the primary tenets of the rule of law within a liberal democratic state.[179]

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174 *Ibid*.
175 D'Amato, *supra* note 171 at 581.
176 Michael J Sandel, *Justice: What's the Right Thing to Do?* (New York: Farrar, Straus & Giroux, 2009) (exploring the strengths and weaknesses of thinking about justice from the approaches of (1) maximizing welfare, (2) respecting freedom and individual rights, and (3) theories that see justice as tied to conceptions of virtue and the good life).
177 Craig L Carr, "The Concept of Formal Justice" (1981) 39:3 Philosophical Studies 211.
178 Alfonso Ruiz Miguel, "Equality before the Law and Precedent" (1997) 10:4 Ratio Juris 372; Andrei Marmor, "Should Like Cases Be Treated Alike?" (2005) 11 Legal Theory 27.
179 A basic definition of the rule of law is that "government officials and citizens are bound by and abide by the law": Brian Z Tamanaha, "The History and Elements of the Rule of Law" (2012) Sing JLS 232 at 233.

At the same time, there has also been recognition that a general requirement that like cases be treated alike can actually lead to injustice.[180] Accordingly, others, who take a more substantive approach to justice, have argued that it is important to be sensitive to and account for relevant grounds of difference, including race, class, and gender.[181] In so doing, there is a need to move away from understanding "difference as opposition—identifying equality with sameness and difference with deviance or devaluation."[182] Acknowledging that something or someone is different than some commonly accepted norm is not automatically to cast it as "lesser than". While construing any group-related difference to be irrelevant to a person's moral worth offers a clear and unambiguous standard of equality, blindness to these salient characteristics is neither fully possible nor desirable. Truly just outcomes for marginalized groups cannot be borne out of this naïve and utopian ideal.

The state has a legitimate and justifiable role to play in ameliorating situations of injustice, including in the form of affirmative government support to allow those with less power "to obtain meaningful access to the choices, opportunities, and living conditions to which negative rights theoretically entitle them."[183] The extension of formal rights to a wider range of persons has certainly been beneficial in many respects. However, "[t]he achievement of formal equality does not eliminate social differences, and rhetorical commitment to the sameness of persons makes it impossible even to name how those differences presently structure privilege and oppression."[184] Institutional and structural factors continue to generate systemic patterns of

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[180] *Ibid* at 240-243 (discussing the limitations of formal legality).
[181] Nancy Ehrenreich, "Foreword: Conceptualizing Substantive Justice" (2010) 13:3 J Gender Race & Just 533; Iris Marion Young, *Justice and the Politics of Difference* (Princeton, NJ: Princeton University Press, 1990). Young argues for a "politics of difference" that recognizes "that equality as the participation and inclusion of all groups sometimes requires different treatment for oppressed or disadvantaged groups. To promote social justice … social policy should sometimes accord special treatment to groups." (at 157)
[182] Young, *ibid* at 11.
[183] Ehrenreich, *supra* note 181 at 542.
[184] Young, *supra* note 181 at 164.

exclusion and marginalization, evidencing a notable gap between the law in books and the law in action. Bridging this gap requires not just theoretical but also empirical research into why it exists and what can be done about it.

Beyond the realm of legal justice, which is concerned primarily with how judges decide the cases that come before them, and how legislatures create rules, it bears mentioning that there are a few overarching theories of political justice that have dominated in Western philosophy (namely, utilitarianism, contractarianism, and egalitarianism).[185] Philosophical theories of justice "typically derive[] fundamental principles of justice that apply to all or most societies, whatever their concrete configuration and social relations, from a few general premises about the nature of human beings, the nature of societies, and the nature of reason."[186] However, as David Miller points out, none of these general frameworks adequately captures our convictions about "what justice requires us to do in a wide and varied range of circumstances."[187] As a result, "we will need to accept that no comprehensive theory of justice is available to us; we will have to make do with partial theories – theories about what justice requires in particular domains of human life."[188]

In virtually all domains, many ethical theorists define justice "almost completely in terms of distribution, either of material goods such as wealth or of nonmaterial goods such as equal opportunity."[189] Framed thusly, moral questions about distribution are central to thinking about the relationship between law and justice, because "[t]he economic, political, and social frameworks that each society has—its laws, institutions, policies, etc.—result in different

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[185] Miller, *supra* note 172.
[186] Young, *supra* note 181 at 3.
[187] Miller, *supra* note 172.
[188] *Ibid*.
[189] Kristin Shrader-Frechette, *Environmental Justice: Creating Equality, Reclaiming Democracy* (New York: Oxford University Press, 2002) at 24.

distributions of benefits and burdens across members of the society. … The structure of these frameworks is important because the distributions of benefits and burdens resulting from them fundamentally affect people's lives."[190] Yet, placing too strong an emphasis on distribution or allocation of resources may inappropriately restrict the scope of justice, in that it "fails to bring social structures and institutional contexts under evaluation."[191]

Iris Marion Young has argued for a notion of justice that begins with the concepts of domination and oppression, as opposed to centring on the concept of distribution.[192] Domination and oppression are conceived of as disabling constraints that inhibit or prevent people's ability or capacity to fully participate in social life, including determining the conditions and consequences of their actions.[193] I agree with Young that while distributive issues are certainly important, there are many "claims about justice and injustice in our society [that] are not primarily about the distribution of income, resources, or positions."[194] The thrust of Young's position is that:

> Economic domination in our society occurs not simply or primarily because some persons have more wealth and income than others, as important as this is. Economic domination derives at least as much from the corporate and legal structures and procedures that give some persons the power to make decisions about investment, production, marketing, employment, interest rates, and wages that affect millions of other people.[195]

Even while questions about distribution can go to nonmaterial goods, the effect of couching a discussion of justice solely or even primarily in distributive terms may serve an ideological function by "implicitly support[ing] the institutional relations it assumes as given."[196] Further, other dimensions of justice, like intergenerational and interspecies considerations, and

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[190] Julian Lamont & Christi Favor, "Distributive Justice" in Edward N Zalta, ed, *The Stanford Encyclopedia of Philosophy* (Fall 2017 Edition), online: <https://plato.stanford.edu/archives/win2017/entries/justice-distributive/>.
[191] Young, *supra* note 181 at 20.
[192] *Ibid*.
[193] *Ibid* at 38-39.
[194] *Ibid* at 20.
[195] *Ibid* at 23.
[196] *Ibid* at 198.

relatedly, participative capacity, are pushed into the background by a framework that focuses on distribution. For example, in the context of food justice, elaborated on later in this chapter, Clement Loo remarks that "[t]o properly diagnose and address disparities in food systems, those concerned with food justice must examine the participative inequalities that are the basis of material and distributive injustices."[197]

As a critical legal scholar, I am wary of the universalizing tendencies of existing philosophical theories of justice, and prefer to draw attention to the specific circumstances (historical, social, political, economic) in which a particular justice-related claim is being made. Consequently, I adopt a contextual, relational understanding of what justice means and/or demands in the remainder of this work. Instead of relying on any overarching theory of justice—which may, in any event, be an impossibility—I contend that an understanding of justice rooted in core societal principles and values with respect to what is necessary for human flourishing, coupled with commitments to addressing injustice, in its various manifestations, at every level of process, is perhaps a better way of producing just outcomes and capturing a range of justice-related concerns.

To this end, "the concept of justice may be less important for what it *is* than for what it *does*."[198] In particular, the concept of justice can be used as a tool to shift the parameters of discourse away from concerns about efficiency, and engaging instead with concerns about accountability.[199] Within such an account, rather than being seen as synonymous with justice, law is simply one tool for achieving justice. Looking to the efforts of various justice movements

[197] Clement Loo, "Towards a More Participative Definition of Food Justice" (2014) 27 J Agric Environ Ethics 787 at 788.
[198] Benjamin K Sovacool & Michael H Dworkin, "Energy justice: Conceptual insights and practical applications" (2015) 142 Applied Energy 435 at 436 [emphasis in original].
[199] *Ibid* at 437.

can provide a model of how law can be used to enhance justice for marginalized groups, and where law's limitations in this respect may lie.

4.3 Justice Movements

Coordinated social activism and civic engagement has long been a backbone of legal and extra-legal strategies to spur change. In recent years, a variety of social justice movements have materialized in response to issues ranging from environmental harms and animal welfare to workers' rights and gender inequality. In particular, there is an identifiable subset of justice movements—including the environmental justice movement, the climate justice movement, and the food justice movement—that largely emerged as a reaction to the perceived failures of mainstream engagements and policy agendas to adequately consider the situations of low-income, racialized, and other marginalized groups, particularly when it comes to the disproportionate burdens often experienced by those communities.

At least in theory, justice movements start from the premise that there are profound inequalities that are created or sustained at the institutional level, and that these need to be better addressed, including in the forms of fair(er) treatment, recognition of rights, equal opportunity, and meaningful participation in decision-making that affects all people. Thus, justice movements point to substantive (i.e. issues with laws, rules, policies, and regimes themselves), procedural (i.e. inadequate and uneven access to justice, information, consultation, enforcement), and systemic (i.e. the ongoing legacy of colonialism) problems with the law, and call for corresponding reforms.[200]

When it comes to law, "[x] justice movements", as Angela Harris refers to them, "invoke legal rights while simultaneously calling attention to law's limits: they seek to build power in the

[200] See generally Andil Gosine & Cheryl Teelucksingh, *Environmental Justice and Racism in Canada: An Introduction* (Toronto: Emond Montgomery, 2008) 1-32.

name of radical democracy and reject law's commitment to 'order.'"[201] Harris articulates three basic commitments of [x] justice movements: (1) a commitment to acknowledging interlocking systems of oppression; (2) a commitment to a politics of life; and (3) a commitment to "justice" that explicitly calls attention to the limits of white settler law.[202] In particular, [x] justice movements are concerned with the ways in which institutional systems operating within colonial legal orders produce differentiated access to "the fundamentals of life on earth: land, water, health, food, and reproduction."[203]

The aim of [x] justice movements is not merely inclusion in settler colonial law, which would preserve existing distributions of wealth and power, but rather, empowerment, which "exceeds existing law."[204] This means that legal tools are seen as "necessary, yet ultimately inadequate, to achieve movement goals."[205] [X] justice movements resist the efforts of established institutions and structures to absorb and contain their demands into a narrowly distributive framework that yields only feeble, incremental improvements. Instead, [x] justice movements seek to disrupt "the conceptual splits between democracy and capitalism, state and market, and public and private that have so long stabilized the settler colonial legal order."[206] The examples of justice movements briefly sketched below are illustrative of their core objectives and how they operate in practice to demand a new political economy that includes, *inter alia*, the right of peoples who have been marginalized to "participate in governance and the disruption of existing conventions of knowledge and expertise."[207]

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[201] Angela P Harris, "Anti-Colonial Pedagogies: "[X] Justice" Movements in the United States" (2018) 30 CJWL 567.
[202] *Ibid* at 582.
[203] *Ibid* at 584.
[204] *Ibid* at 588.
[205] *Ibid*.
[206] *Ibid* at 585.
[207] *Ibid* at 588.

4.3.1 Environmental Justice

The environmental justice (EJ) movement first emerged as a visible social movement in the United States in the 1980s as a grassroots reaction to the disproportionate number of hazardous waste sites located in poor, racialized communities.[208] Canadian legal scholar Dayna Scott defines EJ as "a social movement, and a theoretical lens, that is focussed on fairness in the distribution of environmental benefits and burdens, and in the processes that determine those distributions."[209] As this definition emphasizes, EJ is concerned not only with fair treatment, but also with the significant involvement of marginalized communities in decisions about environmental policy and natural resource development that directly affect them (and particularly, affect them in negative ways).[210]

The EJ movement served to expand conceptions of "environment" and "justice", and link the two together, in several notable ways. For one, EJ activists insisted on a definition of "environment" beyond a Nature detached from everyday life to encompass the settings where people "live, work and play".[211] In this way, the EJ movement explicitly connected the environment with other kinds of social concerns.

In addition to its shift in premises, the EJ movement also broke with the mainstream environmental movement in its strategies. Instead of relying to a significant degree on legal strategies as a means for achieving social change, the EJ movement makes "grass-roots political organizing its central priority", and "calls [a] focus on law reform into question by noting how it

[208] Dayna Nadine Scott, "Environmental Justice" in David Coghlan & Mary Brydon-Miller, eds, *The SAGE Encyclopedia of Action Research* (Thousand Oaks, CA: SAGE Publications Ltd, 2014) 300-302.
[209] Dayna Nadine Scott, "What is Environmental Justice?" (2014) 10:16 Osgoode Hall Law School Legal Studies Research Paper Series, Research Paper No. 72, online: <http://digitalcommons.osgoode.yorku.ca/cgi/viewcontent.cgi?article=1003&context=olsrps>.
[210] *Ibid*.
[211] Patrick Novotny, *Where We Live, Work and Play: The Environmental Justice Movement and the Struggle for a New Environmentalism* (Westport, CT: Praeger, 2000).

continues to privilege elites at the expense of people working on the ground to improve their communities."[212] EJ originated very much as a bottom-up movement that galvanized local peoples—united by race, class, place, or other grounds—to take collective action against the unequal environmental burdens that they shouldered, as well as the evident asymmetries in power to make relevant decisions.

The EJ movement has undergone a series of evolutions that have seen it expand and develop. The first wave of EJ research focused on documenting the existence and scope of environmental injustice through spatial, empirical analysis.[213] This exemplifies a reactive, as opposed to proactive approach, seeking to expose the inadequacies of environmental law regimes in responding to place-based harms by articulating and describing the problem, and offering critical insights into the patterns and conditions that enable the perpetuation of injustices. Later, the scope of environmental justice research and activism stretched to encompass more theoretical, qualitative, and interdisciplinary methods.[214]

Since then, the pluralistic nature of EJ has been embraced even further, evidenced by expansion along horizontal (consideration of a broader range of issues), vertical (global scope and growing internationalization) and conceptual (inclusion of relationship between humans and the non-human world) axes.[215] As many scholars have observed, the "growth, spread and evolution of environmental justice activity over recent decades" now encompasses a "vast range of evidence, arguments, explanations and demands".[216] Indeed, according to one account, "the

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[212] Scott, "What is Environmental Justice?", *supra* note 209.
[213] Julian Agyeman et al, "Trends and Directions in Environmental Justice: From Inequity to Everyday Life, Community, and Just Sustainabilities" (2016) 41 Ann Rev Environ Resour 321 at 326.
[214] *Ibid* at 327.
[215] *Ibid*. See also David Schlosberg, "Theorising environmental justice: the expanding sphere of a discourse" (2013) 22:1 Environmental Politics 37.
[216] Gordon Walker, *Environmental Justice: Concepts, evidence and politics* (New York: Routledge, 2012) at 3. See also Ryan Holifield, Jayajit Chakraborty & Gordon Walker, eds, *The Routledge Handbook of Environmental Justice* (New York: Routledge, 2018).

scope of EJ activism and research has now expanded to encompass almost everything that is unsustainable about the world".[217] The EJ movement has also influenced and informed a number of closely related offshoots, such as the climate justice, energy justice, and food justice movements, to which we now turn.

4.3.2 Climate Justice

The adverse environmental and health consequences of climate change are increasingly well documented, and range from displacement caused by sea level rise to food insecurity and malnutrition to mental health problems.[218] Though climate change will affect us all, to varying degrees, vulnerable communities—particularly low-income countries and poor people in wealthy industrialized countries—are the first and worst affected, which renders social justice considerations highly salient when thinking about climate change and responses to climate change.[219] Climate-related concerns have featured as part of the EJ agenda since its early days, but it was the aftermath of Hurricane Katrina, which hit New Orleans in 2005, that "solidified the confluence of the environmental justice framework and the issue of climate change."[220]

The climate justice (CJ) movement, generally speaking, is explicitly concerned with global warming and climate change as a political and ethical issue. As with EJ, there is enormous diversity within the CJ movement, which has sometimes contributed to growing pains.[221] David

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[217] Ryan Holifield, Jayajit Chakraborty & Gordon Walker, "Introduction: The worlds of environmental justice" in Ryan Holifield, Jayajit Chakraborty & Gordon Walker, eds, *The Routledge Handbook of Environmental Justice* (New York: Routledge, 2018) 1 at 2.
[218] See e.g. Barry S Levy & Jonathan A Patz, "Climate Change, Human Rights, and Social Justice" (2015) 81:3 Annals of Global Health 310.
[219] See e.g. Annie Rochette, "Climate Change is a Social Justice Issue: The Need for a Gender-Based Analysis of Mitigation and Adaptation Policies in Canada and Québec" (2016) 29 JELP 383.
[220] David Schlosberg & Lisette B Collins, "From environmental to climate justice: climate change and the discourse of environmental justice" (2014) 5:3 WIREs Clim Change 359 at 362. See also Robert D Bullard & Beverly Wright, eds, *Race, Place, and Environmental Justice After Hurricane Katrina: Struggles to Reclaim, Rebuild, and Revitalize New Orleans and the Gulf Coast* (Boulder, CO: Westview Press, 2009).
[221] Paul Chatterton, David Featherstone & Paul Routledge, "Articulating Climate Justice in Copenhagen: Antagonism, the Commons, and Solidarity" (2013) 45:3 Antipode 602.

Schlosberg and Lisette Collins note that CJ has “at least three broad conceptualizations: ideal theories from the academic community, a fairly elite NGO perspective on policy, and grassroots movement perspectives”.[222] The development of each of these strands has contributed to a burgeoning body of literature on the various dimensions of climate justice, especially in the context of human rights.[223]

A unique aspect of CJ is the centrality of states and a corresponding focus on increasing state accountability, as “states remain in the first and last instance central agents and beneficiaries of any duties to address climate change.”[224] Thus, in contrast with the often local-level struggles of the EJ movement, many debates about CJ have played out at the national and international levels.[225]

The global nature of climate change mandates an equally expansive conception of justice. As Tracey Skillington puts it, “[t]he advantage of approaching issues of justice from the perspective of all those subjected to the same transnational governance structures is its focus on those rules and capitalist norms that push for further and more intense resource exploitation and, in that, cumulatively inflict untold harms on people everywhere.”[226] Accordingly, some of the primary goals of the CJ movement have been to remove the causes of climate change, address the inequitable impacts generated by major GHG emitters, foster a “just transition” to a post-carbon economy, and provide assistance to vulnerable communities.[227]

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[222] Schlosberg & Collins, *supra* note 220 at 364.
[223] See e.g. Henry Shue, *Climate Justice: Vulnerability and Protection* (Oxford: Oxford University Press, 2014); Teresa M Thorp, *Climate Justice: A Voice for the Future* (New York: Palgrave Macmillan, 2014); Tracey Skillington, *Climate Justice and Human Rights* (New York: Palgrave Macmillan, 2017); Andrea Schapper, “Climate justice and human rights” (2018) 32:3 International Relations 275.
[224] Skillington, *ibid* at 54.
[225] Harriet Bulkeley et al, “Climate justice and global cities: mapping the emerging discourses” (2013) 23:5 Global Environ Change 914.
[226] Skillington, *supra* note 223 at 67-68.
[227] Schlosberg & Collins, *supra* note 220 at 366.

4.3.3 Energy Justice

Despite the ongoing efforts of the EJ movement, the persistence of environmental harms in contemporary life has led to an “increasing drive to find new, more focused, justice models, including those centered on energy issues.”[228] Contrasted with the now expansive breadth of the EJ movement, energy justice is concerned primarily with energy systems, which may position it to be more “strategically impactful” by offering a “more manageable justice framing that already comes with a clear, definable content”.[229] Unlike the EJ and CJ movements, energy justice “has principally been developed as an academic concept.”[230] Kirsten Jenkins suggests that this non-activist origin is a strength of energy justice, in that the “lack of an anti-establishment past opens the door for significant contributions in mainstream policy-making.”[231]

Energy justice can be defined as a “cross-cutting social science research agenda, which seeks to apply justice principles to energy policy, energy production and systems, energy consumption, energy activism, energy security, the energy trilemma, political economy of energy and climate change.”[232] In other words, energy justice infuses considerations of equity in discussions about the multivalent impacts of energy policy. Energy justice adopts “a framework informed by the environmental justice movement, including attention to the core tenets of distributional justice, procedural justice and justice as recognition.”[233] In this way, energy justice,

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228 Kirsten Jenkins, “Setting energy justice apart from the crowd: Lessons from environmental and climate justice” (2018) 39 Energy Research & Social Science 117 at 119.
229 *Ibid*.
230 *Ibid* at 120.
231 *Ibid*.
232 Kirsten Jenkins et al, “Energy justice: A conceptual review” (2016) 11 Energy Research & Social Science 174 at 175.
233 Jenkins, *supra* note 228 at 119. But see Joohee Lee & John Byrne, “Expanding the Conceptual and Analytical Basis of Energy Justice: Beyond the Three-Tenet Framework” (2019) 7 Frontiers in Energy Research 1 at 2, arguing that “[w]hile the three-tenet framework [of distributional, procedural, and recognition justice] provides a conceptual backbone for identifying and analyzing problems with regard to common energy (including fuel poverty), it does not directly address complex political and economic forces that routinely produce energy injustice. The framework tends to shed more light on ‘tailpipe’ problems and fixes like improved accessibility and affordability while leaving the structural and ideological pillars of the problem under-examined.”

like EJ and CJ, acts as a *conceptual* tool for better integrating a range of justice-related concerns, an *analytical* tool for clarifying the relationship between ethical values and social systems, and a *decision-making* tool for helping a range of actors make more considered choices.[234]

4.3.4 Food Justice

The nascent food justice movement emerged at the intersection between the EJ movement and the food movement more broadly. Food-related issues have been of concern to EJ activists since at least the 1980s.[235] However, in recent years, the quality and quantity of the food we consume has become a point of heightened concern. More attention is being paid to where food comes from, and the conditions under which it is grown, harvested, produced, and prepared.

Though there is no authoritative definition of the food movement, Michael Pollan describes it as "unified as yet by little more than the recognition that industrial food production is in need of reform because its high social/environmental/public health/animal welfare/gastronomic costs are too high."[236] Alison Alkon and Julian Agyeman use the term "food movement" to "indicate a broad range of proponents including those of organic, local, and slow food."[237] The food movement narrative suggests that by transforming our food practices, "we can live healthier, more authentic lives while supporting positive social and environmental change."[238]

Despite the rising significance and popularity of the food movement, it has also come under fire by those who have claimed that it is elitist and blind to deeper structural obstacles

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[234] Sovacool & Dworkin, *supra* note 198.
[235] Alison Hope Alkon & Julian Agyeman, "Introduction: The Food Movement as Polyculture" in Alison Hope Alkon & Julian Agyeman, eds, *Cultivating Food Justice: Race, Class, and Sustainability* (Cambridge, MA: The MIT Press, 2011) 1 at 9.
[236] Michael Pollan, "The Food Movement, Rising", *The New York Review of Books* (June 10, 2010), online: <http://www.nybooks.com/articles/2010/06/10/food-movement-rising/>.
[237] Alkon & Agyeman, "Introduction", *supra* note 235 at 16, note 2.
[238] *Ibid* at 2.

faced by certain groups. As Alkon and Agyeman put it, "[t]he food movement narrative is largely created by, and resonates most deeply, with white and middle-class individuals."[239] While the food justice movement shares the broader food movement's goal of radically re-envisioning our food system, it simultaneously emphasizes the need to be cognizant of and address structural inequalities leading to increased burdens on poor and otherwise marginalized groups in realizing these goals.

Thus, the food justice movement focuses explicitly on "the barriers that low-income or other marginalized groups face in realizing the goals of the broader food movement, such as access to fresh, unprocessed food."[240] Unlike the reformist paradigm of food security, food justice places much more of an emphasis on consumers. Relying on rights- and equality-based rhetoric, food justice advocates argue that everyone has an equal right to access fresh, healthy, unprocessed food, regardless of income.[241] Rather than focusing on concerns like health, obesity, or food insecurity in isolation, food justice activists and organizations "speak instead about rights, equality, community empowerment, cultural appropriateness, and, of course, justice."[242]

The food justice movement mirrors two of the EJ movement's key concerns—namely, equal protection from environmental pollution, and procedural justice—through the concepts of food access and food sovereignty. Food access is "the ability to produce and consume healthy food. While the environmental justice movement is primarily concerned with preventing disproportionate exposure to toxic environmental burdens, the food justice movement works to ensure equal access to the environmental benefit of healthy food."[243] Meanwhile, food

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[239] *Ibid* at 3.
[240] Rebecca L Goldberg, "No Such Thing as a Free Lunch: Paternalism, Poverty, and Food Justice" (2013) 24:1 Stan L & Pol'y Rev 35 at 49.
[241] *Ibid*.
[242] *Ibid* at 50-51.
[243] Alkon & Agyeman, "Introduction", *supra* note 235 at 8.

sovereignty "is a community's 'right to define their own food and agriculture systems'. Like procedural justice, food sovereignty moves beyond the distribution of benefits and burdens to call for a greater distribution of power in the management of food and environmental systems."[244] The concepts of self-sufficiency and local control are fundamental to food sovereignty frameworks.

Notwithstanding these parallels, traditional EJ approaches are not necessarily satisfactory nor wholly appropriate for the purpose of advancing a more rigorous critique of the environmental and social harms engendered by industrial agriculture.[245] To this end, the growing body of research on food justice is "informed by a variety of interdisciplinary traditions including environmental justice, critical race theory, sustainable agriculture, and food studies."[246] Arguments for food justice are often coupled with a critique of neoliberalism and market-based reform efforts that forestall the need for transformative structural change.[247]

As Robert Gottlieb and Anupama Joshi point out, the notion of food justice is a "powerful idea. It resonates with many groups and can be invoked to expand the support base for bringing about community change *and* a different kind of food system." [248] Despite the promissory potential of the food justice movement to unite disparate groups, "including those concerned with health, the environment, food quality, globalization, workers' rights and working conditions, access to fresh and affordable food, and more sustainable land use",[249] some of these

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[244] *Ibid*.
[245] *Ibid* at 9.
[246] Alison Hope Alkon & Julian Agyeman, "Conclusion: Cultivating the Fertile Field of Food Justice" in Alison Hope Alkon & Julian Agyeman, eds, *Cultivating Food Justice: Race, Class, and Sustainability* (Cambridge, MA: The MIT Press, 2011) 331 at 331.
[247] Alison Hope Alkon, "Food Justice and the Challenge to Neoliberalism" (2014) 14:2 Gastronomica 27.
[248] Robert Gottlieb & Anupama Joshi, *Food Justice* (Cambridge, MA: The MIT Press, 2010) at 5.
[249] *Ibid*.

interests are also in tension, which raises the question of which goals the food justice movement will prioritize, and how these goals will be realized.

Likewise, there is a danger that the food justice movement's praiseworthy aspirations may be subverted by failures of reflexivity. For the food justice movement to avoid the pitfalls encountered by the food movement—namely, reflecting and reproducing white privilege—activists need to ensure that what they are trying to accomplish actually resonates with the communities that are affected, as opposed to simply swapping out one set of oppressive values and practices for another.[250] In contemporary conversations about food insecurity and food justice, "[w]hen activists (and, in particular, *white, middle-class, settler* activists) talk about including diverse groups, they can reinforce preconceived notions of who "needs help" and who are the helpers."[251] The aspiration of the food justice movement must remain, above all, to effect transformative change in the food system for everyone.

Food justice efforts can only become more effective and equitable when dialogue among activists, academics, and communities is increased, rather than simply imposing on one group what another group thinks it needs. To this end, the focus of food justice efforts should shift away from "intervening in the lives of marginalized communities" and instead to "challenging the activities and structures of oppression that we are all implicated within in different ways."[252] Intersectional analyses can help food justice movements better recognize and address "the

[250] Julie Guthman, "Bringing good food to others: investigating the subjects of alternative food practice" (2008) 15:4 Cultural Geographies 431; Julie Guthman, "'If They Only Knew': The Unbearable Whiteness of Alternative Food" in Alison Hope Alkon & Julian Agyeman, eds, *Cultivating Food Justice: Race, Class, and Sustainability* (Cambridge, MA: The MIT Press, 2011) 263-281.
[251] Lauren Kepkiewicz et al, "Beyond inclusion: Toward an anti-colonial food justice praxis" (2015) 5:4 Journal of Agriculture, Food Systems, and Community Development 99 at 100 [emphasis in original].
[252] *Ibid* at 103.

overlapping and conflicting dynamics of race, gender, class, sexuality, and citizenship related to food inequalities."[253]

Food justice activists must remain especially mindful of the broader hierarchies and power structures that create privilege and disadvantage in our society, and that mediate our relationships to food and the land from which it comes.[254] In Canada, situating food justice in the context of colonialism's pernicious legacy is particularly important,[255] as colonialism and its effects are an enduring cause of Indigenous food insecurity. Ideally, the use of both justice rhetoric and activism should be consonant with these realities. Concepts of sovereignty and autonomy, which speak to a community's right to define its agricultural and/or food policy for *itself*, may represent the most productive ways of framing food system change.[256] Accordingly, creating the conditions under which food sovereignty could take root and flourish is one encouraging means of enhancing justice in food systems. The role of technology in this process will be considered in detail in the following chapters.

4.4 Conclusion

A retrospective examination of how our understanding of law and its relationships with society, technology, and justice have developed shows that it is often predicated on a set of assumptions that are historically and culturally specific. In particular, as is reflected perhaps most starkly in

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[253] Carolyn Sachs & Anouk Patel-Campillo, "Feminist Food Justice: Crafting a New Vision" (2014) 40:2 Feminist Studies 396 at 409.
[254] Katharine Bradley & Hank Herrera, "Decolonizing Food Justice: Naming, Resisting, and Researching Colonizing Forces in the Movement" (2016) 48:1 Antipode 97; Kepkiewicz et al, *supra* note 251.
[255] Kepkiewicz et al, *ibid*.
[256] See generally La Via Campesina, "Food sovereignty", online: <https://viacampesina.org/en/food-sovereignty/>; Teresa M Mares & Devon G Peña, "Environmental and Food Justice: Toward Local, Slow, and Deep Food Systems" in Alison Hope Alkon & Julian Agyeman, eds, *Cultivating Food Justice: Race, Class, and Sustainability* (Cambridge, MA: The MIT Press, 2011) 197-219; Eric Holt-Giménez, "Food Security, Food Justice, or Food Sovereignty?: Crises, Food Movements, and Regime Change" in Alison Hope Alkon & Julian Agyeman, eds, *Cultivating Food Justice: Race, Class, and Sustainability* (Cambridge, MA: The MIT Press, 2011) 309-330; Constance Gordon & Kathleen Hunt, "Reform, Justice, and Sovereignty: A Food Systems Agenda for Environmental Communication" (2019) 13:1 Environmental Communication 9.

dominant property law paradigms, "[c]lassical liberalism gives only limited attention to relationships that make humans dependent on one another in political communities; it largely ignores the interdependence of humans and other components of land communities."[257] This failure to attend to the myriad relationships that sustain us has arguably been one of the root causes of the attitudes and behaviours that have led us to the state of crisis that we now confront.

Without intervention, existing structures of domination and oppression are continuously reinforced and perpetuated through various levels of abstraction, including legal frameworks. Although current approaches to law and policy form a significant basis of the problem, law and policy can also be used to ameliorate identifiable gaps and deficiencies. Because law is a social institution that responds to exogenous cues and influences, it can act as a catalyst for change, thereby helping to better reconcile scientific and technological innovations with enduring social and environmental challenges.

Across multiple domains, law and policy can be deliberately pivoted to ensure that safeguarding the environment is prioritized over the long term, a plurality of voices and perspectives is heard, and that a more holistic range of salient factors is accounted for within decision-making processes. However, in order to imagine alternatives to current orderings, we need to be able to better challenge and address the gap between law in books and law in action, which can be facilitated, in part, by socio-legal scholarship that brings together empirical research, interdisciplinary methods, and theoretical rigour.

The frameworks adopted by existing justice movements help provide conceptual lucidity, analytical insights, and decision-making guidance when it comes to a range of justice-related concerns. The experiences of the various [x] justice movements considered in this chapter

[257] Frazier, *supra* note 17 at 300-301.

provide valuable insight into why a concept of technology justice is useful, and what technology justice might look like in practice. Building on the foundations established by existing [x] justice movements, the following chapter further fleshes out my vision for technology justice, especially in terms of the implications of the concept for law, policy, and governance.

5. A Vision for Technology Justice

Despite the influential role that law plays in terms of prefiguring the operative boundaries of science, technology, and innovation (STI), there is a dearth of analysis on what this means in terms of resultant environmental, social, cultural, ethical, and economic impacts. Few scholars have closely studied the interplay between law and STI in the contemporary Canadian context, and especially not from a critical legal perspective. The advent of a wide variety of new and emerging technologies with significant potential ramifications for society and the environment adds urgency to the case for considering their fundamental drivers and systemic implications more critically, because according to Moor's law, "[a]s technological revolutions increase their social impact, ethical problems increase."[1]

There are other reasons why timing is crucial and the deliberate and inadvertent decisions we make about technologies and how they are regulated (or not) require serious attention at the earliest possible stages. There is a relatively slender window of latitude beyond which choices "tend to become strongly fixed in material equipment, economic investment, and social habit", thereby transmuting into commitments that "are similar to legislative acts or political foundings that establish a framework for public order that will endure over many generations."[2] Further complicating matters, "the consequences of new technologies can not always be predicted, and by the time it becomes apparent that something is wrong with a technology, both its artifactual form and the social interest surrounding it, have become so entrenched that they represent major barriers to change."[3] When it comes to large-scale technical systems in particular, "conditions of

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[1] James H Moor, "Why we need better ethics for emerging technologies" (2005) 7 Ethics and Information Technology 111 at 117.
[2] Langdon Winner, "Do Artifacts Have Politics?" (1980) 109:1 Daedalus 121 at 127-128.
[3] Wendy Faulkner, "The Technology Question in Feminism: A View from Feminist Technology Studies" (2001) 24:1 Women's Studs Int'l Forum 79 at 91.

size, complexity, and mutual interdependence give them a rigidity and inertia difficult to overcome."[4] Given that technologies tend to reflect existing structures of power, there is a real potential for the divide between dominant and marginalized groups to be enlarged through this process, which constitutes a significant justice concern.

Much of the existing legal literature on technology and justice has tended to focus on information and communication technologies (ICTs), insofar as this subset of digital technologies presents some of the most direct and obvious linkages with traditional legal practice. Richard Susskind goes so far as to state that "[t]he technology that has exerted the greatest impact so far on the practice of law and the administration of justice is information technology (IT)."[5] Alternatively, the analysis of law-technology relations has been limited to discrete fields such as criminal law,[6] or particular themes such as access to justice.[7] While these topics are undoubtedly important, a broader examination of how material technologies (as contrasted with digital technologies) can enable or constrain various forms of justice is clearly warranted in an age of both widespread environmental and social problems and extensive technological development.

This chapter articulates a notion of technology justice that braids together concerns about worsening social injustices, increasing environmental anxieties, and rapid technological changes,

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[4] Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: The MIT Press, 1978) at 251.
[5] Richard Susskind, "Technology and the Law" in Jan Kyrre Berg Olsen, Stig Andur Pedersen & Vincent F Hendricks, eds, *A Companion to the Philosophy of Technology* (Malden, MA: Blackwell Publishing Ltd, 2009) 449 at 449. See also Richard Susskind, *Transforming the Law: Essays on Technology, Justice and the Legal Marketplace* (New York: Oxford University Press, 2000).
[6] See e.g. David Lazer, ed, *DNA and the Criminal Justice System: The Technology of Justice* (Cambridge, MA: The MIT Press, 2004); Phil Bowen & Blair Gibbs, *Just technology: Emergent technologies and the justice system…And what the public thinks about it* (London, UK: Centre for Justice Innovation, 2018).
[7] See e.g. Ronald W Staudt, "All the Wild Possibilities: Technology that Attacks Barriers to Access to Justice" (2009) 42 Loy LA L Rev 1117; Jane Bailey & Jacquelyn Burkell, "Implementing technology in the justice sector: A Canadian perspective" (2013) 11:2 CJLT 253.

and the role of the law therein. I begin by establishing why a concept of technology justice is useful and important, before moving on to elaborate a tripartite framework for understanding and applying technology justice in the context of technologies with numerous environmental, social, and ethical implications. The goal is to reorient the way we think about and structure our technologies and the institutions that support them, such that they are predicated on more transparent and less partial *premises*, allow for more inclusive and democratic decision-making *processes*, and create more socially equitable and environmentally sustainable *outcomes*.

5.1 Why Technology Justice?

Technologies can obviously have a bearing on justice in multiple ways. Technologies and technological infrastructures have the potential to not only alleviate or generate inequalities on their own, but also to facilitate or hinder progress toward cognate, justice-related goals.[8] Thus, the task here is not so much about establishing a connection between technology and justice, but rather, contemplating the question of what that connection demands from an ethical and a legal perspective.

The concept of technology justice goes beyond merely seeking to redress the harms resulting from specific technologies via a tort system or other compensation scheme (whether public or private), and instead strives to infuse justice considerations into each stage of a technology's life cycle. This necessitates scrutiny into how technology operates as a social phenomenon. Developing a theory that is mindful of the overarching "logic of technology" requires that "the *entire structure* of the technological order be the subject of critical inquiry."[9] As such, technology justice is not just about the law, and the framework pulls liberally from

[8] For example, for a discussion of IP law's effects on social and cultural life, distributions of wealth and power, and global justice, see Madhavi Sunder, *From Goods to a Good Life: Intellectual Property and Global Justice* (New Haven, CT: Yale University Press, 2012).
[9] Winner, *Autonomous Technology*, *supra* note 4 at 226 [emphasis in original].

other disciplines. STS is an especially useful starting point for elucidating the myriad and often subtle ways in which "the rule of technological circumstances in the modern era … supplant[s] other ways of building, maintaining, choosing, acting, and enforcing, which are more commonly considered political."[10]

Somewhat curiously, explicit engagements with the concept of justice are limited in existing STS literature.[11] Similarly, "[w]ith a few notable exceptions, critical legal theorists have concentrated on 'social justice' and environmental scholars have concentrated on 'sustainability,' with few overlaps in these distinct conversations."[12] Though disciplinary boundaries offer a partial explanation, they do not justify the continued existence of this lacuna. Given the close connections between science and technology, environmental degradation, and social justice, a justice-oriented framework, underpinned by a distinctly legal analysis, provides a valuable site in which to unite what have otherwise been separate bodies of scholarship.

There are many synergies to capitalize on by adopting an interdisciplinary approach to this undertaking, seeing as how critical legal theory, STS, and much of the environmental sustainability discourse are all animated by many of the same concerns. As Benjamin Cohen and Gwen Ottinger note, "environmental injustice is an important source of ruptures in technical practice and thus a powerful force for the transformation of sciences."[13] Further, I concur with Mamo and Fishman's claim that it is not only possible, but desirable to "use STS modes of

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[10] *Ibid* at 237.

[11] Laura Mamo & Jennifer R Fishman, "Why Justice?" Introduction to the Special Issue on Entanglements of Science, Ethics, and Justice" (2013) 38:2 Science, Technology & Human Values 159 at 163.

[12] Angela P Harris, "Vulnerability and Power in the Age of the Anthropocene" (2014) 6 Washington & Lee Journal of Energy, Climate, and the Environment 98 at 105.

[13] Benjamin Cohen & Gwen Ottinger, "Introduction: Environmental Justice and the Transformation of Science and Engineering" in Gwen Ottinger & Benjamin R Cohen, eds, *Technoscience and Environmental Justice: Expert Cultures in a Grassroots Movement* (Cambridge, MA: The MIT Press, 2011) 1 at 4.

interpretation to ground and nuance justice frameworks to allow for greater theorization, specificity, and interpretation", especially "with an eye toward enacting social change."[14]

In this way, the notion of technology justice does not see technology simply as an instrumental tool to attain environmental justice, climate justice, energy justice, or food justice. Even within these movements, there is a growing sentiment that technologies are not enough to effect the kind of change that is needed or desired. For example, Jafry, Mikulewicz and Helwig write that "the prominence of climate justice has … been fuelled by the growing consensus among critical observers that technological innovation alone has proved insufficient to address the stratifying nature of climate-related challenges, including limited and increasingly unequal access to food, water and energy."[15]

Moreover, technocratic approaches to problem-solving can serve to actively retrench inequalities insofar as technologies tend to reflect particular kinds of ideas and ideals. In the energy justice context, Joohee Lee and John Byrne point to a number of key characteristics contributing to systemic injustice within the modern energy paradigm. Structurally, these include a preference for large-scale technical systems that are distanced from local decision-making processes, the centralization of energy production and the concomitant distancing of supply from users, and a widespread "risk-taking" tendency that is portrayed as the "price to pay" for technological innovation and social progress.[16] Ideologically, these characteristics include top-down, authoritarian decision-making structures, a technical framing of sustainability, a specialist understanding of fairness, and a significant level of path dependency.[17]

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[14] Mamo & Fishman, *supra* note 11 at 163.
[15] Tahseen Jafry, Michael Mikulewicz & Karin Helwig, "Introduction: Justice in the era of climate change" in Tahseen Jafry, ed, *Routledge Handbook of Climate Justice* (New York: Routledge, 2019) 1 at 2-3.
[16] Joohee Lee & John Byrne, "Expanding the Conceptual and Analytical Basis of Energy Justice: Beyond the Three-Tenet Framework" (2019) 7 Frontiers in Energy Research 1 at 4.
[17] *Ibid* at 4-5.

Reactive efforts that focus on remedying distributional injustices through fairer allocation of costs and benefits do not satisfactorily address the more invidious implications of this paradigmatic model. As such, Lee and Byrne argue that we need to take a wider systems-level perspective in order to "shed light on underlying drivers of energy injustice embedded in the dominant modern energy paradigm."[18] Likewise, the detrimental consequences of technologies are often part and parcel of the structures they are rooted in and the beliefs that they reflect, which requires a broadening of the analytical boundaries beyond simply the immediate harms to encompass macro-level forces like capitalism,[19] globalization, and industrialization.

Though it is not limited to law, the concept of technology justice turns heavily on law, as both a cause of and a solution to inequalities of power and access. It reminds us, fundamentally, of the failures and limitations of liberal legalism, in which crabbed understandings of humans, institutions, and rights lead to equally crabbed solutions to the problems they cause. For the most part, "capitalist democracies accept that law enables private property regimes under the values of liberalism or in an attempt to promote wealth creation by protecting the interests of innovators. Markets in turn determine whether technologies persist or become obsolete."[20] I contest the inevitability of these premises, and offer an alternative model of thinking about the relationships between technological developments, markets, and the law. More specifically, I argue that the role of law is not only to provide a framework under which technological innovation can take place, but also to help ensure that the kinds of technological innovations that are incentivized,

[18] *Ibid* at 8.
[19] As Miguel Altieri, Clara Nicholls and Rene Montalba note, "[c]hallenging the root causes of the environmental and social crisis of industrial agriculture implies challenging capitalism": Miguel A Altieri, Clara I Nicholls & Rene Montalba, "Technological Approaches to Sustainable Agriculture at a Crossroads: An Agroecological Perspective" (2017) 9:3 Sustainability 1 at 1.
[20] Arthur J Cockfield, "Towards a Law and Technology Theory" (2003) 30:3 Manitoba LJ 383 at 404.

brought to market, and taken up are those that will help meet the most pressing concerns that we face today.

To be sure, the aims of this project overlap to a large degree with many of the core concerns of the justice movements discussed in the previous chapter. In espousing a standalone concept of technology justice, I am not jettisoning existing and familiar tenets that pertain to "[x] justice movements" writ large. However, a concept of technology justice brings issues especially related to technology to the forefront of discussions involving the environment, sustainability, climate change, energy, labour, food, and our collective future. It also responds to criticisms about the EJ movement having become too expansive and unwieldy by trying to capture too much within its ambit.

Further, although other justice movements have largely coalesced as a result of grassroots organizing, there is something different about technology that makes mobilizing against it a challenge. For one, technologies are exceptionally diverse, and raise different kinds of concerns depending on their specific characteristics. Additionally, while issues relating to the environment, food, and climate are clearly relevant to everyone, issues relating to technology are still commonly conceived of as lying within the domain of an elite group of experts with specialized knowledge. This is not only a perceptual barrier but also a practical one; IPRs and IP regimes, from which many technologies derive their incentives, can be difficult to understand for non-specialists.[21] As with energy justice, adopting a stance that is not primarily an activist one may allow for technology justice to be more impactful in mainstream policymaking.

[21] Mario Biagioli & Marius Buning, "Technologies of the law/ law as a technology" (2019) 57:1 History of Science 3 at 13: "Perhaps because of the technical density of the discipline, the mechanics of patent law have so far remained the province of expert lawyers, at least in terms of the capacity to represent or explain the particular language of the patent claim or the intricacies of patent prosecution."

Some may contend that the proliferation of various kinds of justice movements is not actually useful, serving instead to dilute and disperse attention, energy, and resources from what are essentially allied causes. Yet, justice is not finite, and the existence of multiple forms of opposition to oppression can be normatively and politically significant, without being mutually exclusive. Each individual justice movement, with its unique area of emphasis, serves to demonstrate that there are multiple loci for re-evaluating exploitative structures and processes, developing collective capacities, and suggesting "alternative possible trajectories for knowledge, intervention and change [that] prioritize different goals, values and functions."[22] To this end, the articulation of a vision for technology justice can contribute to a more inclusive reimagining of the role of STI in improving or worsening our food, environment, health, societies, and economies.

The vision for technology justice I propose seeks to ensure that technologies are used sustainably, can be accessed equitably, and respond to real social and environmental needs, especially those of the most vulnerable. In order for this vision to be realized, governance needs to be rethought and reconfigured in three major areas profoundly influencing the economic, political, social, and cultural context in which technologies are developed, incubated, and assessed. Each of these areas—drivers of innovation, discourses of risk, and distribution of returns—is elaborated on in turn. These three areas also align with the focus on principles, processes, and outcomes articulated at the beginning of this chapter.

This is not meant to be a conclusive analysis, nor is it meant to usurp the important work of existing social activism when it comes to food, the environment, and technology. Instead, it is a contribution to a larger conversation that can hopefully inform and influence enhanced legal

[22] Melissa Leach, Ian Scoones & Andy Stirling, *Dynamic Sustainabilities: Technology, Environment, Social Justice* (Washington, DC: Earthscan, 2010) at 5.

and policy responses to the environmental and social ramifications arising from new and emerging technologies in a range of different settings and scales, from poor to wealthy, small to large.

5.2 Drivers of Innovation

Within capitalist economies, the research and development (R&D) that makes innovation possible is contingent on funding. This makes decisions about what kind of R&D is funded, by whom, and to what extent, highly significant. Though many innovations in the agri-food sector are ostensibly spurred by a panoply of environmental, social, and ethical concerns,[23] they are also catalyzed by less laudable motivations. According to Andrew Feenberg, "history shows that modern Western technology has been profoundly shaped by capitalist enterprise. As such it privileges the narrow goals of production and profit."[24]

The current incentive structure for innovation creates severe perversions and inequities on multiple levels. For example, defense-related spending is one of the highest categories of technological-related expenditures in many wealthy industrialized nations.[25] The close relationship between science and military power is attributable, in part, to an economic and organizational climate that is favourable to "private financing of scientific research for industrial purposes".[26] Under such conditions,

> [t]he growth of knowledge and technical capacities is not prompted merely by sheer curiosity interested in penetrating the secrets of nature and society but is also driven by economic and military interests. In deploying novel knowledge and technical artifacts

[23] See e.g. Angela Lee, "Meat-ing Demand: Is *In Vitro* Meat a Pragmatic, Problematic, or Paradoxical Solution?" (2018) 30:1 CWJL 1 at 7-10.
[24] Andrew Feenberg, *Questioning Technology* (New York: Routledge, 1999) at 222.
[25] The US, in particular, spends a significant amount on defense. See e.g. Global Firepower, "Defense Spending by Country (2020)", online: <https://www.globalfirepower.com/defense-spending-budget.asp>; Max Roser & Mohamed Nagdy, "Military Spending", *Our World in Data*, online: <https://ourworldindata.org/military-spending>.
[26] Janine Marie Morgall, *Technology Assessment: A Feminist Perspective* (Philadelphia: Temple University Press, 1993) at 13.

> for economic growth and military purposes, the social costs and environmental burdens produced are treated as exogenous and ex post developments.[27]

Another consequence is that "[m]oney and status flow to researchers investigating topics of concern to military and industrial interests at the expense of topics important to less powerful groups."[28]

Similarly, in many other sectors, the creation of frivolous luxuries for the privileged, which are more profitable in a system with an inherent preference for lucrativeness and bent toward short-termism, often takes precedence over providing essentials to the poor. As such, the kinds of research that funding is channeled towards do not necessarily respond to human needs or the imperative to reduce environmental harm and degradation, but rather, have a tendency to reflect a specific set of incumbent, deeply vested values and priorities. This state of affairs is problematic insofar as technologies created in response to the demands of wealth or want, such as consumer electronics, will preferentially and inevitably serve the already advantaged.[29]

Incentives influence the directionality of innovation in significant ways. Notably, there is a distinction to be made between technology-push and demand-pull innovations. The technology-push concept "assumes a supply-side-driven and mainly linear process from research to development and ultimately to diffusion."[30] Meanwhile, "the demand-pull hypothesis "postulat[es] that anticipated market demand [is] a key determinant of technical change by incentivizing research in new directions."[31] Technologies developed without being attached to

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[27] Nico Stehr, *Knowledge Politics: Governing the Consequences of Science and Technology* (New York: Routledge, 2016) at 13.
[28] Gwen Ottinger, Javiera Barandiarán & Aya H Kimura, "Environmental Justice: Knowledge, Technology, and Expertise" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2016) 1029 at 1032.
[29] Daniel Sarewitz, *Frontiers of Illusion: Science, Technology, and the Politics of Progress* (Philadelphia: Temple University Press, 1996) at 131.
[30] Michael Peters et al, "The impact of technology-push and demand-pull policies on technical change – Does the locus of policies matter?" (2012) 41 Research Policy 1296 at 1297.
[31] *Ibid*.

specific needs or demands end up “search[ing] for applications that can be patented and from which rents can be appropriated.”[32] By contrast, “technologies that are pulled along by consumer demand, or by producer demand to lower environmental costs, are more likely to be guided by full social values, provided by either markets or extra-market (e.g., regulatory) institutions, than the ‘technology-push’ variety.”[33]

There are also discernible effects further down the innovation pipeline. For example, in the case of innovations that arise largely in response to scientific advances, it is only after they already have entered the market that consumers can express their preferences and “shape their development trajectory through market and extra-market signals.”[34] The lack of opportunity for stakeholder engagement early on in the process of R&D weakens the likelihood that the end results will be appropriate for and adapted to the contexts into which they are released, because when innovations “emerge from private laboratories with little contact with farmers or consumers, there may be less sensitivity to farming and eating as part of ecological and cultural systems.”[35]

In the agri-food sector, agroecological technologies that build on local and regional knowledge have the potential to significantly improve the lives of subsistence and small-scale farmers, especially in low-income countries.[36] Unfortunately, agroecological technologies—which many may not even consider to qualify as “technologies”—are rarely the beneficiaries of private-sector R&D investment. Technical knowledge about “improv[ing] soil fertility and moisture content, [] manag[ing] pest and disease threats, and [] sustainability increas[sing]

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[32] Sandra S Batie & David E Ervin, “Transgenic crops and the environment: missing markets and public roles” (2001) 6 Enviro & Development Econ 435 at 438.
[33] *Ibid* at 438-439.
[34] *Ibid* at 439.
[35] *Ibid*.
[36] See e.g. Amber Meikle, *Technology Justice: A Call to Action* (Rugby, UK: Practical Action Publishing, 2016), online: <http:// dx.doi.org/10.3362/9781780446585> at 21.

productivity" exists, including through integrative farming models, but due to underfunding of services, this knowledge is often not available to those who need it.[37] Instead, in the context of global agriculture, investment tends "to focus on areas where the benefits are more easily monetized: fertilizers, herbicides, insecticides, machinery, and hybrid seeds that have to be replaced every year or two."[38] This myopia has resulted in an increase in vertical integration, corporate consolidation and concentration, with serious implications for food system sustainability,[39] as well as a growing gulf between the wealthy and the poor.

Realizing technology justice will require a reconfiguration of the drivers of innovation, such that innovations that are socially beneficial and/or environmentally advantageous, but not necessarily profitable in a narrow economic sense, can still be nurtured and given the conditions required to prosper. Shifting our understandings of property, our expectations of science and technology, and the role of the state in promoting and incentivizing innovation will be an integral part of this process.

5.2.1 The Role of Property Rights

As outlined in Chapter 4, our understandings of property, and the way these are given legal effect, have profound ramifications when it comes to our relationships with each other and with the Earth. In many ways, property law and property rights facilitate a limited focus on short-term economic gain that precludes a more expansive approach to innovation directed to social and environmental ends. As Carol Rose puts it,

> rational economic decision-making favors investments in scientific investigation where there is some potential for private gains at the end of the road—that is, where the end-product can be turned into property. … [H]ence there is a gap between research whose

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[37] *Ibid* at 11.

[38] Simon Trace, *Rethink, Retool, Reboot: Technology as if people and planet mattered* (Rugby, UK: Practical Action Publishing, 2016) at 151.

[39] Jennifer Clapp, "Mega-Mergers on the Menu: Corporate Concentration and the Politics of Sustainability in the Global Food System" (2018) 18:2 Global Environmental Politics 12.

> results can be propertized relatively easily, and research whose results cannot be so easily propertized, even though the latter might much enhance our collective welfare.[40]

Closing this gap will require a dual commitment to facilitating R&D in innovations that can enhance our collective welfare, and checking the capitalistic impulse to focus R&D only on innovations that can be easily propertized under existing models.

The role of IP and IPRs is increasingly important to consider in this context, as "[c]ommon across the more developed world since the 1980s has been a shift in government commitment to emphasize markets and private ownership of intellectual property."[41] This shift is problematic for several reasons. For one, "[p]atents and classification have been central to the cultivation of a certain ethos of research – research that is off limits to the general public or is only accessible with considerable difficulty."[42] In their current formulations, IPRs and their governing regimes, especially pertaining to patents and copyrights, effectively help ensure that knowledge is "produced to benefit only those who also have the capital to distribute the results for profit or the power to organize and maintain policies of social control."[43]

Moreover, critical feminist perspectives have worked to make visible the "underlying masculine assumptions existing in our construction of intellectual property as well as highlight[ing] a political economy of intellectual property that has historically benefited men more than women."[44] Since men have defined many key copyright concepts and conditions of copyright law, "[i]t is highly probable that there are gendered differences in the ways that

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[40] Carol M Rose, "Scientific Innovation and Environmental Protection: Some Ethical Considerations" (2002) 32 Envtl L 755 at 764.

[41] Sergio Sismondo, *An Introduction to Science and Technology Studies*, 2d ed (Malden, MA: John Wiley & Sons, Ltd, 2010) at 195.

[42] Gernot Böhme, *Invasive Technification: Critical Essays in the Philosophy of Technology* (trans. Cameron Shingleton) (New York: Bloomsbury, 2012) at 66.

[43] Sandra Harding, *The Science Question in Feminism* (Ithaca, NY: Cornell University Press, 1986) at 71.

[44] Debora Halbert, "Feminist Interpretations of Intellectual Property" (2006) 14 Am UJ Gender Soc Pol'y & L 431 at 433.

copyright laws benefit and burden everyone affected by copyright laws and practices."[45] According to another account, "Western IP laws, built on patriarchal knowledge systems and imposed through colonial regimes, reproduce gender biases and operate as a space of continued subordination and exploitation."[46] Race,[47] culture,[48] colonialism,[49] and other grounds of diversity and difference[50] are also relevant vectors of analysis in considering the partial logic of Western property conventions, both in the agri-food sector and beyond.

The exclusionary effects of IPRs do not only have differential impacts on marginalized groups. Many scholars have pointed to glaring problems with the patent system, including the ways in which it can lead to patent trolling, patent gridlock, and rent-seeking behaviours.[51] These inefficiencies work to the collective detriment of us all, not least because "IP laws manufacture artificial scarcity—and they make that scarcity real in the world."[52] Arguably, if we are to devise innovative solutions to the social and environmental problems that we face, we need more free

[45] Ann Bartow, "Fair Use and the Fairer Sex: Gender, Feminism, and Copyright Law" (2006) 14 Am UJ Gender Soc Pol'y & L 551 at 558.

[46] Carys J Craig, "Critical copyright law and the politics of 'IP'" in Emilios Christodoulidis, Ruth Dukes & Marco Goldoni, eds, *Research Handbook on Critical Legal Theory* (Northampton, MA: Edward Elgar Publishing, Inc., 2019) 301 at 315. See also Halbert, *supra* note 44; Sharmishta Barwa & Shirin M Rai, "Knowledge and/as Power: A Feminist Critique of Trade Related Intellectual Property Rights" (2003) 7:1 Gender, Technology and Development 91.

[47] See e.g. Jonathan Kahn, "Race-ing Patents/Patenting Race: An Emerging Political Geography of Intellectual Property in Biotechnology" (2007) 92:2 Iowa L Rev 353; Shubha Ghosh, "Race-specific Patents, Commercialization, and Intellectual Property Policy" (2008) 56:2 Buffalo L Rev 409.

[48] See e.g. Rosemary J Coombe, *The Cultural Life of Intellectual Properties: Authorship, Appropriation and the Law* (Durham, NC: Duke University Press 1998).

[49] See e.g. Thomas Burelli, "Access and Valorization of Aboriginal Seeds in Canada: Opportunities and Limits of Existing Legal Frameworks to Frame Collaborations between Aboriginal Peoples and Researchers" in Heather McLeod-Kilmurray, Angela Lee & Nathalie Chalifour, eds, *Food Law and Policy in Canada* (Toronto: Carswell, 2019) 499-529.

[50] See e.g. Irene Calboli & Srividhya Ragavan, eds, *Diversity in Intellectual Property: Identities, Interests, and Intersections* (New York: Cambridge University Press, 2015).

[51] See e.g. Robert P Merges, "The Trouble with Trolls: Innovation, Rent-Seeking, and Patent Law Reform" (2009) 24:4 Berkeley Tech LJ 1583; Michael Heller, *The Gridlock Economy: How Too Much Ownership Wrecks Markets, Stops Innovation, and Costs Lives* (New York: Basic Books, 2010).

[52] Craig, *supra* note 46 at 309.

flow of knowledge and ideas, not less. This mandates a critical reflection on the legitimacy of the IP system as it currently exists.

At the same time, "strategies of resistance to exploitative power structures can productively include the adaptation of prevailing legal categories."[53] There is "capacity to harness IP discourse and the rhetoric of rights in order to advance social justice and equality."[54] Put differently, in walking the "delicate line[] between … rejection and redirection",[55] there is no need to throw out the baby with the bathwater. Alternative perspectives can help shed light on how to create "a system that is more representative of or practically responsive to the diverse needs, interests and values of peoples across the globe".[56] For example, "[c]ritics of IP from the [I]ndigenous perspective have helped open up a more pluralistic view about the nature of what the IP system can and should be, whom it should benefit and how."[57]

The foregoing underscores the point that "property rights must be constantly and continuously updated"[58] in order to better accommodate an expanded matrix of considerations. This updating "is not a straightforward process",[59] and will rely on both legislatures and the courts to work through the particulars. While law reform is percolating, private sector responses can also correct for suboptimal market outcomes associated with property regimes.[60] What Robert Merges has described as "private intellectual property systems"[61] can serve to codify

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[53] *Ibid* at 318.
[54] *Ibid* at 319.
[55] *Ibid*.
[56] Antony Taubman, "Preface: Indigenous Innovation: New Dialogues, New Pathways" in Peter Drahos & Susy Frankel, eds, *Indigenous Peoples' Innovation: Intellectual Property Pathways to Development* (Canberra, Australia: ANU E Press, 2012) xv at xvi.
[57] *Ibid*.
[58] Merges, "The Trouble with Trolls", *supra* note 51 at 1585.
[59] *Ibid*.
[60] Jonathan M Barnett, "Property as Process: How Innovation Markets Select Innovation Regimes" (2009) 119:3 Yale LJ 384.
[61] Robert P Merges, "Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations" (1996) 84 Calif L Rev 1293 at 1361-62.

informal norms, thereby supplementing public law and policy and self-correcting "market inefficiencies" to better promote innovation. Such phenomena demonstrate that, when investments in transactional mechanisms can be induced through means, "explicit policy interventions [are] not always necessary to lower transaction costs."[62]

Yet, in conceding the value of private sector initiatives, we should not undermine the role of the state and the importance of state action in this context. In pointing out that patents "are only one strategy for incentivizing information production",[63] Amy Kapczynski and Talha Syed have argued for a broadening of institutional approaches to innovation on the basis that patents "can have distortive effects, stemming from structural features of exclusion rights."[64] Other strategies that do not rely on exclusionary mechanisms include "public funding (where a government agency either directly carries out research or sponsors others through grants), and financial inducement through prizes (where financial awards are established, typically by the government, in exchange for specified information goods)."[65] Embracing government-led strategies for driving innovation, as opposed to relying primarily on the market or private sector, is a crucial way to encourage the creation of goods and services that have social and environmental value but would otherwise be neglected within existing incentive structures.

5.2.2 The Role of Expectations

Property regimes are not the only assemblages that bear on technological trajectories. Expectations, too, play a major role in incentivizing R&D and bringing technologies to fruition. This is because "[w]ithout a strong vision of how technologies will develop and of the benefits

[62] Merges, "The Trouble with Trolls", *supra* note 51 at 1606.
[63] Amy Kapczynski & Talha Syed, "The Continuum of Excludability and the Limits of Patents" (2013) 122 Yale LJ 1900 at 1904.
[64] *Ibid* at 1905.
[65] *Ibid* at 1904.

that will accrue in the future[,] it is difficult for proponents of particular innovations to gain the support of public, funders and policymakers that is necessary to secure research funding and a supportive policy environment."[66] When it comes to innovation, the expectations of entrepreneurs, financiers, policymakers, and the public are both descriptive and performative:

> Promises and concerns around technologies in the making mobilize and legitimate the activities of scientists, innovators, policy makers, and regulators, along with NGOs and other societal actors. In broader societal discourses, expectations of scientific progress are enduring components of "grand challenges" narratives, buttressing arguments about how science and technology are supposed to address the wicked problems of the twenty-first century.[67]

The expectations that we have of technology in general, and of specific technologies in particular, work to both mobilize and legitimate R&D in efforts to realize certain visions of the future. However, there is reason to be cautious about the grounds in which our expectations of technologies are sowed. In Lee Worth Bailey's words, "[t]he central expectation of control, the desire for mastery, is an integral part of technological intentions, but it is an inflated expectation—an enchantment—that can lead to terrible consequences. … Initial expectations sometimes neglect critical factors."[68] Consequently, it is important to acknowledge the ways in which "technological culture is teeming with dreams, visions, goals, expectations, and imaginative premises"[69] that tell us as much about the present state of affairs as it does about the future.

Beyond cultural factors, political and economic dynamics also push expectations about technologies in certain directions. For example, a problem with the private venture capital model is that the motivations of investors and entrepreneurs are often mismatched: "Entrepreneurs stand

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[66] Alan Petersen, "The Ethics of Expectations: Biobanks and the Promise of Personalised Medicine" (2009) 28:1 Monash Bioethics Rev 5.1 at 5.1.
[67] Kornelia Konrad et al, "Performing and Governing the Future in Science and Technology" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 465 at 465.
[68] Lee Worth Bailey, *The Enchantments of Technology* (Chicago: University of Illinois Press, 2005) at 21.
[69] *Ibid* at 17.

to benefit enormously from immediate share value growth, whilst the burden of longer-term failure usually falls on other kinds of community (investors, patients, public policy makers)."[70] This means that when it comes to early or emerging technologies, "there are few limiting constraints on the hyperbolic expectations seeded by entrepreneurial innovators."[71]

Relatedly, much of the early news that is reported about a technological innovation is provided by those who stand to profit or otherwise gain from society's acceptance of it. Because these actors are not "motivated to report the negative sides of new technologies[,] … the public gets its first insights and expectations from sources that are clearly biased."[72] The connection between expectation, innovation, and ethics is a growing site of critical attention,[73] and taking a justice perspective buttresses the argument that a more principled approach to developing and evaluating technologies must turn on less slanted representations of their real and potential impacts. Any glowing assessment of a technology provided by those who have a stake in its success should not be accepted at face value without independent assessment by an arm's length party.

The gap between what entrepreneurs claim technologies will do, what investors expect them to do, and the actual results is a major contributor to the proliferation of technological harms. This means that the task is not just about asking regulators or the public to become more skeptical when it comes to technological promises. Instead, it also points to "the significance of influencing the visions of entrepreneurs, the expectations of financiers and the preferences of

70 Nik Brown & Mike Michael, "A Sociology of Expectations: *Retrospecting Prospects* and *Prospecting Retrospects*" (2003) 15:1 Technology Analysis & Strategic Management 3 at 13.
71 *Ibid*.
72 Jerry Mander, *In the Absence of the Sacred: The Failure of Technology and the Survival of the Indian Nations* (San Francisco, CA: Sierra Club Books, 1991) at 2.
73 This is especially apparent in the field of health, and biomedicine more specifically: see e.g. Mike Michael & Marsha Rosengarten, *Innovation and Biomedicine: Ethics, Evidence and Expectation in HIV* (New York: Palgrave Macmillan, 2013); Wendy Lipworth & Renata Axler, "Towards a bioethics of innovation" (2016) 42:7 J Med Ethics 445.

users which are often not closely reflected in existing markets, as well as recognizing wider diversities in livelihoods and lifestyles."[74] This should be both a top-down and a bottom-up process; the role of the state therein will be discussed in the next section. Any transition towards more just and sustainable socio-technical regimes will require efforts on the part of all actors to recalibrate their expectations of technologies, how these are represented to others, and the consequences of these representations.

To this end, it bears repeating that we must remain cognizant of the negative, unpredictable, and systemic effects that can flow from the adoption of any new technology, no matter how innocuous it may seem. The laws of ecology, famously formulated by Barry Commoner in his book *The Closing Circle*, first published in 1971, remind us, *inter alia*, that everything is connected to everything else, and that every gain is won at some cost.[75] Though it is tempting to be credulous when it comes to technologies posing as solutions, technological fixes are not exempted from these laws.

History has repeatedly demonstrated that expectations of how technologies will develop and of the benefits that will accrue are not necessarily borne out in practice, and that even when new technologies do solve some problems, they too often create several more in their wake. Concurrent developments, like convergence in previously discrete fields of scientific inquiry and the increasing power of transnational corporations, have multiplied technology's potential impacts. As such, the hopes, promises and beliefs associated with technological fixes cannot substitute for truly transformative change. Good intentions are not good enough.

[74] Leach, Scoones & Stirling, *supra* note 22 at 29.
[75] Barry Commoner, *The Closing Circle: Nature, Man & Technology* (Mineola, NY: Dover Publications, 2020).

5.2.3 The Role of the State

Sources of funding and types of financing can colour the kind of R&D that follows, and have multiple trickle-down consequences.[76] For instance, the World Bank is a leading financier of agricultural development initiatives at the international level.[77] The World Bank is dedicated to providing assistance to middle- and low-income countries around the world, with the goals of ending poverty and increasing overall economic prosperity.[78] While these goals are commendable on their face, the World Bank has faced substantial criticism, including for its aggressive promotion of a particular kind of neoliberal capitalism[79] and for its lack of attention to the environmental and social impacts of the projects that it supports.[80]

At the national level, funding for R&D can come from either the public or the private sector. Generally, the private sector is considered more entrepreneurial than the public sector. The private sector is seen to be better positioned to drive innovation because it is faster, nimbler, and has a greater appetite for risk, whereas the state's role is largely seen to be limited to a "market-fixing" one, rather than a "market-making and market-shaping" approach.[81] However, this view is increasingly unconvincing. A clearer picture of the relative advantages and disadvantages of public and private sector funding demonstrates why the state should take a more proactive role in fostering, regulating, and steering innovation, both in the context of the agri-food sector and beyond.

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[76] Mariana Mazzucato & Gregor Semieniuk, "Public financing of innovation: new questions" (2017) 33:1 Oxford Review of Economic Policy 24 at 25: "the type of finance that innovators receive *is not neutral* and can affect both the rate and the direction of innovation." [emphasis in original]
[77] The World Bank, "Agriculture and Food", online: <http://www.worldbank.org/en/topic/agriculture/overview>.
[78] The World Bank, "What We Do", online: <https://www.worldbank.org/en/about/what-we-do>.
[79] See e.g. Richard Peet, *Unholy Trinity: The IMF, World Bank and WTO*, 2d ed (New York: Zed Books, 2009); Ngaire Woods, *The Globalizers: The IMF, the World Bank, and Their Borrowers* (Ithaca, NY: Cornell University Press, 2006).
[80] See e.g. Bruce Rich, *Mortgaging the Earth: The World Bank, Environmental Impoverishment, and the Crisis of Development* (Washington, DC: Island Press, 2013).
[81] Mazzucato & Semieniuk, *supra* note 76 at 26 [emphasis removed].

Contrary to conventional wisdom that markets should be left free from state interference (and indeed, the notion that they ever were or could be is a fallacy), Mariana Mazzucato has argued that the state's role in encouraging, facilitating, and shaping innovation can be significant.[82] Indeed, though the full range of actors is relevant in reconfiguring political, economic, social, and ethical incentive structures, the state has an especially pivotal part to play, because

> it can shape innovation in ways that either support or work against the development of socially and environmentally useful technology. It plays a crucial role in ensuring that technology, innovation and knowledge reach the most marginalized … And it finances a wide range of elements of national innovation systems and much of the basic research that private-sector entrepreneurs rely on when developing commercial products.[83]

As much as any party is or can be, the state is also better positioned to increase transparency in R&D, including in the forms of third-party review processes and quality control, thereby enriching our knowledge of what kinds of innovations have been attempted, and what the results were.[84] Accordingly, there is a strong case to be made for public funding of both basic research and applied research directed to more targeted ends, especially for solving widespread social and economic problems.

The state's capacity to bridge gaps where markets fail is key to incentivizing socially and environmentally beneficial innovations that might otherwise be undervalued. As opposed to the private sector, the state is well-placed to allocate R&D funds for playing a longer game, since building generative niches takes time. There is real value in making room to "fail" and learning from the process, reflecting a "willingness to engage in big thinking, and its underlying

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[82] See e.g. Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (New York: Anthem Press, 2013).
[83] Meikle, *supra* note 36 at 28.
[84] Pat Mooney & ETC Group, "The changing agribusiness climate: Corporate concentration, agricultural inputs, innovation and climate change" (2015) 2:2 Canadian Food Studies 117 at 121-122.

uncertainty."[85] Information about what does not work can be as instructive as information about what does, but current incentive structures tend to promote the generation of new research over the testing of existing research, and null findings, which can be extremely useful in their own right, are often unreported because they are not seen to add any value.[86] Shifting the drivers of innovation must therefore also entail a rethinking of our approaches to research more generally, such that we can enhance both the knowledge base we have to draw on along with what we do with that knowledge.

In light of the environmental and social problems that we face, moving away from a business-as-usual approach will become more and more imperative in the future. To this end, the concept of "eco-innovation" has recently received more attention,[87] as innovation is increasingly being undertaken with the aim of meeting commitments relating to environmental sustainability. Eco-innovations can be defined as "all measures of relevant actors (firms, politicians, unions, associations, churches, private households) which; develop new ideas, behavior, products and processes, apply or introduce them and; which contribute to a reduction of environmental burdens or to ecologically specified sustainability targets".[88] Eco-innovations therefore encompass a range of "products, services, processes, or business models" that can "benefit the environment by reducing pressure on natural resources and/or the emission of pollutants."[89] Over

[85] Mazzucato & Semieniuk, *supra* note 76 at 31.
[86] See e.g. Nathan Collins, "When Science Finds Nothing, It Often Publishes Nothing", *Pacific Standard* (3 September 2014, updated 14 June 2017), online: <https://psmag.com/social-justice/science-finds-nothing-often-publishes-nothing-research-academic-literature-90041>; Annie Franco, Neil Malhotra & Gabor Simonovits, "Publication bias in the social sciences: Unlocking the file drawer" (2014) 6203:345 Science 1502 (finding that authors in the social sciences do not write up and submit null findings); Susanne M Miller-Halegoua, "Why null results do not mean no results: negative findings have implications for policy, practice, and research" (2017) 7:2 Transl Behav Med 137 (arguing that null findings can helpfully inform and advance research, policy, and practice in improving health outcomes).
[87] See e.g. OECD, *Better Policies to Support Eco-innovation* (OECD Publishing, 2011), online: <http://dx.doi.org/10.1787/9789264096684-en>.
[88] Klaus Rennings, "Redefining innovation – eco-innovation research and the contribution from ecological economics" (2000) 32:3 Ecological Economics 319 at 322.
[89] OECD, *supra* note 87 at 13.

and above their environmental benefits, eco-innovations, such as those relating to organic agriculture, can also foster economic development and act "as a major driver of green growth."[90]

However, eco-innovations are "normally not self-enforcing. Because factors of technology push and market pull alone do not seem to be strong enough, eco-innovations need specific regulatory support."[91] Thus, thoughtful regulation and policy intervention is necessary not only to mitigate risks and harms arising from technologies, but also to support the development and growth of the kinds of technologies, and their corresponding infrastructures, that can further shared goals and ethical aspirations. This is an area that demands state leadership. Likewise, discourses of risk—the topic of the next section—is another area where serious rethinking is needed.

5.3 Discourses of Risk

In his influential book *Risk Society*, Ulrich Beck defined risk as "a *systematic way of dealing with hazards and insecurities induced and introduced by modernization itself.*"[92] Beck suggests that we have entered a period of "reflexive modernization", in which "the gain in power from techno-economic 'progress' is being increasingly overshadowed by the production of risks."[93] As a result, the question of how to best govern risk has spawned a vast body of scholarship in a cascade of disciplines.[94] Discourses of risk help determine the answers to questions like: when

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[90] *Ibid*.
[91] Rennings, *supra* note 88 at 326.
[92] Ulrich Beck, *Risk Society: Towards a New Modernity* (London: SAGE, 1992) at 21 [emphasis in original].
[93] *Ibid* at 13.
[94] See e.g. Pat O'Malley, *Risk, Uncertainty and Government* (Portland, OR: Glasshouse Press, 2004); Michael Baram & Mathilde Bourrier, eds, *Governing Risk in GM Agriculture* (New York: Cambridge University Press, 2011); Peter WB Phillips, Stuart J Smyth & William A Kerr, eds, *Governing Risk in the 21st Century: Lessons from the World of Biotechnology* (New York: Nova Science Publishers, 2006); Shawn HE Harmon, Graeme Laurie & Gill Haddow, "Governing risk, engaging publics and engendering trust: New horizons for law and social science?" (2013) 40:1 Science & Public Pol'y 25.

should a precautionary approach be used in regulating new and emerging technologies? Who carries the burden of proof? On what basis is that burden of proof discharged?

The analysis and governance of risk is "often characterized as a multi-stage process comprising risk identification, risk measurement, risk evaluation and risk management."[95] This framework presumes that it is possible to accurately distinguish specific hazards, calculate the magnitude of potential harm along with the probability of its occurrence, and eliminate or reduce risks through a variety of control measures. However, by concealing "issues relating to shifting relationships, dependencies, and power distributions, as well as attention to specific context", the "consequentialist and broadly utilitarian" approach that dominant risk frameworks for assessing and governing risk embody "is inadequate for identifying the varied forms of peril that may lurk beneath the hype and hyperbole surrounding [a] technology's introduction."[96]

Technology regulation often proceeds from an enduring assumption that rational decision-making should be based on sound scientific evidence.[97] Yet, the fact that a decision can be grounded in "science" does not necessarily mean that it is the best course of action in policymaking, or that it is free from subjective considerations. As Sujatha Raman puts it, "the notion of 'science-based' or 'evidence-based' policymaking can be misleading if it implies that evidence speaks for itself unmediated by particular agents."[98] Modern scholarship has made clear that, despite the ideal of objectivity, science is decidedly not value-free.[99] Therefore, "[s]cience itself rarely provides sufficient basis for selecting between different courses of action, given that

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[95] Paul B Thompson, *Food Biotechnology in Ethical Perspective*, 2d ed (Dordrecht, The Netherlands: Springer, 2007) at 24.
[96] Christopher J Preston & Fern Wickson, "Broadening the lens for the governance of emerging technologies: Care ethics and agricultural biotechnology" (2016) 45 Technology in Society 48 at 49.
[97] *Ibid* at 54.
[98] Sujatha Raman, "Science, uncertainty and the normative question of epistemic governance in policymaking" in Emilie Cloatre & Martyn Pickersgill, eds, *Knowledge, Technology and Law* (New York: Routledge, 2015) 17 at 19.
[99] See generally Harold Kincard, John Dupré & Alison Wylie, eds, *Value-Free Science?: Ideals and Illusions* (New York: Oxford University Press, 2007).

such action inevitably involves beliefs as to what the future *should* look like."[100] This is especially so in cases of great uncertainty.

Moreover, science itself generates conflicting results that are often treated differently within the internal scientific community than outside of it.[101] When an issue becomes politicized, and scientific knowledge claims are contested in turn, this can result in "the perpetuation of extreme viewpoints that often have little acceptance in the wider scientific community."[102] The power of the term "science-based" thus becomes diluted, as "[a]ny policy maker can choose from a generous menu of options in seeking scientific support for political positions."[103] Meanwhile, the rhetoric of impartial science can be mobilized by governments to add a veneer of neutrality and legitimacy to what are ultimately political decisions.[104] In the context of plant biotechnologies, for example, Peter Andrée has criticized the current Canadian model of regulation as being "a system that hides behind the guise of being science-based in order to further only one particular set of value judgements regarding GMOs."[105]

Cloaking the value judgments inherent in scientific determinations of risk elides their character as subjective choices based on mediated information about a circumscribed set of variables, as opposed to objective ones based on best available knowledge in any absolute sense. The effect of this shrouding is to tacitly endorse a particular normative standpoint. By making the outcomes of "science-based" decision-making more difficult to challenge, the discourse of

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[100] Michael S Carolan, "The Bright- and Blind-Spots of Science: Why Objective Knowledge is Not Enough to Resolve Environmental Controversies" (2008) 34:5 Critical Sociology 725 at 734 [emphasis in original].
[101] *Ibid*.
[102] *Ibid* at 731.
[103] Sarewitz, *supra* note 29 at 93.
[104] See Mark Brown, "Environmental Science and Politics" in Teena Gabrielson et al, eds, *The Oxford Handbook of Environmental Political Theory* (Oxford: Oxford University Press, 2016) 491-504.
[105] Peter Andrée, "The Biopolitics of Genetically Modified Organisms in Canada" (2002) 37:3 J Can Studs 162 at 186.

"value-neutrality, objectivity, social impartiality appears to serve projects of social control."[106] Indeed, Sandra Harding asserts that "[a]n institution that insists it is already satisfying such goals, and can point to its rules for doing so, has created a powerful rhetorical device for legitimating its own biases and their adoption into equally biased law and public policy."[107]

In sum, science does not provide conclusive answers that can adequately guide the inherently political exercise of decision-making based on calculated costs and benefits, and risk, as narrowly construed, is hardly the only relevant element for consideration. The sidelining of subjective, "emotional" elements of decision-making both misses the point—such dimensions play an identifiable role in people's assessments of technologies[108]—and fatuously assumes that it is possible to neatly divorce subjective and objective considerations within a risk framework. A democratically justified process for regulating risk demands more than science can provide on its own terms; the ethical and political dimensions of establishing the norms and rules for risk-based decision-making need to be made manifest as well.

5.3.1 The Precautionary Principle

Rethinking discourses of risk includes rethinking related concepts like the precautionary principle.[109] Questions of how to determine what constitutes appropriate thresholds for safety and/or harm are omnipresent in decision-making regarding the environment, as well as when it comes to new and emerging technologies. In such circumstances, the precautionary principle is often invoked as "the legal and ethical wastebasket for situations involving scientific

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[106] Harding, *supra* note 43 at 67.
[107] *Ibid*.
[108] Preston & Wickson, *supra* note 96 at 54.
[109] See generally Carolyn Raffensperger & Joel Tickner, eds, *Protecting Public Health and the Environment: Implementing the Precautionary Principle* (Washington, DC: Island Press, 1999).

uncertainty".[110] Chris Tollefson explains that "at its core the [precautionary] principle seeks to formalize precaution as a regulatory obligation in the face of environmental threats and scientific uncertainty."[111]

Although the precautionary principle enjoys widespread theoretical acceptance and is enshrined in various domestic and international laws and treaties relating to the environment,[112] it has been much maligned for a variety of reasons, including the accusation that it is "a recipe for stagnation … [and] anathema to innovation."[113] In particular, there is "a strong and persistent level of opposition to the use of the precautionary principle from powerful corporations on commercial grounds, as well as from some scientists who have been compromised by sources of funding, and from politicians fearing high economic or political costs arising from its application."[114] Special interests appear to significantly influence the reception of the precautionary principle; most objections are not rooted in some fundamental flaw inherent to the principle itself.

That being said, there are several challenges associated with implementing the precautionary principle irrespective of whether or not one acknowledges its value, and if so, to

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[110] Hailemichael Teshome Demissie, "Taming Matter for the Welfare of Humanity: Regulating Nanotechnology" in Roger Brownsword & Karen Yeung, eds, *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Oxford: Hart Publishing, 2008) 327 at 343.

[111] Chris Tollefson, "A Precautionary Tale: Trials and Tribulations of the Precautionary Principle" in Allan E Ingelson, ed, *Environment in the Courtroom* (Calgary: University of Calgary Press, 2019) 17 at 18.

[112] The most notable international acknowledgment of the precautionary principle is contained in the Rio Declaration, at Principle 15. 1992 Rio Declaration on Environment and Development, UN Doc A/CONF.151/26 (vol. I); 31 ILM 874 (1992), online: <http://www.unep.org/documents.multilingual/default.asp?documentid=78&articleid=1163>. In Canada, the precautionary principle is found in most federal environmental laws, including in the preamble of *CEPA, 1999*, when it states that "the Government of Canada is committed to implementing the precautionary principle that, where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation": *Canadian Environmental Protection Act, 1999*, SC 1999, c 33.

[113] Henry I Miller & Gregory Conko, *The Frankenfood Myth: How Protest and Politics Threaten the Biotech Revolution* (Westport, CT: Praeger, 2004) at xviii. See also Cass R Sunstein, *Laws of Fear: Beyond the Precautionary Principle* (New York: Cambridge University Press, 2005) at 26-34.

[114] Trace, *supra* note 38 at 140.

what extent. Among these challenges, the lack of a clear and consistent definition at both the national and international level is a major hurdle to overcome, and "[c]reating a common consensus around what the practical application of the precautionary principle would look like is clearly important if we are to manage the risks inherent in science and technology research and innovation."[115]

Compared to the EU, which has openly endorsed a precautionary approach in areas including food policy,[116] a "softer interpretation" of precaution is adopted in Canada. As Doern, Castle, and Phillips explain, "Canada's caution arises, in part, because of the pressure to sustain open and competitive international markets for our exports."[117] This ironic caution in relation to precaution indicates that political and economic considerations need to take a backseat if the precautionary principle is truly to function to protect environmental and human health over the long term, rather than capitulate to variables like trade pressures.

Further, Andrée has pointed out that "while the Government of Canada now formally accepts that precaution is a legitimate approach within risk-management, it has a … limited understanding of what this means in regulatory practice … allow[ing] for precautionary decision-making in cases of scientific uncertainty, but … not requir[ing] a precautionary approach to be the norm in risk assessment."[118] Thus, even when regulators adopt a precautionary approach, this

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[115] Meikle, *supra* note 36 at 22.
[116] For example, compared to the "product based" approach adopted in Canada and the US, the "process based" approach to GM regulation in the EU is much stricter, and imposes stringent approval and labelling requirements. European Commission, "GMO legislation", online: <https://ec.europa.eu/food/plant/gmo/legislation_en>. See in particular Regulation EC, *Regulation (EC) 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed*, [2003] OJ L 268/1.
[117] G Bruce Doern, David Castle & Peter WB Phillips, *Canadian Science, Technology, and Innovation Policy: The Innovation Economy and Society Nexus* (Montreal: McGill-Queen's University Press, 2016) at 47.
[118] Peter Andrée, "An analysis of efforts to improve genetically modified food regulation in Canada" (2006) 33:5 Science & Pub Pol'y 377 at 387.

does not necessarily encompass decisions made in the context of incomplete—and not merely uncertain—scientific information.[119]

Advocating for and implementing a more precautionary approach to regulating new and emerging technologies will certainly not be easy, insofar as it will require strong political backing. The task that is called for is not simply one of "cobbling new practices to existing frameworks",[120] but one that demands a more fundamental shift in values, since "[a]cting on even a qualified precautionary basis … represent[s] a challenge to current orthodoxy in legal decision-making, which is based so profoundly on the concept of proof."[121]

However, when it comes to new and emerging technologies, we cannot dispense with safeguards against unknown or uncertain harms. At the very least, some type of assessment should occur before any new technology is released, which accounts for social, economic, cultural, health, environmental, and ethical implications. Given the unique nature of risks arising in relation to new and emerging technologies in the agri-food sector, something even more than a generally precautionary approach may be called for in this context.

A compelling justification for adopting a precautionary approach when it comes to risky technologies is that it can help better align policy frameworks with public mores and thereby improve democratic decision-making. According to Roberto Andorno, "[t]he greatest merit of the precautionary principle is that it has succeeded to reflect the current public concern about the need to favor the protection of the public health and the environment over short term commercial interests at the time of choosing among different technological alternatives."[122] Moreover, Karen

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119 *Ibid*.
120 *Ibid*.
121 Karen Morrow, "Genetically Modified Organisms and Risk" in Luc Bodiguel & Michael Cardwell, eds, *The Regulation of Genetically Modified Organisms: Comparative Approaches* (New York: Oxford University Press, 2010) 54 at 63.
122 Roberto Andorno, "The Precautionary Principle: A New Legal Standard for a Technological Age" (2004) 2 JIBL 11 at 16.

Morrow argues that as the public has increasingly come to recognize science's faltering claim to authority, distrust and disenchantment has flourished.[123] Forging ahead with risky technologies without popular buy-in risks further alienating the public and breeding cynicism and suspicion, which can be politically and economically damaging, over and above being socially and environmentally detrimental.

Significantly, a precautionary approach does not necessarily void the potential benefits of a new technology, but simply postpones them until more persuasive evidence has been gathered.[124] While this process may be more difficult and time-consuming, a hasty but faulty decision is, in most cases, a dangerously inadequate substitute for a slower but sounder one. At the same time, "the precautionary principle calls for a greater imaginative effort in the development of safer and cleaner technologies."[125] It can therefore work synergistically with a shift in drivers of innovation to stimulate the development of more creative and perhaps less risky technologies and innovations that are better suited to meet environmental and social needs.

5.3.2 The Expert-Lay Divide

Another problem associated with existing discourses of risk relates to the ways in which they create and/or contribute to an expert-lay divide, whereby public concerns are often "reduced to issues of poor communication or lack of information."[126] This is also commonly referred to as the "knowledge-deficit model", which "assumes that if people just knew the facts, they would

[123] Morrow, *supra* note 121 at 57.
[124] Batie & Ervin, *supra* note 32 at 449.
[125] Andorno, *supra* note 122 at 16.
[126] André Magnan, "Refeudalizing the Public Sphere: 'Manipulated Publicity' in the Canadian Debate on GM Foods" (2006) 31:1 Can J Sociology 25 at 43. See also Melissa L Finucane et al, "Gender, race, and perceived risk: the 'white male' effect" (2000) 2:2 Health, Risk & Society 159 at 160; Melissa L Finucane, "Mad cows, mad corn and mad communities: the role of socio-cultural factors in the perceived risk of genetically-modified food" (2002) 61 Proceedings of the Nutrition Society 31 at 31.

reach the right conclusions or make the right decisions."[127] Opposition to or hesitation about technologies is "assumed to derive from ignorance and irrational fears" that can be remedied with better "transmission of knowledge from informed experts to the uninformed lay public."[128] The gulf between "lay" opinions and those of "experts" is not attributed to different perspectives and priorities founded on some legitimate basis, but instead, non-expert opinions are largely trivialized, "tending … to disqualify lay views as useful contributions to the public debate."[129]

As dependency on science and technology has deepened, particular forms of knowledge and expertise are commanding greater weight. Courts often defer to legislators, who, in turn, defer to "experts",[130] such that scientific and technical authority come to exert a disproportionate influence on law and policymaking, which should rightly take into account a much broader range of considerations. In this way, dominant discourses of risk act as "accomplices to the systematic patronization of the public as intellectually vacuous, and to the protection of scientific institutions from the necessary processes of critical self-reflexivity about the implicit limitations and contingencies of their own knowledge[,] which is being given unqualified sovereignty."[131]

When it comes to new and emerging technologies in the agri-food sector, we should not automatically defer to science as the most salient basis for decision-making. As stated in the previous chapter, the methods and goals of law and science differ in important ways, and "[t]he degree to which courts see the scientific issues as being central or peripheral to the legal question to be determined, and the degree to which they defer to the science, should … vary according to

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[127] William K Hallman, "GM Foods in Hindsight" in Edna F Einsiedel, ed, *Emerging Technologies: From Hindsight to Foresight* (Vancouver: UBC Press, 2009) 13 at 22.
[128] Magnan, *supra* note 126.
[129] *Ibid* at 42.
[130] David Collingridge & Colin Reeve, *Science Speaks to Power: The Role of Experts in Policy Making* (London: Frances Pinter Publishers Ltd, 1986).
[131] Brian Wynne, "Creating Public Alienation: Expert Cultures of Risk and Ethics on GMOs" (2001) 10:4 Science as Culture 445 at 447.

the scientific and legal contexts."[132] Since new and emerging technologies are associated with many different known unknowns and unknown unknowns, and coherent legal precedent does not exist, there is no justification for entirely subordinating the public's ethical and trust concerns to expert estimations.

The case of GMOs is demonstrative: rather than representing "a naïve (much less insatiable) demand for certainty," Brian Wynne has stressed how public resistance to GMOs reflects "a recognition that uncertainty is inevitable, and thus a demand that the implications of this endemic predicament of science and its dependence … be taken seriously."[133] However, the response to these demands often takes the form of doubling-down on the need for "science-based" policy. In such circumstances, invocation of the expert-lay divide is, in effect, "usually less a plea for understanding than an urging to compliance."[134]

As the debate about GMOs rages on, and new developments further strain attempts to ascribe conclusive authority to science, it becomes more apparent that "[n]one of the myths supporting the traditional concept of science's special role in policymaking can now be upheld; … there are serious difficulties in matching the needs of policy and research in science."[135] In addition to the implications for proactive policymaking, this means that "[s]cientific expertise and uncertainty should not be an excuse for courts to abdicate their legal duties, and should not be used as tools to hide policy preferences or to deny justice to those most seriously affected by environmental harm."[136] Focusing on the schism between scientific and technical experts and laypeople in terms of technical knowledge, as opposed to focusing on the common strivings, of

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132 Heather McLeod-Kilmurray, "Placing and Displacing Science: Science and the Gates of Judicial Power in Environmental Cases" (2009) 6:1-2 UOLTJ 25 at 28.
133 Wynne, *supra* note 131 at 456.
134 Winner, *Autonomous Technology*, *supra* note 4 at 199.
135 Collingridge & Reeve, *supra* note 130 at 28.
136 McLeod-Kilmurray, *supra* note 132 at 52.

all people, for a more just and sustainable world, undercuts the ability to develop collective solutions to the problems we face.

Moreover, the view that formal scientific training is required in order to legitimately participate in conversations about the acceptability and appropriateness of technologies is increasingly untenable, especially in domains as socially, culturally, and ethically charged as food. As Daniel Sarewitz points out, "just as society often counts on nonexpert juries to make reasoned decisions about difficult legal problems, so are interested members of the public—working with technical experts and mediators—quite able to acquire the background and information necessary to make reasoned and balanced decisions about complex technical issues."[137] Although it may be easy and convenient to dismiss lay perspectives on the basis that they lack recognized claims to authority and are grounded in non-objective considerations, it is not necessarily optimal to prioritize technoscientific expertise at the expense of other forms of knowledge and lived experience.

By contrast, the feminist emphasis on the experiential perspective begins with the understanding that lived realities are legitimate forms of knowledge that can give rise to constructive criticisms of existing distributions of power.[138] Rather than claiming a superior authority or a unitary stance, feminist positionality "acknowledges the existence of empirical truths, values and knowledge, and also their contingency."[139] It recognizes that the boundaries between the scientific and the social are porous, and determinations of what counts as relevant knowledge, and the further implications of those distinctions, are closely tied to flows of power

[137] Sarewitz, *supra* note 29 at 182. See also John Doble & Amy Richardson, "You Don't Have to be a Rocket Scientist…" (1992) 95:1 Technology Review 51.
[138] Deborah L Rhode, "Feminist Critical Theories" (1990) 42 Stanford L Rev 617.
[139] Katharine T Bartlett, "Feminist Legal Methods" (1990) 103:4 Harvard L Rev 829 at 880.

that are often rendered invisible by their sustained dominion. No singular set of interests is "natural, objective, and inevitable".[140]

To be clear, this is not to say that any subjective opinion can stand in for established facts, or that all opinions are equally valid. The epistemic assumptions made within each of the fields of science, technology, and law can be useful and necessary to carry out certain tasks. However, specialist training can also have the effect of restricting the approaches taken to problems, including at each of the stages of risk identification, risk measurement, risk evaluation, and risk management. Unduly privileging scientific and technical expertise may come at the expense of other valid and valuable ways of seeing, knowing, and acting. Given the scope and complexity of the problems we face today, it is essential that we take seriously the point that the voices of the marginalized ought to be included not only because it is right, but also because certain kinds of political changes may be enabled through greater inclusion.[141]

In chipping away at the expert-lay divide, framing is significant, because it influences not only the way that problems are understood, but also the kinds of solutions that are imagined, and then considered the most effective and appropriate.[142] Problems that are framed as questions of costs and benefits are more easily characterized "as technical issues that are best resolved by

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[140] *Ibid* at 886.

[141] Marianne Janack, "Standpoint Epistemology Without the 'Standpoint'?: An Examination of Epistemic Privilege and Epistemic Authority" (1997) 12:2 Hypatia 125 at 137 [emphasis in original].

[142] According to Robert Entman, to frame is "to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described." Robert M Entman, "Framing: Toward Clarification of a Fractured Paradigm" (1993) 43:4 Journal of Communication 51 at 52 [emphasis removed]. Another definition of framing posits that it involves "the particular contextual assumptions, methods, forms of interpretation and values that different groups might bring to a problem, shaping how it is bounded and understood. In many situations, such understandings take the form of diverse storylines about a given problem: how it has arisen, why it matters and what to do about it." Leach, Scoones & Stirling, *supra* note 22 at 4. See also Erving Goffman, *Frame Analysis: An Essay on the Organization of Experience* (Cambridge, MA: Harvard University Press, 1974); Amos Tversky & Daniel Kahneman, "Rational Choice and the Framing of Decisions" (1986) 59:4 The Journal of Business S251.

technical experts",[143] but many complex problems are not amenable to this kind of atomistic analysis. There are two reinforcing processes at work here: one that reframes social problems as technical ones, and one that evaluates the success of a solution on technical terms. While scientific and technical expertise is valuable in its own way, it does not necessarily help resolve ethical questions, and may in fact be antithetical to thinking ethically about risk. Discussions and decisions about risk cannot and should not be sanitized from the inevitably subjective ethical and social questions they entail. Consequently, reframing "problems as ethical or moral conundrums can help … producers and consumers see them in ways that make them more aware, accountable, or responsible for their decisions."[144]

5.2.3 The Perception of Risk

The value judgments that are reflected in risk-based decision-making are appreciably coloured by one's position. Research has established that there are notable differences in risk perception based on factors like gender, race, and socioeconomic standing, even accounting for differences in education and technical understanding.[145] Risk perception is "influenced as much by social relations and feelings of power and powerlessness as by objective knowledge about the likelihood of large-scale accidents or individual harm."[146] For example, in the context of climate change, conservative white males are more likely than other demographic groups of adults in the US to express climate change denial views, and "display tendencies to justify and defend the current social and economic system."[147]

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[143] Sarewitz, *supra* note 29 at 160.
[144] Benjamin K Sovacool & Michael H Dworkin, "Energy justice: Conceptual insights and practical applications" (2015) 142 Applied Energy 435 at 436.
[145] Finucane et al, *supra* note 126.
[146] Ambuj Sagar, Arthur Daemmrich & Mona Ashiya, "The tragedy of the commoners: biotechnology and its publics" (2000) 18 Nature Biotechnology 2 at 3.
[147] Aaron M McCright & Riley E Dunlap, "Cool dudes: The denial of climate change among conservative white males in the United States" (2011) 21 Global Environmental Change 1163 at 1171.

Thus, when it comes to risks associated with technologies, risk perception "may reflect deep-seated values about technology and its impact on society. White males may perceive less risk than others because they are more involved in creating, managing, controlling and benefiting from technology. Women and non-white men may perceive greater risk because they tend to be more vulnerable, have less control, and benefit less."[148] The results of consumer surveys also indicates that ''young, white, male, and college-educated individuals are more likely to react favorably to food biotechnology".[149] Tellingly, the executive teams of many companies working on large-scale technologies in the agri-food sector are predominantly male, with a majority of them also being white.[150] This correlation cannot simply be chalked up to coincidence; it speaks to entrenched structural biases, complex social and cultural entanglements, and the particular ways in which these intersect with science and technology.

Taking a systems-level perspective illuminates why the development of particular kinds of new and emerging technologies in the agri-food sector might arouse greater pushback than in other areas. Attempts to boil risk down to a quantitative measure ignores the fact that

> study after study of risk perception has pointed out … that the public is often more concerned about the social and cultural dimensions of risk than about actual or predicted numerical impacts. Thus, people will tolerate a higher probability of death or injury from activities that they feel they can meaningfully control (smoking, eating, automobile driving) than from activities that heighten their sense of powerlessness or distrust (nuclear power, pesticide use, air transportation).[151]

Because the social and cultural dimensions of risk are so prominent when it comes to food, the public is understandably more leery to concede control when it comes to technologies that have

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[148] Finucane et al, *supra* note 126 at 161.
[149] Brian Bennett et al, "Willingness to Consume Genetically Modified Foods—The Case of Fish and Seafood" (2005) 9 Aquaculture Economics & Management 331 at 334
[150] See e.g. the Chief Executive Officers and Chief Scientific Officers of companies like AquaBounty, Mosa Meats, SuperMeat, Finless Foods, and Clara Foods.
[151] Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (Cambridge, MA: Harvard University Press, 1995) at 13.

the potential to affect their ability to make autonomous, informed choices about what they grow, buy, consume, and feed to their families.

Ultimately, it is those who stand to benefit most—and those who feel confident that they will have access to treatment or remedies if things go wrong (i.e. suffer the least harm)—that generally seem to perceive less risk when it comes to technological, health, and environmental hazards.[152] In a similar vein, positionality also affects attitudes towards decision-making and regulatory processes when it comes to risk: "compared with others, white males seem to promote individual achievement, initiative, and self-regulation, trust in experts and risk proponents, and intolerance of community-based decision and regulation processes".[153] This "hierarchical and anti-egalitarian"[154] attitude tracks closely with the rational, autonomous actor of liberal legal theory, in contrast with the more relational ontology espoused by many feminist accounts.[155]

From a justice-based perspective, these findings on the mutually constitutive relationship between positionality and risk perception underscore how the products and processes of science and technology are intimately tied to power and control.[156] The differences in how risks are perceived have a clear bearing on opinions about how risks should be treated at law, reinforcing the need for more community-based decision-making processes that include a wide range of perspectives and abilities to affect the outcomes. It also suggests why an increasing reliance on scientists, technocrats, and other kinds of "experts" is problematic, insofar as these groups of people tend to be in situations of relative privilege and may therefore be limited in their ability to perceive the risks arising from technologies for other groups.

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[152] See e.g. McCright & Dunlap, *supra* note 147.
[153] Finucane et al, *supra* note 126 at 170.
[154] *Ibid* at 162.
[155] See e.g. Preston & Wickson, *supra* note 96.
[156] Dorothy Nelkin, "Science Controversies: The Dynamics of Public Disputes in the United States" in Sheila Jasanoff et al, eds, *Handbook of Science and Technology Studies* (Thousand Oaks: Sage Publications, 1995) 444 at 445.

Accounting for risk perception in the interconnected processes of developing, deploying, using, and regulating technologies means conceding that risk is not some objective value that relates to a specific, identifiable hazard. When it comes to designing technologies, ensuring that they afford people a sense of control is one way to better mitigate risk and enhance public trust in risk-related policy- and decision-making. At the other end of the spectrum, legislators and judges should not necessarily defer to expert authority in making decisions about risks emanating from technologies. Rather, there are instances where "[d]oing justice in a democratic society requires courts to respect … normative positions even if they cut against the managerial preferences of the nation's scientific and technological elite."[157] More nuanced understandings of risk can help shed light on such instances as they arise, as well as lend acumen in resolving them.

5.4 Distribution of Returns

Though a common characterization of the relationship between technology and justice holds that "a rising technological tide lifts all boats and leads to a convergence of living standards",[158] a closer examination through a less rose-coloured lens makes it patently clear that with any new technology, there will be winners and losers, albeit to varying degrees. Not only do marginalized groups bear a disproportionate burden of risks arising from many technologies, but in many cases, they also do not receive their fair share of benefits from technological developments.

Too often, there is a glaring disparity between the beneficiaries of technologies and those who are exploited in the process. As the work of the EJ movement has firmly established,

> hazardous technologies do not in practice spread randomly or evenly across space and social groups. They tend to cluster in poorer, politically disadvantaged neighborhoods (and, increasingly, in poorer regions of the world), where people have neither the

[157] Jasanoff, *Science at the Bar*, *supra* note 151 at 13.
[158] Frank Pasquale, "Technology, Competition, and Values" (2007) 8:2 Minn JL Sci & Tech 607 at 610.

> technological expertise nor the connections and clout needed to keep dangerous developments out of their localities.[159]

The uneven allocation of the benefits and burdens of technologies serves not just to prejudice the already disadvantaged, but aggravates inequality at all scales by allowing the rich to get richer off the backs of the poor, because "much technology is used not just … to improve its user's life, but also to help its user gain advantage over others."[160] What this means is that "we need to ensure that in supporting technology innovation we avoid distributing a return on investment that results in the privatization of gain but the socialization of risk."[161]

We cannot disregard or forget the fact that even while they have enabled a dramatic rise in the standard of living for many segments of the world's population, many technologies have also had the counterintuitive effect of causing or worsening an array of social and ethical harms. When it comes to food production alone,

> [m]illions of people worldwide suffer from environmental health problems arising from agrochemicals (pesticides and fertilisers) and other pollutants in ground water (such as manure); from livestock-related zoonoses and food-borne pathogens; from water-borne diseases such as malaria that are linked to agricultural water use; and exposed to a wide range of agricultural occupational health hazards, from respiratory diseases to accidents, UV radiation and mental health problems.[162]

Adding insult to injury, the new problems that arise often compound the already difficult situations of the most vulnerable groups in society: "[p]oor health status due to other factors in turn undermines people's ability to absorb the nutrients available in food, which further increases their vulnerability to disease. Poor people, particularly those who are most marginalised, are most likely to be affected by the negative health effects of food production."[163] This vicious

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[159] Sheila Jasanoff, *The Ethics of Invention: Technology and the Human Future* (New York: W.W. Norton & Company, 2016) at 49.
[160] Pasquale, *supra* note 158 at 608.
[161] Trace, *supra* note 38 at 124.
[162] Tara Garnett, "Food sustainability: problems, perspectives and solutions" (2013) 72 Proceedings of the Nutrition Society 29 at 31.
[163] *Ibid*.

cycle is unlikely to be broken without targeted interventions that go beyond a mindset that more technologies are straightforward solutions to problems wrought by previous technologies.

As evidenced across virtually all sectors, "new technologies can harden social stratification and prompt arms races that merely reallocate (rather than produce new) goods and services."[164] Thanks to globalization, the chain connecting technological "progress" in the wealthy, industrialized countries with environmental and social harms in other parts of the world is often difficult to appreciate. For example, in the "information age", the rapid proliferation of personal technological devices, combined with an economic system that incentivizes planned obsolescence,[165] has created devastating consequences.

Electronic waste, or e-waste, is a growing problem that has profound ramifications for global environmental and human health.[166] There are also social costs at every stage of the life cycle of technological devices. In December 2019, International Rights Advocates brought a lawsuit against some of the world's largest technology companies, including Apple, Microsoft, and Dell, for the deaths of and injuries sustained by children who mined for cobalt in the Democratic Republic of Congo.[167] Cobalt is in high demand because it is an essential element of

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[164] Pasquale, *supra* note 158 at 611.

[165] Sabine Lebel, "Fast Machines, Slow Violence: ICTs, Planned Obsolescence, and E-waste" (2016) 13:3 Globalizations 300.

[166] See e.g. Brett H Robinson, "E-waste: An assessment of global production and environmental impacts" (2009) 408:2 Science of the Total Environment 183; Kristen Grant et al, "Health consequences of exposure to e-waste: a systematic review" (2013) 1:6 Lancet Global Health E350; Devin N Perkins et al, "E-Waste: A Global Hazard" (2014) 80:4 Annals of Global Health 286; Michelle Heacock et al, "E-Waste and Harm to Vulnerable Populations: A Growing Global Problem" (2016) 124:5 Environmental Health Perspectives 550. See also Alana Semuels, "The World Has an E-Waste Problem", *TIME* (23 May 2019), online: <https://time.com/5594380/world-electronic-waste-problem/> (discussing some of the regulatory aspects of the problems of and solutions to e-waste, such as Extended Producer Responsibility (EPR) laws).

[167] International Rights Advocates, "Class Complaint for Injunctive Relief and Damages", online: <http://iradvocates.org/sites/iradvocates.org/files/stamped%20-Complaint.pdf>; International Rights Advocates, "IRAdvocates Files Forced Child Labor Case Against Tech Giants Apple, Alphabet, Dell, Microsoft and Tesla for Aiding and Abetting Extreme Abuse of Children Mining Cobalt in DRC", Press Release (15 December 2019), online: <http://www.iradvocates.org/press-release/iradvocates-files-forced-child-labor-case-against-tech-giants-apple-alphabet-dell> ["Press Release"].

rechargeable lithium-ion batteries that are commonly used in consumer electronics. As the Press Release published by International Rights Advocates contends, "[r]ather than step up to help these children with a negligible portion of their vast wealth and power, these companies do nothing but continue to benefit from cheap cobalt mined by kids robbed of their childhoods, their health, and for far too many, their lives."[168]

While legal challenges and social movements can serve to demand greater accountability from the corporations that perpetuate these kinds of harms, we must continue to strike at the foundational structures that allow such wrongs to manifest in the first place. Applying a justice framework to our understanding of technologies and their impacts reminds us that there is not some inexorable way in which the chips must fall. Attention to capacity—both to engage and to resist—reveals that technologies are far from neutral, their benefits and burdens are unequally shared, and laws and policies can exacerbate these imbalances, whether directly or indirectly. Developing strategies that promote fairer allocation of the benefits arising from technologies, as well as encouraging more equal access to technologies, can serve to reorient the development, deployment, use, and regulation of technologies such that they can produce more just outcomes.

5.4.1 Benefits of Technologies

Though it seems almost too obvious to have to state, technology justice requires that the benefits associated with technologies be more equally distributed, both within and among nations. If technology is to be used as a means of strengthening rather than diminishing justice, it "must reduce rather than increase the gaps between rich and poor."[169] Moreover, efforts to create more equitable and sustainable outcomes from our uses of technology should not only be prospective, but should also be concerned with the correction of historical injustices, because "what is

[168] International Rights Advocates, "Press Release", *ibid*.
[169] Ian G Barbour, *Technology, Environment, and Human Values* (New York: Praeger, 1980) at 295.

important is not the particular pattern of distribution at a particular moment, but rather the reproduction of a regular distributive pattern over time."[170]

However, ensuring that the benefits of technologies are channelled to noble ends and better distributed among the haves and have-nots is easier said than done. Questions about how to equitably distribute returns become especially complicated when it comes to adjudicating competing claims. There is seldom clear direction as to how to proceed in such situations. For example, within the Canadian Biotechnology Strategy (CBS), goals like being "sensitive to the needs of developing countries to build local capacity in managing the potential risks of biotechnology" and "[p]osition[ing] Canada as a responsible world leader in the development, commercialization, sale and use of biotechnology"[171] are difficult to reconcile conceptually, and there is little guidance on how to balance conflicting priorities in practice.

Similar problems arise in the context of Canada's Food Security Strategy for developing countries, which reflects a productionist approach to addressing food insecurity that relies heavily on technology and innovation, as well as exports.[172] Yet, the relationship between agricultural biotechnology and poverty is already complex,[173] and there is no guarantee that technologies will alleviate poverty, increase food security, or generate other positive outcomes. What is clear is that without context-specific design and application, the needs of the most vulnerable are unlikely to be met by technologies developed without close attention paid to local systems. To this end, vague claims about "meeting the needs of the poor" should be replaced by

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[170] Iris Marion Young, *Justice and the Politics of Difference* (Princeton, NJ: Princeton University Press, 1990) at 29.
[171] Government of Canada, "Canada's Biotechnology Strategy", online: <https://www.canada.ca/en/health-canada/services/science-research/emerging-technology/biotechnology/role/canada-biotechnology-strategy.html> (last updated August 29, 2017).
[172] See Chapter 2.2.
[173] Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2003-04: Agricultural Biotechnology: Meeting the needs of the poor?* (Rome: FAO, 2004), online: <www.fao.org/3/a-y5160e.pdf> [*The State of Food and Agriculture 2003–04*].

more measurable benchmarks and targeted goals, informed by conversations with affected groups as to what having their needs met actually looks like, and how they would prefer that to be done.

Prescribing technological solutions for social problems is not only paternalistic, but in many cases, it usually does not respond to the underlying issues causing or contributing to the problem in the first place. Meanwhile, a continued focus on technological solutions may obviate a need to address the disparate contributions to the current state of affairs. For one, "[i]n more and more areas, industry is beginning to profit from its secondary problems, ignoring its own role in their origin."[174] Industries need to be held more accountable for the long-standing harms that they are responsible for creating, rather than being given carte blanche to carry on as they have before, in exchange for technological promises that speak only to increases in efficiency or remedying only certain kinds of consequences.

To this end, part of the task of more equitably sharing the benefits relating to technologies will entail increasing transparency around funding: who is providing it, to what extent, and for what purposes. In particular, the state's role in funding R&D must be more clearly articulated, such that the dividends can be better redistributed to ends that further the public good, as opposed to being predominantly captured by the private sector.[175] For example, many of the participants of the newly-formed Protein Industries Supercluster mentioned in Chapter 2 are large corporations like AGT Food and Ingredients Inc, Maple Leaf Foods Inc, and Dow Dupont Agriculture.[176] This composition is worrisome insofar as it seems to reinforce the

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174 Beck, *supra* note 92 at 176.
175 See e.g. Ian Scoones, Melissa Leach & Peter Newell, eds, *The Politics of Green Transformations* (New York: Routledge, 2015); Mazzucato, *supra* note 82.
176 Government of Canada, "Protein Industries Supercluster", online: <http://www.ic.gc.ca/eic/site/093.nsf/eng/00012.html> (last updated March 17, 2020).

power of such organizations to exert a disproportionate influence on policy outcomes and policy-making processes. The close associations between large corporations, centralized control structures, and industrial technology renders them less likely and less well positioned to develop radically different approaches that may run counter to their private interests, but better serve the public interest. As such, increasing support for small, independent farmers and producers (both in terms of financial support and in terms of increasing participatory capacity) and finding other ways to diffuse the concentration of power in the agri-food sector will be necessary to help promote fairer and more positive outcomes.

There are also significant inconsistencies at the nation-state level that need to be better recognized. The GHG emissions associated with the industrialization of wealthy countries is largely culpable for climate change and much of the environmental degradation that we are contending with today.[177] There remains a marked inequality in the distribution of international energy footprints, with the wealthiest tenth of the population consuming about 20 times more energy than the bottom ten.[178]

The question of how best to reconcile the need to take action on climate change while fairly allocating the costs of such action has led to considerable handwringing.[179] In response, a principle of international environmental law has emerged that holds that we have "common but differentiated responsibilities and respective capabilities"[180] in addressing climate change, which

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[177] See e.g. Hannah Ritchie & Max Roser, "CO_2 and Greenhouse Gas Emissions", *Our World in Data* (December 2019), online: <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>.
[178] Yannick Oswald, Anne Owen & Julia K Steinberger, "Large inequality in international and intranational energy footprints between income groups and across consumption categories" (2020) 5 Nature Energy 231.
[179] See e.g. Henry Shue, "Subsistence Emissions and Luxury Emissions" (1993) 15:1 Law & Policy 39; Edward A Page, "Distributing the burdens of climate change" (2008) 17:4 Environmental Politics 556; Fabian Schuppert, "Climate change mitigation and intergenerational justice" (2011) 20:3 Environmental Politics 303.
[180] The principle of common but differentiated responsibilities in enshrined in the 1992 UNFCCC treaty, which reads that "the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but

generally means that wealthier nations are charged with carrying a greater share of the burden.[181] Though the principle has been contested in terms of its ability to contribute to a robust international regime to address climate change,[182] it serves as an important reminder that we are not equally blameworthy when it comes to the consequences of production and consumption practices at individual, national, and global levels. Thus, it is profoundly unjust to continue to develop technologies that, in their outcomes, work counter to the needs of the most marginalized. If they are to contribute to a more just and sustainable future for all, technologies and their benefits must be redirected to serve people instead of profit.

5.4.2 Access to Technologies

It is not just access to the benefits of technologies, but also access to technologies themselves that must be facilitated, such that technology development, use, and innovation can be fostered in a more inclusive, adaptive, and appropriate way. Indeed, in the context of the agri-food sector, the FAO has observed that technologies "can benefit the poor when appropriate innovations are developed and when poor farmers in poor countries have access to them on profitable terms."[183] That being said, technologies should form but one part of "an integrated and comprehensive agricultural research and development programme that gives priority to the problems of the poor."[184]

In speaking of access to technologies, both "access" and "technology" should be construed broadly, to include access to the process of developing a wide range of technologies,

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differentiated responsibilities and respective capabilities and their social and economic conditions." United Nations Framework Convention on Climate Change, 4 June 1992, 1771 UNTS 107 at 1 (entered into force 21 March 1994).

[181] See e.g. Christopher D Stone, "Common but Differentiated Responsibilities in International Law" (2004) 98:2 Am J Int'l L 276.

[182] See e.g. Mary J Bortscheller, "Equitable but Ineffective: How the Principle of Common but Differentiated Responsibilities Hobbles the Global Fight against Climate Change" (2010) 10:2 Sustainable Dev L & Pol'y 49.

[183] *The State of Food and Agriculture 2003-04*, *supra* note 173 at 5.

[184] *Ibid*.

in addition to end-user access to technologies themselves. Expanding access to technologies is important not only for reasons of justice, but also because drawing on a wider pool of knowledge, talent, and insight can contribute to the development and adaptation of technologies that are better able to meet pressing human needs and demands.[185]

The case of women in agriculture is illustrative. Women play a significant role in global food security and agricultural production.[186] As a result, women's empowerment and greater gender equality has been proposed as an important tool against hunger and food insecurity.[187] In most parts of the world, women perform the majority of food-related work.[188] On average, 43 percent of the agricultural labour force in developing countries is female.[189] According to 2017 data compiled by The World Bank, the percentage of female employment in agriculture is as high as 70 percent in low-income countries.[190] In Canada, women made up 28.7 percent of farm operators in 2016.[191] Though this represents far from a majority, it is up from 27.4 percent in 2011,[192] and in some areas of the country, more new farmers are women than men.[193]

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[185] Sarah Behnam, Raffaela Cagliano & Mercedes Grijalvo, "How should firms reconcile their open innovation capabilities for incorporating external actors in innovations aimed at sustainable development?" (2018) 170 J Cleaner Prod 950.

[186] Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2010-11—Women in agriculture: Closing the gender gap for development* (Rome: FAO, 2011), online: <http://www.fao.org/docrep/013/i2050e/i2050e.pdf> [*The State of Food and Agriculture 2010-11*]; International Food Policy Research Institute, *Women: The Key to Food Security* (Washington, DC: IFPRI, 2000), online: <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/125453/filename/125454.pdf>.

[187] Asian Development Bank & Food and Agriculture Organization of the United Nations, *Gender Equality and Food Security: Women's Empowerment as a Tool against Hunger* (Mandaluyong City, Philippines: Asian Development Bank, 2013).

[188] Vandana Shiva, "Women and the gendered politics of food" (2009) 37:2 Philosophical Topics 17 at 18-19.

[189] *The State of Food and Agriculture 2010-11, supra* note 186 at 5.

[190] The World Bank, "Employment in agriculture, female (% of female employment) (modeled ILO estimate)", online: <https://data.worldbank.org/indicator/SL.AGR.EMPL.FE.ZS?end=2017&start=2017&view=map>.

[191] Statistics Canada, "2016 Census of Agriculture", *The Daily* (10 May 2017), online: <https://www150.statcan.gc.ca/n1/en/daily-quotidien/170510/dq170510a-eng.pdf?st=8qN08pSz> at 4.

[192] *Ibid*.

[193] Tori Weldon, "More new farmers are women than men in Atlantic Canada, study shows", *CBC News* (6 May 2016), online: <https://www.cbc.ca/news/canada/new-brunswick/farmers-women-atlantic-1.3571369>.

Nevertheless, there is a clear and deep-seated gender gap in the agricultural sector. This inequity manifests in several different ways: for example, women persistently face more barriers and constraints than men in accessing resources, markets, and services;[194] women's food and agricultural-related work is frequently under-recognized and under-valued, both inside and outside of the home;[195] and within the agricultural industry, women seldom hold positions of power and the accompanying ability to make or influence decisions that profoundly affect their lives.[196] These impediments exist not only for women in lower-income countries, but also for women in wealthy countries like Canada.[197]

Meanwhile, the growing use of technology in the agri-food sector serves in many ways to exacerbate existing inequalities. Although the agri-food tech sector has exploded in recent years, recent research has demonstrated that funding in the sector is highly gendered.[198] While agri-food tech companies raised a record $16.9 billion dollars globally in 2018,[199] startups with at least one female founder represented only 16 percent of those deals and received just 5 percent of investments.[200] Today, the fact that more than 82 percent of investment decision makers are male creates a structural bias that prevents female founders and CEOs from accessing the necessary capital to start and grow their enterprises.[201]

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[194] *The State of Food and Agriculture 2010-11*, *supra* note 186.
[195] Patricia Allen & Carolyn Sachs, "Women and Food Chains: The Gendered Politics of Food" (2007) 15:1 International Journal of Sociology of Agriculture and Food 1; Shiva, *supra* note 188 at 18-19.
[196] Allen & Sachs, *ibid* at 8.
[197] Tony Seskus, "Women in Canada are choosing farming careers but barriers persist", *CBC News* (1 May 2018), online: <https://www.cbc.ca/news/business/women-farming-canada-1.4595436>; Janet Davison, "'Where's your husband?': Women in farming still fighting against old boys' club", *CBC News* (11 December 2016), online: <https://www.cbc.ca/news/canada/women-agriculture-barriers-1.3878774>.
[198] AgFunder, The New Food Economy & KK&P, *Money Where Our Mouths Are: Female Funding Gaps in Agri-FoodTech* (September 2019), online: <https://mwoma.org/s/MWOMA-Report-Final.pdf> [*Money Where Our Mouths Are*].
[199] *Ibid* at 4.
[200] *Ibid* at 5.
[201] *Ibid* at 27.

Yet, women make a majority of household buying decisions,[202] and tend to be closer to the issues relating to food production and consumption—and are thereby better positioned to devise effective solutions that are less compromised by male-biased design. Indeed, the fact that women are less likely to adopt agricultural technologies[203] may be attributed to the fact that they were not created with the needs and experiences of women in mind. For example, virtually all farm tools and equipment on the US market are designed for men, or an average user whose size, weight, and strength are heavily influenced by the average able-bodied man.[204]

In addition to physical differences, gendered social roles can affect the ways in which women work in the agri-food sector. For example, Danish economist Ester Boserup's "plough hypothesis" posited that societies that had historically used the plough would be less gender equal than those that had not. The relative female-friendliness of shifting agriculture makes it more accessible to women, who may not have the strength or the uninterrupted time necessary to operate a heavy plough, whereas hoeing, by comparison, can easily be started and stopped, meaning it can easily be combined with other domestic tasks.[205]

Because of the central role they play in feeding their families, women also tend to be more involved in the production of nutritious staple crops, as opposed to niche or specialty crops with higher monetary value, like coffee.[206] This is just one of the ways in which women's perspectives on food and agriculture is different from men's. To illustrate, in investigating the reasons why the efforts of an organization to breed and distribute improved varieties of staple

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[202] *Ibid*.
[203] Cheryl Doss, "If women hold up half the sky, how much of the world's food do they produce?", ESA Working Paper No. 11-04, March 2011, online: <http://www.fao.org/3/a-am309e.pdf> at 18.
[204] Caroline Criado Perez, *Invisible Women: Exposing Data Bias in a World Designed for Men* (New York: Abrams Press, 2019).
[205] *Ibid* at 132. See also Alberto Alesina, Paola Giuliano & Nathan Nunn, "On the Origins of Gender Roles: Women and the Plough" (2013) 128:2 The Quarterly Journal of Economics 469 (confirming that cultures with a heritage of traditional plough use end up exhibiting less equal beliefs about gender).
[206] Doss, *supra* note 203 at 6.

crops in a low-income country were unsuccessful, the decision to speak almost exclusively to men during field-testing turned out to be the primary pitfall.[207] Rather than prioritizing yields, as the men did, women farmers cared about "other factors like how much land preparation and weeding … crops required, because these are female jobs. And they cared about how long, ultimately, the crops would take to cook (another female job)."[208] Since "[t]he new, high-yield varieties increased the time the women had to spend on these other tasks, … unsurprisingly, they did not adopt these crops."[209]

If new technologies and innovations are to solve long-standing problems relating to food insecurity and environmental sustainability, then ensuring that they incorporate and reflect women's perspectives will be essential. This means that women must have access to technologies and to the processes of technological R&D, including in the agri-food tech space. If the social case is not enough to persuade, there is also a business case to be made, as women's businesses in agri-food technology have been found to end up delivering far higher revenue and are faster growing, even though they receive less capital.[210] Taking concerted action to close the funding gap for women in the agri-food tech sector is a direct way to expand access to technologies and the process of technological development, which may allow for more creative, effective, just, and sustainable innovations to emerge.

5.5 Conclusion

How solutions to challenges are generated, evaluated, and measured requires careful consideration if they are to be effective, ethical, and equitable rather than simply being efficient. No matter which path we take toward building a more just and sustainable food future,

[207] Criado Perez, *supra* note 204 at 136.
[208] *Ibid*.
[209] *Ibid*.
[210] *Money Where Our Mouths Are*, *supra* note 198 at 27.

compromises will have to be made, and not all stakeholders will be affected equally under different scenarios. If technological fixes offer only "trade-offs, not solutions",[211] then who gets to decide what trade-offs are made? What is the appropriate basis upon which such decisions can be made? Deliberate and democratic reflection on these kinds of questions must be part of any comprehensive assessment of the merits and/or appropriateness of any new and emerging technology.

A technology justice lens spurs us to move away from thinking about "just *technology*" (in the sense that technology is benign, neutral, or apolitical), or "*just* technology" (in the sense that technology necessarily enhances equality), and encourages us to think about the full range of justice-related concerns associated with the development, design, deployment, use, decommissioning/recycling, and regulation of technologies. Sometimes, technologies may need to be adapted to moderate their impacts, while at other times, they may be entirely inappropriate. Sometimes, scientific and technological R&D may need to be redirected, while at other times and/or places, pursuing scientific and technological R&D at the expense of alternative pathways may be wholly irresponsible.

A theory of technology justice also encourages constant attention to the systems and particular settings that technologies are enmeshed within, and especially the structures of domination that are often rendered invisible by virtue of their hegemony. For example, the relationship between gender roles and the maintenance of livelihoods in the agricultural setting is highly relevant in the context of technologies, as women are "often the first to experience the impacts of industrialization and the intensive agricultural practices of modernization."[212] For

[211] Dane Scott, "The Technological Fix Criticisms and the Agricultural Biotechnology Debate" (2011) 24 J Agric Environ Ethics 207 at 219.
[212] Mark J Smith & Piya Pangsapa, *Environment and Citizenship: Integrating Justice, Responsibility and Civic Engagement* (New York: Zed Books, 2008) at 43.

example, Vandana Shiva has written that in India, the "White Revolution, … instead of viewing livestock as ecologically integrated with crops, has reduced the cow to a mere milk machine."[213] Among the detrimental consequences of this reductionist view, "women's traditional role in caring for cows and processing milk falls into the hands of men and machines."[214] As such, technology justice asks us to confront the reality that it may not be about doing technology and innovation in a slightly different way, but about a more fundamental rethinking of our technological and social paradigms altogether.

There is not necessarily a sinister motive underlying plans and approaches that may have the effect of creating or furthering inequalities relating to technology. That being said, a failure to, at minimum, consider the justice-related implications of any technological innovation is tantamount to being complicit in any injustices that result. In light of a growing gap between the wealthy and the poor, intensified by contemporary threats like climate change, institutional inertia is not a valid excuse to prevent or delay the development of technologies and/or policies that better meet the needs of the most affected and/or the marginalized, both presently and into the future.

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[213] Vandana Shiva, *Stolen Harvest: The Hijacking of the Global Food Supply* (Cambridge, MA: South End Press, 2000) at 59.
[214] *Ibid* at 60.

6. Case Studies

In this chapter, I apply the concept of technology justice articulated in Chapter 5 to a few different case studies, to illustrate how it functions in practice. Each case study begins with an overview of the technology in question, followed by a description of some salient features of the regulatory framework governing the technology. Then, both the technologies and the ways in which they are regulated are considered through a technology justice lens.

The first case study looks at products of cellular agriculture, specifically, animal products traditionally consumed for food, like flesh, dairy, and eggs. Although such products are not yet commercially available to most consumers, R&D into such products has intensified in the past few years. Based on current projections, this trend is unlikely to abate without a pointed intervention or drastic change in circumstance. Despite early enthusiasm, products of cellular agriculture create disquieting ethical and ontological ambiguities as well as legal ones, rendering them especially fruitful grounds for scrutiny.

The second case study looks at genetically engineered (GE) animals, which is another kind of animal biotechnology for food production. The recent experience of the AquAdvantage salmon (AAS)—the first GE animal approved for human consumption—marks an interesting inflection point for this technology. It is too late to reverse direction entirely, as the AAS is already being produced and sold in Canada,[1] but what happens with the AAS from this point onwards can be seen as a test case for GE animals in general. In analyzing the regulatory structure for animal biotechnologies for food production, I highlight noteworthy deficiencies in

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[1] Emily Waltz, "First genetically engineered salmon sold in Canada", *Nature* (4 August 2017), online: <https://www.nature.com/news/first-genetically-engineered-salmon-sold-in-canada-1.22116>; Ashifa Kassam, "GM salmon hits shelves in Canada – but people may not know they're buying it", *The Guardian* (9 August 2017), online: <https://www.theguardian.com/world/2017/aug/09/genetically-modified-salmon-sales-canada-aqua-bounty>.

the existing “novel foods” regime and argue that the understanding of risk on which it is founded reflects a narrow and technocratic approach that fails to adequately account for a broader range of important considerations.

The third case study looks at a cluster of approaches grouped under the heading of “smart agriculture”. This includes the concepts of climate smart agriculture (CSA), “sustainable intensification”, and “smart farming” (which may also be referred to as “precision agriculture” or “digital agriculture”). I do not intend to suggest that all of these concepts are interchangeable, as there are relevant differences between them. Nevertheless, they all tend to rely on specific assumptions about the role of technology in agriculture, the possibility of “optimizing” agricultural processes, and a rhetoric relating to a new agricultural “revolution”, which renders them amenable to analysis on the same terms.

Each case study puts emphasis on one particular aspect of technology justice, though this focus is not exclusive. Namely, the cellular agriculture case study focuses on drivers of innovation. The GE animals case study focuses on discourses of risk, as well as the role of public input in decision-making processes. The smart agriculture case study focuses on distributions of returns. In each instance, the application of a technology justice lens reveals that there are numerous ways in which existing structures of power are imprinted in these new and emerging technologies, despite their emancipatory claims. Assessing their justice-related implications, rather than purporting to evaluate them purely on grounds like “efficiency”, therefore leads to a different conclusion as to the relative merits of these technological innovations and how they should be regulated.

6.1 Cellular Agriculture

6.1.1 Overview

Part of the latest cadre of new and emerging scientific and technological developments promises to reduce or eliminate the death and suffering of living bodies in the production of flesh food and other animal products, while also offering a plethora of other advantages. Falling under the umbrella of "cellular agriculture" —defined as a method of food production that turns on culturing cells or proteins directly, rather than harvesting them from animals[2]—these products go beyond their plant-based counterparts in that they replicate traditionally produced animal products at the cellular level. As such, they do not merely act as imitations of the animal products they seek to replace, but are very much the "real thing".

Within this category, *in vitro* meat (IVM) (also referred to as "cultured meat", "cell-based meat", "lab-grown meat", or "clean meat", to name a few[3]) has been among the most controversial.[4] To offer a very rudimentary explanation, IVM is created using a tissue engineering process that involves growing muscle tissue using starter stem cells from live animals, which are put into a culture medium where they proliferate with the help of a bioreactor.[5] Mark Post, a vascular biologist at the University of Maastricht in the Netherlands, was responsible for creating the first IVM burger, which was presented in London in August

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[2] See Carolyn S Mattick, "Cellular agriculture: The coming revolution in food production" (2018) 74:1 Bulletin of the Atomic Scientists 32; Valentin Waschulin & Liz Specht, *Cellular agriculture: An extension of common production methods for food* (Washington, DC: The Good Food Institute, 2018), online: <https://www.gfi.org/images/uploads/2018/03/Cellular-Agriculture-for-Animal-Protein.pdf>; New Harvest, "What is Cellular Agriculture?", online: <https://www.new-harvest.org/cell_ag_101>.

[3] See e.g. Shujian Ong, Deepak Choudhury & May Win Naing, "Cell-based meat: Current ambiguities with nomenclature" (2020) Trends in Food Science & Technology, DOI: <10.1016/j.tifs.2020.02.010>.

[4] See e.g. Angela Lee, "Meat-ing Demand: Is *In Vitro* Meat a Pragmatic, Problematic, or Paradoxical Solution?" (2018) 30:1 CJWL 1.

[5] For more detailed discussion of the process, see e.g. Shruti Sharma, Sukhcharanjit Singh Thind & Amarjeet Kaur, "In vitro meat production system: why and how?" (2015) 52:12 J Food Sci Technol 7599.

2013.[6] Some commentators noted that this event marked not only a milestone in the development of the scientific and technological capability to produce IVM, but also served as proof of concept, firmly establishing that IVM is something that is feasible to further pursue.[7]

IVM is not yet a commercial reality in Canada, but both public and industry interest in IVM is vigorous. Scientists and startups at varying stages of R&D are currently racing to bring their IVM products to the market. About 30 labs around the world had announced work on IVM in 2012,[8] and by early 2020, there were reportedly "at least 55 startups around the world trying to re-create at least 15 different types of animal flesh, including pork, shrimp, chicken, duck, lamb, even foie gras."[9] Land-based mammals are not the only creatures to have gone under the microscope: some companies are working to produce *in vitro* fish and seafood products.[10]

Forerunners in this space include companies like Mosa Meat,[11] Memphis Meats,[12] and SuperMeat,[13] many of which have secured impressive amounts of venture capital funding. In March 2017, San Francisco-based Memphis Meats unveiled its iteration of cultured chicken meat to much fanfare,[14] and in January 2020, announced the close of a $161 million funding round, part of which is expected to be used to build a pilot production facility.[15] At the end of 2020,

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[6] "World's first lab-grown burger is eaten in London", *BBC News* (5 August 2013), online: <http://www.bbc.com/news/science-environment-23576143>.
[7] Carolyn Mattick & Brad Allenby, "The Future of Meat" (2013) 30:1 Issues in Science and Technology 64 at 64.
[8] Dan Flynn, "Lab-Grown Meat? $1 Million Reward Deadline Nears", *Food Safety News* (16 January 2012), online: <http://www.foodsafetynews.com/2012/01/peta-offers-1-million-for-successful-lab-grown-chicken/>.
[9] Niall Firth, "Flesh Forward", *MIT Technology Review* 124:1 (January/February 2021) 26 at 28.
[10] See e.g. Finless Foods, online: <https://www.finlessfoods.com/>; Wild Type, online: <https://www.thewildtype.com/>.
[11] Mosa Meat, online: <https://www.mosameat.com/>.
[12] Memphis Meats, online: <https://www.memphismeats.com/>.
[13] SuperMeat, online: <https://www.supermeat.com/>.
[14] Jacob Bunge, "Startup Serves Up Chicken Produced From Cells in Lab", *The Wall Street Journal* (15 March 2017), online: <https://www.wsj.com/articles/startup-to-serve-up-chicken-strips-cultivated-from-cells-in-lab-1489570202>.
[15] Michael Pellman Rowland, "Memphis Meats Raises $161 Million In Funding, Aims to Bring Cell-Based Products To Consumers", *Forbes* (22 January 2020), online: <https://www.forbes.com/sites/michaelpellmanrowland/2020/01/22/memphis-meats-raises-161-million-series-b-funding-round-aims-to-bring-cell-based-products-to-consumers-for-the-first-time/?sh=32b9e674428d>.

Singapore's Food Agency green-lighted the sale of US-company Eat Just's cultured chicken bites in the country, marking the first time that such a regulatory approval has occurred.[16] Based on this trajectory, it seems likely that other milestone developments can be expected in the next few years.

In Canada, at the time of writing, there are only a small number of companies and researchers focusing directly on cellular agriculture. Founded in 2016, Appleton Meats, based in Vancouver, is working on scaling up the production of a cultured ground beef product.[17] Meanwhile, Future Fields, based in Edmonton, is working on develop a "cheap and effective serum-free growth media for producing cultured meat."[18] Recently, a group of scientists at the University of Toronto received a US $250,000 grant from the US-based Good Food Institute to investigate less expensive ways to produce IVM—the only project winner from Canada.[19]

Those who work in the industry largely echo the same motivations. The possibility of growing meat *ex vivo* is hoped to bypass the need for large-scale animal husbandry and slaughter and therefore eliminate the ills associated with intensified industrial production practices. When compared along environmental measures like land use and energy use, IVM promises to be far superior to industrially produced meat. One preliminary study from 2011 estimated IVM to involve 7-45 percent less energy, 78-96 percent lower emissions of greenhouse gases, 99 percent lower land use, and 82-96 percent lower water use.[20] Based on these indications, the

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[16] Singapore Food Agency, "Safety of Alternative Protein", online: <https://www.sfa.gov.sg/food-information/risk-at-a-glance/safety-of-alternative-protein> (last updated December 10, 2020); Damian Carrington, "No-kill, lab-grown meat to go on sale for first time", *The Guardian* (2 December 2020), online: <https://www.theguardian.com/environment/2020/dec/02/no-kill-lab-grown-meat-to-go-on-sale-for-first-time>.
[17] Appleton Meats, "About Appleton Meats", online: <https://www.appletonmeats.com/about>.
[18] Future Fields, online: <https://www.futurefields.io/>.
[19] Aleksandra Sagan, "Made-in-Canada lab-grown meat on Toronto scientists' menu after grant from U.S.", *National Post* (21 February 2019), online: <https://nationalpost.com/news/canada/made-in-canada-lab-grown-meat-a-possibility-after-grant-from-u-s-non-profit>.
[20] Hanna L Tuomisto & M Joost Teixeira de Mattos, "Environmental Impacts of Cultured Meat Production" (2011) 45:14 Environmental Science & Technology 6117.

environmental advantages are heavily promoted by a majority of the companies currently working on IVM. For example, Mosa Meat claims that their product "generates an estimated 96% less greenhouse gas emissions, uses 99% less land and 96% less water than livestock meat. It helps protect our planet from climate change, deforestation and biodiversity loss."[21]

IVM may also yield other benefits, many of which have been identified and discussed in the literature.[22] In terms of reducing global hunger and increasing food security, IVM could theoretically function as a readily-available protein source for growing and malnourished populations, as well as helping to meet increasing global demand for meat. The potentially adverse human health impacts of producing and eating flesh food could also be lessened by IVM. According to one source, "[c]ultured meat can prevent the spread of animal-borne diseases and epidemic zoonoses … Controlled conditions also enable the manipulation of nutritional, textural, and taste profiles. The quantity and quality of fat can be controlled, and, therefore, the nutrition-related diseases, such as cardiovascular diseases, can be reduced."[23] By reducing reliance on factory farms, IVM could concomitantly reduce the use of antibiotics and hormones in animal feed.[24] It has been suggested that IVM could increase the range of exotic meats available for human consumption, without the risk of endangering rare species.[25] IVM may also reduce waste and increase efficiency, because inedible animal parts need not be grown.[26]

[21] Mosa Meat, *supra* note 11.
[22] See e.g. Mark J Post, "Cultured meat from stem cells: Challenges and prospects" (2012) 92 Meat Science 297; Zuhaib Fayaz Bhat, Sunil Kumar & Hina Fayaz, "In vitro meat production: Challenges and benefits over conventional meat production" (2015) 14:2 J Integrative Agriculture 241. For research considering the potential moral benefits of IVM, see e.g. Clemens Driessen & Michiel Korthals, "Pig towers and in vitro meat: Disclosing moral worlds by design" (2012) 42:6 Social Studs Science 797; Cor van der Weele & Clemens Driessen, "Emerging Profiles for Cultured Meat; Ethics through and as Design" (2013) 3 Animals 647.
[23] Tuomisto & Teixeira de Mattos, *supra* note 20 at 6117.
[24] See e.g. Fayaz Bhat, Kumar & Fayaz, *supra* note 22.
[25] See e.g. Fayaz Bhat, Kumar & Fayaz, *ibid*; Wyatt Galusky, "Technology as Responsibility: Failure, Food Animals, and Lab-grown Meat" (2014) 27 J Agric Environ Ethics 931 at 936.
[26] Fayaz Bhat, Kumar & Fayaz, *ibid.*

For those who are concerned about animal welfare and the ways in which meat production practices create and intensify animal suffering, IVM offers clear advantages to factory farming. Paul Shapiro, an animal protection advocate who is known for his former work with the Humane Society of the United States, published a book in 2018 with the telling title: *Clean Meat: How Growing Meat Without Animals Will Revolutionize Dinner and the World*,[27] in which he enthuses about the revolutionary potentials of IVM. While industrial meat production is a prime target for animal protectionists, IVM is supported as a significantly more animal-friendly alternative, one that "requires no animal suffering and death to produce."[28] Because of IVM's unique position between destructive industrial meat production and more animal-friendly alternatives (such as entirely plant-based imitation products), proponents emphasize the potential use of nonanimal-sourced polymer scaffolding and a cell-growth medium derived from mushrooms,[29] to create "an illusion of a victimless existence."[30] However, at present, much of IVM technology still relies to a large degree on animals and animal products, including a commonly used growth medium derived from calves or fetal bovine serum.[31]

In addition to traditional flesh foods, several companies are using acellular methods, which rely on microbes like yeast or bacteria, to develop analogues of dairy and egg products. For example, Perfect Day Foods, which is developing an array of "animal-free dairy products"

[27] Paul Shapiro, *Clean Meat: How Growing Meat Without Animals Will Revolutionize Dinner and the World* (Toronto: Gallery Books, 2018).
[28] Patrick D Hopkins & Austin Dacey, "Vegetarian Meat: Could Technology Save Animals and Satisfy Meat Eaters?" (2008) J Agric Environ Ethics 579 at 582.
[29] Zuhaib Fayaz Bhat & Hina Fayaz, "Prospectus of cultured meat--advancing meat alternatives" (2011) 48:2 Journal of Food Science and Technology 125 at 133.
[30] Oron Catts & Ionat Zurr, "Disembodied Livestock: The Promise of a Semi-Living Utopia" (2013) 19:1 Parallax 101 at 107.
[31] See e.g. *ibid*. Some companies are cognizant of this paradox, and SuperMeat's cell culturing process does not require an animal-derived serum: Elaine Watson, "SuperMeat founder: 'The first company that gets to market with cultured meat that is cost effective is going to change the world'", *Food Navigator-USA* (19 July 2016, updated 23 May 2018), online: <https://www.foodnavigator-usa.com/Article/2016/07/20/SuperMeat-founder-on-why-cultured-meat-will-change-the-world>.

using yeast, fermentation, and a process similar to craft brewing, proclaims that their contribution is dairy that is “sustainable, kind and delicious.”[32] Clara Foods, the company working towards creating the “world’s first animal-free egg white”, boasts that “[w]e’re developing technology to create animal protein without the animals. Our protein platform offers all the great taste of the foods you know and love with less cost, better performance, and less waste.”[33] The rallying cry of ethical, sustainable, and taste and performance that is equivalent (or even superior) is evident when it comes to all of these innovations.

6.1.2 Regulation

Given the novelty of the health and environmental questions posed, the lack of established methods for answering them, and uncertainty around the existing data, products of cellular agriculture present unique challenges in relation to decision-making. These kinds of issues need to be taken seriously from a law and policy perspective, as regulatory systems are “among the most important influences in determining the course of technological innovation.”[34] Both champions and critics recognize that regulatory strategies have implications “not only for ensuring the safety and efficacy of the product being brought to market, but also for individual company strategies, for the type of firm that will be successful in bringing the products to market, and for the ability of an entire sector to contribute to national and regional economic development”.[35] Where the two sides diverge, of course, is whether regulation is seen as a detrimental barrier to realizing the benefits of a new and emerging food innovation, or as a necessary measure for mitigating the associated risks and potential harms.

[32] Perfect Day Foods, “Mission”, online: <https://www.perfectdayfoods.com/>.
[33] Clara Foods, online: <https://www.clarafoods.com/>.
[34] Sarah PF Bonny et al, “What is artificial meat and what does it mean for the future of the meat industry?” (2015) 14:2 J Integrative Agriculture 255 at 258. See also Ann Bruce et al, “Novel GM animal technologies and their governance” (2013) 22 Transgenic Res 681 at 687.
[35] Bruce et al, *ibid*.

The regulatory framework in place for products of cellular agriculture in Canada, established several decades ago, does not reflect the new technological reality. Although there are notable distinctions to be made in terms of the impacts and implications of different kinds of new food innovations, in its current formulation, Canadian law generally collapses them into the category of "novel foods". A "novel food" is defined by one of three characteristics: a substance that does not have a history of safe use as a food; a food that has been manufactured, prepared, preserved or packaged by a process that has not been previously applied to that food that causes the food to undergo a major change; or a food that is derived from a plant, animal, or microorganism that has been genetically modified.[36] Thus, within Canada's "product-oriented" regulatory approach (as opposed to the "process-oriented" approach adopted in much of the EU),[37] the concept of "novelty", as specifically defined, acts as the regulatory trigger.

The regulation of public health, food safety, and nutrition falls under the shared federal mandate of Health Canada and the CFIA. Health Canada is responsible for ensuring that all foods proposed for sale in Canada, including novel foods, are safe for public consumption. This assessment of safety is conducted based on the submission of "detailed scientific data" by the companies producing the food product in question.[38] Health Canada also oversees standards and policies governing the nutritional quality of foods, while the CFIA "develops standards related to

[36] *Food and Drug Regulations*, CRC c 870, Division 28, B.28.001.
[37] See Claire Dunlop, "GMOs and Regulatory Styles" (2000) 9:2 Envtl Politics 149; Anton Wohlers, "Regulating genetically modified food: Policy trajectories, political culture, and risk perception in the U.S., Canada, and EU" (2010) 29:2 Politics & The Life Sciences 17; Joyce Tait & Les Levidow, "Proactive and reactive approaches to risk regulation: The case of biotechnology" (1992) Futures 219.
[38] Government of Canada, "About novel and genetically-modified (GM) foods", online: <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods.html> (last updated October 30, 2020).

the packaging, labelling and advertising of foods, and handles all inspection and enforcement duties."[39]

The evaluation of novel foods is broken down into nutritional, toxicology, allergenicity, and chemical considerations.[40] Health Canada employs the concept of "substantial equivalence" as a guide in the safety assessment of genetically modified and other novel foods, which calls for a comparison of the novel food to its unmodified counterpart with a history of safe use.[41] A comprehensive consideration of environmental impacts or indirect human health aspects (e.g. potential to cause adverse effects as a consequences of dermal contact) of the manufacture or import of novel foods remains conspicuously absent in their assessment process.[42] The novel foods regulations were established in the 1990s, and have not been substantively updated since then. Further, specific safety assessment criteria for novel foods derived from animals have not yet been developed.[43]

Health Canada is ostensibly in the process of developing a regulatory framework for the environmental assessment of regulated products,[44] but until then, information on potential environmental and indirect human health impacts of a novel food is required pursuant to the *New*

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[39] Health Canada, "Guidelines for the Safety Assessment of Novel Foods" (June 2006), online: <https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/fn-an/alt_formats/hpfb-dgpsa/pdf/gmf-agm/guidelines-lignesdirectrices-eng.pdf> at 3.
[40] *Ibid*.
[41] Government of Canada, "The safety of genetically-modified (GM) foods", online: <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/safety.html> (last updated January 31, 2020). However, even in the context of GM crops, the concept of "substantial equivalence" is unclear and lacks formal definition within Canadian law and policy. See e.g. Stuart J Smyth & Alan McHughen, "Regulation of Genetically Modified Crops in USA and Canada: Canadian Overview" in Chris A Wozniak & Alan McHughen, eds, *Regulation of Agricultural Biotechnology: The United States and Canada* (New York: Springer, 2012) 15 at 23-25. See also Marianna Schauzu, "The concept of substantial equivalence in safety assessment of foods derived from genetically modified organisms" (2000) 2 AgBiotechNet 1.
[42] Health Canada, "Guidelines for the Safety Assessment of Novel Foods", *supra* note 39 at 13.
[43] *Ibid* at 2 (Part 4.3, "Novel Foods Derived from Animals" is listed as "Under Development" in the Table of Contents).
[44] *Ibid*.

Substances Notification Regulations[45] under the *CEPA, 1999*.[46] Other federal agencies, like ECCC and the DFO, may also be involved in regulating novel foods, depending on the specific characteristics of the product in question.

The characteristics and process of creating cellular agricultural products do not necessarily lend them to a neat division of regulatory responsibilities. Across the border, the US announced in 2019 that the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA) will jointly regulate cultured meat products.[47] Under the agreement, the FDA will oversee the process from cell collection through to cell growth, whereas the USDA's role relates primarily to the production and labelling of cultured meat products for sale to consumers.[48] It remains to be seen whether a similar approach will be adopted in Canada.

Legal definitions and standards relating to this category of product also remain vague and unspecified, which has been a source of conflict as different groups jockey to establish their own frames of meaning. In the US, Missouri enacted a law in August 2018 that specifically defines "meat" as "any edible portion of livestock or poultry carcass or part thereof", and similarly, defines "meat product" as "anything containing meat intended for or capable of use for human consumption, which is derived, in whole or in part, from livestock or poultry".[49] This means that manufacturers of products like IVM and plant-based alternatives to meat products are legally

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[45] SOR/2005-248.

[46] *Canadian Environmental Protection Act, 1999*, SC 1999, c 33 [*CEPA, 1999*].

[47] US Department of Agriculture, "USDA and FDA Announce a Formal Agreement to Regulate Cell-Cultured Food Products from Cell Lines of Livestock and Poultry", Press Release (7 March 2019), online: <https://www.usda.gov/media/press-releases/2019/03/07/usda-and-fda-announce-formal-agreement-regulate-cell-cultured-food>. The "Formal Agreement Between the U.S. Department of Health and Human Services Food and Drug Administration and U.S. Department of Agriculture Office of Food Safety" is available online: <https://www.fsis.usda.gov/wps/wcm/connect/0d2d644a-9a65-43c6-944f-ea598aacdec1/Formal-Agreement-FSIS-FDA.pdf?MOD=AJPERES>.

[48] *Ibid*.

[49] US, SB 627 & 925, *An Act to repeal sections 137.016, 137.021, 137.115, 144.010, 254.075, 254.150, 254.160, 254.170, 254.180, 254.210, 262.900, 265.300, 265.490, 265.494, 267.565, 276.606, 277.020, and 414.032, RSMo, and to enact in lieu thereof fifteen new sections relating to agriculture*, 99th Gen Assem, 2d Reg Sess, Mo, 2018, online: <https://legiscan.com/MO/text/SB627/id/1754497> at 17.

prohibited from "misrepresenting" their products as meat. In taking this step, Missouri became the first state to enact legal measures "to prevent misrepresentation of products as meat that are not derived from livestock or poultry."[50]

Several other states have since followed suit, though not without contestation. For example, a lawsuit filed in Mississippi 2019 by Upton's Naturals (a natural foods company with a focus on meat alternatives) and the Plant Based Food Association (an organization representing the interests of the plant-based foods industry) challenged the enforcement of a law that would have prohibited manufacturers of plant-based foods from using meat or common meat-product terms, like "burgers" and "hot dogs", on their labels, with potential fines and even criminal penalties for violations.[51] In response to the lawsuit, the Mississippi Department of Agriculture amended the impugned regulation to permit the continued use of meat or common meat-product terms on plant-based food labels, as long as the label also describes the food as "meat-free", "meatless", "plant-based", "vegetarian", "vegan", or uses another comparable term.[52]

The issue of whether "meat" should be defined by its origin or by its composition has also been put to the test in Canada. In May 2019, the Quebec Cattle Producers Federation, backed by the Canadian Cattlemen's Association, filed a complaint about the marketing of Beyond Meat's vegan burgers, asserting that the use of the words "plant-based meat" was

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[50] Missouri Department of Agriculture, "Missouri Meat Advertising Law", Public Statement (30 August 2018), online: <https://agriculture.mo.gov/animals/meat.php>.

[51] Andrew Wimer, "New Lawsuit Challenges Mississippi Labeling Law That Makes Selling "Veggie Burgers" a Crime", Press Release (2 July 2019), online: Institute for Justice <https://ij.org/press-release/new-lawsuit-challenges-mississippi-labeling-law-that-makes-selling-veggie-burgers-a-crime/>. See also Institute for Justice, "Complaint for Declaratory and Injunctive Relief", *Upton's Naturals Co. et al. v Bryant et al*., No. 3:19-cv-462-HTW-LRA (SD Miss July 1, 2019), online: <https://ij.org/wp-content/uploads/2019/07/Uptons-Naturals-Co.-et-al.-v.-Phil-Bryant-et-al.-Complaint-for-Declaratory-and-Injunctive-Relief_7.1.2019.pdf>.

[52] Andrew Wimer, "Victory for Vegan Burgers: New Mississippi Labeling Regulations Will Not Punish Plant-Based Meat", Press Release (7 November 2019), online: Institute for Justice <https://ij.org/press-release/victory-for-vegan-burgers-new-mississippi-labeling-regulations-will-not-punish-plant-based-meat/>.

misleading and in contravention of Canadian regulations.[53] Similar clashes have sprung up over what does or does not qualify as "milk" and other dairy products.[54] For example, in January 2019, the CFIA ordered Blue Heron, a vegan cheese shop in Vancouver, to stop using the word "cheese" to market its products.[55] These legal battles and accompanying public debates represent more than just frivolous skirmishes over semantics, as they serve to draw lines around how specific food items are treated and thought about. As IVM and other products of cellular agriculture get closer and closer to being commercially feasible, we can expect to see more legislative and judicial intervention to clarify what has, to date, been an ambiguous regulatory terrain.

6.1.3 Cellular Agriculture and Technology Justice

On their face, IVM and other products of cellular agriculture offer an appealing solution to the quandary posed by the clearly deleterious effects of industrial animal product production in combination with an increasing demand for animal products. Yet, when evaluated more critically, holistically, and comparatively, IVM may not actually be as advantageous as its proponents claim, environmentally or otherwise.[56] Examining the drivers of cellular agriculture through a technology justice lens leads to a less sanguine evaluation of its virtues, especially vis-à-vis courses of action that have fewer systemic implications.

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[53] Mark Lennihan, "Canadian cattle producers back Quebec farmers' beef with Beyond Meat over 'plant-based meat' marketing", *The Globe and Mail* (15 May 2019), online: <https://www.theglobeandmail.com/canada/article-canadian-cattle-producers-back-quebec-farmers-beef-with-beyond-meat/>.
[54] Lisa Held, "The Dairy Industry Takes on Alternative Milks", *Civil Eats* (13 February 2017), online: <http://civileats.com/2017/02/13/the-dairy-industry-lashes-out-against-alternative-milks-with-dairy-pride-act/>.
[55] Alexandra Gill, "Vegan food producer ordered to drop the word 'cheese' from its marketing", *The Globe and Mail* (17 February 2019), online: <https://www.theglobeandmail.com/business/small-business/marketing/article-vegan-food-producer-ordered-to-drop-the-word-cheese-from-its/>.
[56] Stellan Welin, Julie Gold & Johanna Berlin, "In Vitro Meat: What Are the Moral Issues?" in David M Kaplan, ed, *The Philosophy of Food* (Los Angeles: University of California Press, 2012) 292 at 297-298. See also Angela Lee, "An ecofeminist perspective on new food technologies" (2018) 5:1 Canadian Food Studies 63.

Though early figures have been encouraging, they are often based on conjectural and highly specific use scenarios, and it is doubtful whether these benefits will truly be borne out to the extent claimed. For example, a 2019 study found that "[r]eplacing cattle systems with cultured meat production before energy generation is sufficiently decarbonized and/or the more optimistic production footprints … are realized (assuming they can be), could risk a long-term, negative climate impact."[57] Many popular depictions of the future of cellular agriculture "entail an asymmetry where the production process as structured today is paired with hypothetical future technologies."[58] However, abstracting potential benefits from current conditions of production, distribution, and consumptions can lead to an impoverished analysis.

IVM does not inevitably have to be produced on a large scale, but given the current rhetoric of it replacing existing industrial meat production systems, it seems likely that this would be the case. Any system of mass production necessarily comes with significant input requirements (e.g. energy, water), as well as outputs (e.g. waste). Accordingly, all aspects of the cellular agricultural production process, both quantitative and qualitative, should be carefully accounted for in assessing its merits. Across the life cycle, this includes considerations of feed and other inputs, land use, energy use (and source), emissions (and type), water use (and source), processing requirements, waste and other byproducts created, tertiary products, and ancillary harms or benefits, as grounded in current circumstances. Because large-scale *in vitro* biomass cultivation may constitute "a new phase of industrialization", accompanied by complex trade-offs,[59] this will not be a straightforward one-for-one comparison. Nevertheless, we need to find a

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[57] John Lynch & Raymond Pierrehumbert, "Climate Impacts of Cultured Meat and Beef Cattle" (2019) 3 Frontiers in Sustainable Food Systems 5 at 8.
[58] Erik Jönsson, "Benevolent technotopias and hitherto unimaginable meats: Tracing the promises of in vitro meat" (2016) 46:5 Social Studies of Science 725 at 741.
[59] Carolyn S Mattick et al, "Anticipatory Life Cycle Analysis of In Vitro Biomass Cultivation for Cultured Meat Production in the United States" (2015) 49:19 Environmental Science & Technology 11941.

way to get a clearer sense of all of the attendant nuances before accepting cellular agriculture as an inherently superior model.

Further, the context from which products like IVM were born, and the ways in which they are framed, warrant close interrogation.[60] As previously mentioned, many of the companies at the forefront of IVM tout their ethical commitments and the virtuous nature of their products. For example, Memphis Meats states that their goal is "to feed 10 billion people by 2050, and countless more beyond that, while preserving the environment and offering consumers additional choices in meat, poultry and seafood."[61] The company concludes, unequivocally, that their product is "better for you" and "better for the world."[62]

While these types of sentiments are noble, the incentives and driving forces motivating IVM are not purely philanthropic. It is significant that "[t]he US and principally San Francisco, home of Silicon Valley, features heavily [in the geography of actors], perhaps reflecting that animal-free foods are as much a *technology* enterprise as a *food* enterprise."[63] Technology enterprises have fundamentally different priorities and goals than enterprises devoted to food production, with the former being much more preoccupied with producing marketable commodities for private gain than providing nourishment for public benefit. The benevolent rhetoric utilized by these kinds of companies belies the profit motive that spurs them on and the funding models that make them possible. As Erik Jönsson notes, "venture capital has … shaped

[60] Alexandra E Sexton, Tara Garnett & Jamie Lorimer, "Framing the future of food: The contested promises of alternative proteins" (2019) 2:1 ENE: Nature and Space 47.
[61] Memphis Meats, "About Memphis Meats", online: <https://www.memphismeats.com/about>.
[62] Memphis Meats, *supra* note 12.
[63] Michael J Mouat, Russell Prince & Michael M Roche, "Making Value Out of Ethics: The Emerging Economic Geography of Lab-grown Meat and Other Animal-free Food Products" (2019) 95:2 Economic Geography 136 at 147 [emphasis in original].

the research dynamics of the field in ways that potentially sit uneasily with the promissory discourse's emphasis on altruism and collaboration."[64]

Emerging narratives about cellular agricultural products also reflect the potent roles of expectations and framing. In particular, there is a "tension between assuring similarity and asserting difference that remains underexplored in the promissory discourse."[65] Proponents "assert that in vitro meat is similar enough to conventional meat to offer the same nutrition or morale boost. But it is simultaneously deemed different from muscle-derived meat in the relationships it allows (and ends) with non-human animals, in being healthier and in being better for the environment."[66] Due to the ontological ambiguity of the product, IVM thus occupies a peculiar dual role, at once being "just meat" and a technology with transformative power, depending on whether narratives of continuity or contrast better serve the objectives at stake.[67] As such, "[s]pectacular statements underscoring cultured meat's transformative power are symptomatic [of] a period where a shift to private funding renders boosterist speculations profitable and rational, even indispensable."[68] Meanwhile, for regulatory purposes, promoters argue that there is nothing about the products or processes of cellular agriculture that warrants differential treatment. Framing also has a demonstrable effect on consumer acceptance of IVM.[69] The selective and strategic framing of IVM reveals how, rather than just being about meat as object, "prominent in vitro meat promises seem more about chiseling out new meat *relations*."[70]

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[64] Jönsson, *supra* note 58 at 728.
[65] *Ibid* at 737.
[66] *Ibid* at 737.
[67] *Ibid* at 733-734.
[68] *Ibid* at 742.
[69] See e.g. Christopher Bryant & Courtney Dillard, "The Impact of Framing on Acceptance of Cultured Meat" (2019) 6 Frontiers in Nutrition 1; Christopher J Bryant & Julie C Barnett, "What's in a name? Consumer perceptions of in vitro meat under different names" (2019) 137 Appetite 104; Linnea I Laestadius, "Public Perceptions of the Ethics of In-vitro Meat: Determining an Appropriate Course of Action" (2015) 28 J Agric Environ Ethics 991.
[70] Jönsson, *supra* note 58 at 734 [emphasis in original].

Taking a technology justice perspective behooves us to probe what these "new meat relations" mean for intra- and interspecies relations. Unfortunately, the idea that animal products can be produced "without animals" or in a "victimless" manner is a chimera, and the belief that cellular agriculture will eliminate animal suffering or act as a technology of animal liberation is unproven. To the extent that IVM production still requires the use of animal products (such as the starter stem cells and the fetal bovine serum that is commonly used as a growth medium), it continues to instrumentalize nonhuman animals as a whole, and raise questions about how the specifically affected nonhuman animals are to be treated.[71] As Oron Catts and Ionat Zurr put it, "there is a shift from 'the red in tooth and claw' of nature to a mediated nature. The victims are pushed farther away; they still exist, but are much more implicit."[72]

Further, even while IVM may substantially improve the welfare of animals farmed for food, it "quite clearly perpetuates the idea that meat is inevitably desirable"[73] and therefore does not fundamentally call into question the exploitation associated with treating and conceptualizing nonhuman animals as food, nor does it address other problematic dimensions of meat eating and meat production, such as the human health, social, and environmental costs associated, and whether these can still be justified in contemporary circumstances. Instead, "meat is made to reflect specific current values."[74] Thus, as Robert Chiles argues, "incorporating stakeholders' ideological dispositions can help to explain how stakeholders' competing understandings about ambiguous goods, technology, ethics, sustainability, and consumers are grounded according to

[71] See e.g. Neil Stephens, "Growing Meat in Laboratories: The Promise, Ontology, and Ethical Boundary-Work of Using Muscle Cells to Make Food" (2013) 21 Configurations 159.
[72] Catts & Zurr, *supra* note 30 at 107.
[73] Matthew Cole & Karen Morgan, "Engineering Freedom? A Critique of Biotechnological Routes to Animal Liberation" (2013) 21 Configurations 201 at 212.
[74] Galusky, *supra* note 25 at 937.

fundamentally diametric worldviews (perspectives that have practical consequences)."[75] Whether or not one sees meat-eating as an immutable part of the human experience will significantly influence what means are considered justifiable to meet that end.

Ultimately, regardless of one's ethical views on the continued desirability of eating animals, it is clear that there are problems associated with the current model of industrial meat production, and "animal-free food relies on a narrative of the failure of capitalist agriculture and so reveals itself as no more than a techno-fix, merely rerouting the social and economic problems of current meat production systems."[76] New food innovations like cellular agricultural products do not represent a panacea for the multifaceted problems they seek to solve, and may pre-empt more serious consideration of more challenging—but also more worthwhile—structural reforms to our food systems, which I explore in the following chapter. The Cellular Agriculture Society, an international non-profit organization devoted to advancing cellular agriculture, states on their website that "[t]hrough Cellular Agriculture, we are creating a relationship that respects both animals and the planet without the need for mass behaviour-change."[77] However, mass behavioural change, both in terms of food production and consumption, may be exactly what we need to build a more just and sustainable food future for all.

On the production end, there is no guarantee that a transition away from conventional methods and towards cellular agriculture would leave us better off. For one, even while it presents an alternative to the destructive practices of industrial meat production, cellular agriculture could also extinguish more viable options, such as a move towards less-intensive

[75] Robert M Chiles, "Intertwined ambiguities: Meat, *in vitro* meat, and the ideological construction of the marketplace" (2013) 12 Journal of Consumer Behaviour 472 at 478.
[76] Mouat, Prince & Roche, *supra* note 63 at 153. Rather than being a true alternative to the efficiency-driven paradigms of existing models of capitalist agriculture, IVM simply shifts how "efficiency" is defined and measured in no longer condoning ethical, social, and environmental harms as part of the price to be paid.
[77] Cellular Agriculture Society, "What is Cellular Agriculture?", online: <https://www.cellag.org/?p=m1>.

farming, restoring more traditional farming practices, and encouraging reduced consumption. One of the most significant advantages of pursuing these alternatives is that they are available to us now, and would serve purposes relating to public health, sustainability, and food security at potentially a much lower cost and with far fewer negative consequences. Thus, a critical assessment of cellular agriculture necessitates accounting for both comparative considerations as well as a full consideration of the secondary effects that a move away from conventional livestock agriculture would initiate, including impacts on traditional meat producers and implications for global development.[78]

On the consumption end, the advancement of cellular agriculture does not absolve "[t]he relatively few humans who enjoy routine access to flesh, eggs, and milk products [from] consider[ing] the drain of resources and environmental decay caused by these privileges."[79] Unlike in the past, when food production was much more constrained (geographically, economically, temporally, and otherwise), thereby limiting the scope of options available for consumption, eating meat and other animal products is now far from a necessity for most people living in wealthy countries to have a healthy, delicious, nutritionally-balanced diet. To choose what we eat—whether in the form of indulgence or abstention—is also to make inherent choices about ecological destruction, public health, global hunger, and animal welfare, whether intentionally or otherwise. Acknowledging the agency that accompanies our behaviours and choices imbues them with a much greater ethical significance. As a result, making a commitment to justice demands more from us than a technological workaround.

[78] Carolyn S Mattick & Braden R Allenby, "Cultured Meat: The Systemic Implications of an Emerging Technology" (2012) IEEE International Symposium on Sustainable Systems and Technology 1.
[79] Sheri Lucas, "A Defense of the Feminist-Vegetarian Connection" (2005) 20:1 Hypatia 150 at 169.

A critical examination of the drivers behind cellular agriculture reveals that "animal-free food is not simply a reaction against animal agriculture, or a *disruption* of the model. It is a product of a world animal agriculture has had a major role in making."[80] Rather than reflecting a sincere ethical commitment to the public good, or offering a genuine way out of the circumstances that triggered its existence, cellular agriculture is in many ways an extension of the same kind of logics, systems, and power structures (favouring centralization, corporatization, and the consolidation of capital) that created the problems it is now claiming to miraculously solve.

While this is not to say that a cellular agricultural production system is not without its advantages, it does suggest that, in reality, all of its purported benefits will not necessarily be borne out as a matter of course. There are also serious justice-related implications of cellular agriculture that are not being given adequate consideration in dominant discourses. Thus, more careful reflection—including on the role of law and policy—is required if cellular agriculture is to reduce and not merely shift inequality between and among differently situated food producers, food consumers, and between species. The whole range of systemic implications must be taken more seriously.

6.2 Genetically Engineered Animals

6.2.1 Overview

The genetic modification of food is a highly controversial topic that has generated a vast body of academic literature and sparked a heated public debate, often rancorous in tone.[81] Concerns

[80] Mouat, Prince & Roche, *supra* note 63 at 153 [emphasis in original].
[81] See e.g. Alan McHughen, *Pandora's Picnic Basket: The Potentials and Hazards of Genetically Modified Foods* (New York: Oxford University Press, 2000); Guy Cook, *Genetically Modified Language: The Discourse of Arguments for GM Crops and Food* (New York: Routledge, 2004); Rebecca Bratspies, "The Illusion of Care: Regulation, Uncertainty, and Genetically Modified Food Crops" (2002) 10 NYU Envt'l LJ 297.

raised about GMOs have related to the environment, human health, social and economic equality, and consumer choice, and debates on these fronts remain ongoing. Nevertheless, due in part to strides in scientific and technological capabilities, GMOs have become an important part of global food production. Having already made its mark on plants and crops, the biotechnology industry has now turned its focus towards animals and animal products.

GE animals are animals whose genomes have been modified through the process of transgenesis. In the context of food, the purpose of intentionally mutating, inserting, or deleting genes within organisms is generally to increase certain characteristics considered to be desirable, and/or to reduce certain characteristics considered to be undesirable (for example, the performance of crop plants can be improved by breeding them for qualities like disease resistance).[82] Humans have practiced selective breeding of organisms for many years, but it is only in recent decades that scientific and technological advances such as the CRISPR gene-editing technique[83] have allowed for the degree of precise control over the artificial selection process that we see today.[84] Though traditional breeding practices are slow and difficult, new technologies are revolutionizing the process.[85] This is a notable development, because "the current generation of [GMOs] consists mostly of plants modified for a handful of traits. With the expected availability of genomic information for many species in the next few years, the

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[82] TG McEvoy, JJ Robinson & JM Sreenan, "A role for transgenic animals in food production?" (1992) 3 Trends in Food Science & Technology 294.
[83] See e.g. Caixia Gao, "The future of CRISPR technologies in agriculture" (2018) 19 Nature Reviews Molecular Cell Biology 275.
[84] See e.g. National Research Council, *Animal Biotechnology: Science Based Concerns* (Washington, DC: National Academies Press, 2002) at 34-50 [*Animal Biotechnology*]; Bruce et al, *supra* note 34 at 683-685.
[85] See generally The Royal Society, *Reaping the benefits: Science and the sustainable intensification of global agriculture* (London: The Royal Society, 2009), online: <https://royalsociety.org/~/media/royal_society_content/policy/publications/2009/4294967719.pdf>.

floodgates of genetic modifications could open and release on the market an unprecedented variety of genetically enhanced products."[86]

There is a variety of applications for which GE animals have been developed, with human consumption being only one.[87] The genes of at least 30 aquatic species, including flounder, carp, lobster, and shrimp, have been altered for both scientific study and commercial production.[88] Terrestrial transgenic animals are also in various stages of development for a range of purposes, from enhanced growth rates to improved protein content.[89] It therefore appears reasonable to conclude that animal biotechnology, and the issues raised, will assume greater importance in coming years, rendering it all the more imperative that the consequences and the attendant regulatory framework are carefully assessed.

Although the scientific processes of manipulating plant and animal genes are similar, research reveals that the public perceives GE animals as being more problematic. This is due in part to pragmatic concerns about factors like the health and welfare of the sentient beings involved,[90] environmental considerations, and food safety,[91] as well as culturally and ethically motivated anxieties, including arguments about "naturalness" and disgust reactions.[92]

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[86] The Royal Society of Canada, *Elements of Precaution: Recommendations for the Regulation of Food Biotechnology in Canada* (Ottawa: The Royal Society of Canada, 2001), online: <https://rsc-src.ca/sites/default/files/GMreportEN.pdf> at 14.
[87] See Rudolf Jaenisch, "Transgenic animals" (1988) 240:4858 Science 1468.
[88] Olivier Le Curieux-Belfond et al, "Factors to consider before production and commercialization of aquatic genetically modified organisms: the case of transgenic salmon" (2009) 13 Envtl Science & Pol'y 170 at 179.
[89] *Ibid*. For a summary of some current and envisioned GE livestock applications for agriculture, see SC Fahrenkrug et al, "Precision genetics for complex objectives in animal agriculture" (2010) 88 J Anim Sci 2530 at 2534, Table 1.
[90] See e.g. Lyne Létourneau, "Animal Justice: Understanding the Implications of Animal Biotechnology for Animal Welfare and Animal Rights" in Conrad G Grunk & Sarah Hartley, eds, *Designer Animals: Mapping the Issues in Animal Biotechnology* (Toronto: University of Toronto Press, 2012) 189-209.
[91] See e.g. Núria Vàzquez-Salat & Louis-Marie Houdebine, "Will GM animals follow the GM plant fate?" (2013) 22 Transgenic Res 5; Núria Vàzquez-Salat et al, "The current state of GMO governance: Are we ready for GM animals?" (2012) 30 Biotechnology Advances 1336.
[92] See e.g. Monica Pivetti, "Natural and unnatural: activists' representations of animal biotechnology" (2007) 26:2 New Genetics and Society 137.

Accordingly, GE animals are expected to face “a significantly higher number of barriers [to reaching the consumer] when compared to GM plants.”[93]

The experiences of the Enviropig and the AAS—both Canadian innovations—illustrate several of the challenges around developing and regulating GE animals, especially those produced for human consumption. The Enviropig, a transgenic pig developed at the University of Guelph to have a reduced environmental footprint,[94] was at the forefront of GE animals in this category before its major industry partner, Ontario Pork, withdrew from the project in April 2012. Ontario Pork claimed that upon reassessing the potential return on investment, they were going to redirect the funding to other research projects that had the potential to generate a better “return on investment”.[95] Unable to secure alternative sources of funding, the remaining herd of Enviropigs was killed shortly thereafter.[96]

Despite being stalled in the regulatory process for nearly two decades,[97] the AAS has enjoyed more success than the ill-fated Enviropig by making it both to and past the approval stage. The AAS is a transgenic fish produced by the Massachusetts-based AquaBounty Technologies Inc. (AquaBounty). By combining genes from the Chinook salmon and the ocean

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[93] Vàzquez-Salat & Houdebine, *supra* note 91 at 11.
[94] Enviropigs had genetically modified salivary glands, allowing them to utilize a normally indigestible form of phosphorus in feed grains, thereby reducing phosphorus pollution associated with their manure. See University of Guelph, “Enviropig Moves Ahead”, News Release (19 February 2010) online: <http://www.uoguelph.ca/news/2010/02/ee_13.html>; American Society of Animal Science, “Scientists improve transgenic ‘Enviropigs’”, *ScienceDaily* (7 March 2013), online: <https://www.sciencedaily.com/releases/2013/03/130307124802.htm>.
[95] Wency Leung, “University of Guelph left foraging for Enviropig funding”, *The Globe and Mail* (2 April 2012), online: <http://www.theglobeandmail.com/news/national/university-of-guelph-left-foraging-for-enviropig-funding/article4097328/>.
[96] Jay Sanderson, “Who killed the EnviroPig? Assemblages, genetically engineered animals and patents” (2015) 24:2 Griffith L Rev 244 at 245.
[97] AquaBounty filed its first application to the FDA for approval in 1995. See Heidi Ledford, “Transgenic salmon nears approval” (2013) 497:7447 Nature 17; Heidi Ledford, “Salmon approval heralds rethink of transgenic animals” (2015) 527:7579 Nature 417 at 418.

pout with the genome of an Atlantic salmon,[98] the result is a fish that is able to grow faster and year-round, thereby reaching market size much sooner than its unmodified counterpart.[99] This feature is an obvious boon for the company who stands to profit, but AquaBounty also boasts that the AAS "is better for the environment and consumers," with their two major sustainability claims pertaining to conserving wild fish populations and reducing carbon emissions.[100] Thus, the AAS holds out the promise that it could "offer a way out of the deadly spiral of overfishing that is decimating wild fish stocks",[101] while also reducing the energy burden associated with sating the global appetite for seafood, since land-based fish farms can be located almost anywhere as opposed to being restricted to coastlines and requiring import to other locations by airfreight.[102]

6.2.2 Regulation

Regulation of the use of biotechnology first began to be taken seriously in Canada in the 1980s, and the federal government has since played a significant role in promoting biotechnology R&D.[103] The CBS is "Canada's plan for the emerging field of biotechnology that supports and compliments the regulatory and research activities of various federal departments and

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[98] See Fisheries and Oceans Canada, *Summary of the Environmental and Indirect Human Health Risk Assessment of AquAdvantage® Salmon*, Canadian Science Advisory Secretariat, Science Response 2013/023, at 2 [Fisheries and Oceans Canada, *Risk Assessment*].
[99] *Ibid*.
[100] AquaBounty, "Sustainable", online: <www.aquabounty.com/sustainable/>.
[101] Richard Martin, "One Fish, Two Fish, Strange Fish, New Fish", *bioGraphic* (13 February 2018), online: <www.biographic.com/posts/sto/one-fish-two-fish-strange-fish-new-fish>.
[102] AquaBounty, "Land-Based Fish Farming", online: <https://aquabounty.com/about-us/land-based-fish-farming>.
[103] Jorge Niosi & Tomas G Bas, "Canadian biotechnology policy: designing incentives for a new technology" (2004) 22 Environment and Planning C: Government and Policy 233 at 236-238. See also Vivien Walsh, Jorge Niosi & Philippe Mustar, "Small-firm formation in biotechnology: A comparison of France, Britain and Canada" (1995) 15:5 Technovation 303 (finding that in Canada, as compared to the US, public policy made up for the relative lack of an entrepreneurial culture and a supportive private finance industry providing venture capital as a stimulus to high-tech firm formation).

agencies."[104] The current version of the CBS, which was released in 1998, operates within a policy framework with numerous defined objectives and guiding principles, including to "[e]nsure that Canadians have access to, confidence in and benefit from safe and effective biotechnology-based products and services."[105]

Despite this explicit commitment to safety and public confidence, the Canadian public has not shown the same enthusiasm for biotechnology as the government. In response to demands for greater transparency in the biotechnology policy-making process, and amidst growing controversy surrounding GMOs, the Government of Canada established the Canadian Biotechnology Advisory Committee (CBAC) in 1999.[106] Now defunct, the CBAC, described as a "key element of the CBS", was an arms-length committee charged with the task of providing independent advice to the federal government on topics cutting across the mandates of various federal departments and agencies.[107] As part of its work, the CBAC was also responsible for raising public awareness and facilitating a national conversation on biotechnology-related issues.[108]

The application of biotechnology in the agri-food sector has been a particularly contentious issue in Canada,[109] as elsewhere. In Canadian legislation, "genetically modify" is defined to mean: "change the heritable traits of a plant, animal or microorganism by means of

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[104] Government of Canada, "Canada's Biotechnology Strategy", online: <https://www.canada.ca/en/health-canada/services/science-research/emerging-technology/biotechnology/role/canada-biotechnology-strategy.html> (last updated August 29, 2017) ["Canada's Biotechnology Strategy"].
[105] *Ibid*.
[106] Elisabeth Abergel, "The Canadian Biotechnology Advisory Committee: Legitimacy, Participation, and Attempts to improve GE Regulation in Canada" in Rod MacRae & Elisabeth Abergel, eds, *Health and Sustainability in the Canadian Food System: Advocacy and Opportunity for Civil Society* (Vancouver: UBC Press, 2012) 97 at 97.
[107] Government of Canada, "Canada's Biotechnology Strategy", *supra* note 104.
[108] *Ibid*.
[109] See e.g. Hollie Shaw, "Canadians deeply divided over genetically modified food, study shows", *Financial Post* (24 May 2018), online: <https://financialpost.com/news/retail-marketing/canadians-deeply-divided-over-genetically-modified-food-study-shows>; Canadian Biotechnology Action Network, "Polls in GM Food Labelling in Canada", online: <https://cban.ca/gmos/issues/labelling/polls-on-gm-food-labelling-canada/>.

intentional manipulation."[110] The modification of organisms can involve traditional techniques of crossbreeding, the process of mutagenesis, the application of recombinant DNA or genetic engineering techniques,[111] or gene editing.[112] Health Canada is the primary federal department that is responsible for regulating GM foods,[113] although other departments may also be involved depending on the particular product in question.

Health Canada and the CFIA approved the sale of the AAS for human consumption in 2016,[114] following the US FDA's approval in 2015,[115] giving it the distinction of being the first GE animal officially sanctioned for this purpose. Health Canada and the CFIA deal with the food use of AAS for human and livestock consumption, respectively. Meanwhile, ECCC and Health Canada are the key authorities for assessing the potential harm of new substances, including organisms, to the environment and human health. The requirements for this assessment are set out in the *CEPA, 1999*,[116] specifically, the *New Substances Notification Regulations (Organisms)* (*NSNR (Organisms)*).[117] The DFO also "assists in implementing the NSNR (Organisms) by

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[110] *Food and Drug Regulations*, *supra* note 36.
[111] Government of Canada, "About novel and genetically-modified (GM) foods", *supra* note 38.
[112] Government of Canada, "Gene editing techniques", online: <https://www.inspection.gc.ca/plant-varieties/plants-with-novel-traits/gene-editing-techniques/eng/1541800629219/1541800629556> (last modified February 24, 2020).
[113] Government of Canada, "About novel and genetically-modified (GM) foods", *supra* note 38.
[114] Health Canada, "Health Canada and Canadian Food Inspection Agency approve AquAdvantage Salmon", Statement (19 May 2016), online: <https://www.canada.ca/en/health-canada/news/2016/05/health-canada-and-canadian-food-inspection-agency-approve-aquadvantage-salmon.html> ["Approval Statement"]. The approval also permits the AAS to be sold for livestock consumption.
[115] Food and Drug Administration (US), "FDA Has Determined That the AquAdvantage Salmon is as Safe to Eat as Non-GE Salmon", Consumer Updates (19 November 2015), online: <https://www.fda.gov/consumers/consumer-updates/fda-has-determined-aquadvantage-salmon-safe-eat-non-ge-salmon>.
[116] *CEPA, 1999*, *supra* note 46. Part 6 of *CEPA, 1999* prohibits the manufacture or import of animate products of biotechnology not included in the Domestic Substances List maintained under s. 66, or constituting a "significant new activity". Per s. 108(1), the Minister is supposed to assess information provided in respect of a living organism in order to determine whether it is toxic or capable of becoming toxic.
[117] SOR/2005-248.

conducting an environmental and indirect human health risk assessment for fish products of biotechnology and recommending any necessary measures to manage risks."[118]

Assessments conducted for the purpose of complying with the *NSNR (Organisms)* are used to "ensure that human health, the environment and biological diversity are protected."[119] Although it was not determinative, the Science Response[120] produced as a result of the DFO's risk assessment of the AAS was foundational to the AAS approval process in that it informed a finding of non-toxicity according to the requirements of the *CEPA, 1999*,[121] and was used in order to make recommendations on any necessary risk-management measures to ECCC.[122] Based on the Science Response, ECCC indicated that AquaBounty could proceed with its plans to commercially produce AAS eggs at their R&D facility in Prince Edward Island (PEI), and then transport the eggs to a land-based facility in Panama for commercial grow-out and processing.[123] The AAS is bred to be all-female and triploid, so that the GE fish will be functionally sterile and therefore unable to successfully breed with a wild fish in the event of an escape.

However, the approval also permits AquaBounty to grow out the fish in Canada,[124] and the company has expressed interest in expanding production to other countries.[125] Since the

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118 Health Canada, "Novel Food Information – AquAdvantage Salmon", online: <http://www.hc-sc.gc.ca/fn-an/gmf-agm/appro/aquadvantage-salmon-saumon-decision-eng.php> (last modified May 19, 2016) ["Novel Food Information"].

119 Government of Canada, *Guidelines for the Notification and Testing of New Substances: Organisms* (Ottawa, Public Works and Government Services Canada, 2010), online: <www.canada.ca/content/dam/eccc/documents/pdf/new-substances-guidelines-for-ganisms/En14-36-1-2011-eng.pdf> at 12.

120 Fisheries and Oceans Canada, *Risk Assessment*, *supra* note 98 at 2.

121 *CEPA, 1999*, *supra* note 46, s 64. A substance is deemed to be toxic if it is entering or may enter the environment in a quantity or concentration that: a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; b) constitute or may constitute a danger to the environment on which life depends; or c) constitute or may constitute a danger in Canada to human life or health.

122 Fisheries and Oceans Canada, *Risk Assessment*, *supra* note 98 at 1.

123 *Ibid* at 2.

124 *Ibid*.

125 See Tom Seaman, "AquaBounty conducting 'field trials' of GM salmon in Argentina, Brazil", *Undercurrent News* (28 July 2016), online: <https://www.undercurrentnews.com/2016/07/28/aquabounty-conducting-field-trials-of-gm-salmon-in-argentina-brazil/>.

initial approval of the AAS, a hatchery in PEI's Rollo Bay West was approved by PEI's Minister of Communities, Land and Environment in 2017.[126] According to the Coalition for the Protection of PEI Water, AquaBounty's approach to the approval process reflects "a classic example of project splitting, where the company was able to get approval for a smaller piece of the project (raising eggs) and then returned a short time later with what would seem to be their actual plan, thereby avoiding an independent evaluation of a very different project."[127] There are no indications that this concern about project splitting was accounted for in the approval process.[128] Recently, the US FDA has also allowed AAS eggs to be exported from Canada to a facility owned and operated by AquaBounty in Indiana, where they will be grown out for sale in the US market.[129] In response to these developments, AquaBounty "has determined that it is no longer necessary for the Company to operate a farm in Panama."[130] AquaBounty is reportedly "looking to purchase land and build a new facility in Kentucky that could eventually handle 10 thousand metric tons of salmon a year."[131]

In terms of consumption-related concerns, Health Canada notes that its assessment of the AAS was conducted according to the Codex Alimentarius *Guideline for the Conduct of Food*

[126] See Brian Higgins, "Expansion of GMO Salmon Facility Approved by Province", *CBC News* (23 June 2017), online: <https://www.cbc.ca/news/canada/prince-edward-island/pei-aquabounty-gmo-rollo-bay-west-1.4174761>.
[127] Kevin Yarr, "Genetically-Modified Salmon Plant Environmental Assessment 'Woefully Inadequate,' Says Coalition", *CBC News* (21 July 2017), online: <https://www.cbc.ca/news/canada/prince-edward-island/pei-aquabounty-environmental-assessment-1.4214252>.
[128] For more about project splitting, including how it can be avoided, see e.g. Álvaro Enríquez-de-Salamanca, "Project splitting in environmental impact assessment" (2016) 34:3 Impact Assessment and Project Appraisal 152.
[129] See Amy Nordrum, "U.S. Consumers Might Get Their First Taste of Transgenic Salmon This Year", *IEEE Spectrum* (5 January 2020), online: <https://spectrum.ieee.org/energy/environment/us-consumers-might-get-their-first-taste-of-transgenic-salmon-this-year>.
[130] AquaBounty, "AquaBounty Technologies, Inc. Announces Results for the Quarter Ended March 31, 2019, and Company Update", Press Release (2 May 2019), online: <https://aquabounty.gcs-web.com/news-releases/news-release-details/aquabounty-technologies-inc-announces-results-quarter-ended>.
[131] Jon Quast, "Why AquaBounty Stock Was Falling Today After More Than Doubling in Two Weeks", *The Motley Fool* (10 December 2020), online: <https://www.fool.com/investing/2020/12/10/heres-why-aquabounty-technologies-was-falling-toda/>.

Safety Assessment of Foods Derived from Recombinant-DNA Animals (Guideline),[132] concluding that "fillets derived from AAS are as safe and nutritious as fillets from current available farmed Atlantic salmon."[133] Since Health Canada did not identify any health and safety concerns in the course of its review, there are no special labelling requirements for the AAS.[134] There is a National Standard of Canada[135] stipulating that products can be voluntarily labelled with their GE status if these claims "are in compliance with the labelling requirements of the *Food and Drugs Act*",[136] but it seems unlikely that AquaBounty will take up this option, given the already low take up of this voluntary standard by producers of GM foods.[137]

The labelling of GM foods has been an ongoing political touchpoint in Canada. Multiple failed efforts have been made to pass Bills relating to mandatory labelling for GM foods.[138] Based on polling data, the majority of Canadians seem to be in support of mandatory GM labelling.[139] Yet, the most recent effort, Bill C-291, a Private Member's Bill tabled by NDP MP

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[132] Codex Alimentarius, *Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Animals*, CAC/GL 68-2008, online: <ftp://ftp.fao.org/docrep/fao/011/a1554e/a1554e00.pdf> 57-76.
[133] Health Canada, "Novel Food Information", *supra* note 118.
[134] Health Canada, "Approval Statement", *supra* note 114.
[135] Canadian General Standards Board, *Voluntary Labelling And Advertising of Foods That Are and Are Not Products of Genetic Engineering*, CAN/CGSB-32.315-2004 (reaffirmed May 2016), online: <http://publications.gc.ca/collections/collection_2014/ongc-cgsb/P29-32-315-2004-eng.pdf>.
[136] Health Canada, "Frequently Asked Questions: AquAdvantage Salmon", online: <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products/frequently-asked-questions-aquadvantage-salmon.html> (last updated February 10, 2020) ["FAQ"].
[137] The Canadian Biotechnology Action Network notes that "to our knowledge, no company has yet labeled their products as containing GM ingredients." Canadian Biotechnology Action Network, "Labelling", online: <https://cban.ca/gmos/issues/labeling/>. But see Preston Mulligan, "AquaBounty considers labelling genetically modified salmon", *CBC News* (16 April 2019), online: <https://www.cbc.ca/news/canada/prince-edward-island/aquabounty-considers-labelling-genetically-modified-salmon-1.5098818>.
[138] Bill C-287, *Labeling of Genetically Modified Foods*, 1st Sess, 37th Parl, 2001; Bill C-456, *An Act to amend the Food and Drugs Act (mandatory labeling for genetically modified foods)*, 1st Sess, 39th Parl, 2007; Bill C-517, An Act to amend the Food and Drugs Act (mandatory labelling for genetically modified foods), 2nd Sess, 39th Parl, 2008; Bill C-257, *An Act to amend the Food and Drugs Act (mandatory labeling for genetically modified foods),* 1st Sess, 41st Parl, 2011, reinstated 2nd Sess, 41st Parl, 2013. For a discussion of these various efforts, see Stuart J Smyth, "The state of genetically modified crop regulation in Canada" (2014) 5:3 GM Crops & Food 195 at 199.
[139] In a poll conducted in 2018, 70.10 percent of the 1,049 respondents strongly agreed that all GM foods/ingredients should be clearly labelled as such on food packages, with 18.50 percent somewhat agreeing: Sylvain Charlebois et al, "Biotechnology in food: Canadian attitudes towards genetic engineering in both plant- and animal-based foods"

Pierre-Luc Dusseault, was voted down in the House of Commons in May 2017.[140] Though one commentator has noted that, when it comes to mandatory GM labelling, "there is little reason to believe that future efforts will be any more successful than previous efforts",[141] the advent of GE animals, with all of their attendant apprehensions, may be a factor that helps tips the equation in favour of consumer demands for labelling.

Beyond issues related to labelling alone, the topic of GE animals, in general, has attracted legislative attention in the past several years. The House of Commons Standing Committee[142] on Agriculture and Agri-Food (Committee) "studies bills, government activities and expenditures, and issues related to Canada's agriculture and agri-food industry."[143] As part of their work, the Committee has looked specifically at the issue of GM animals for human consumption. In September and October 2016, they had 13 witnesses, representing a broad range of stakeholder perspectives, including representatives from industry organizations, regulatory agencies, NGOs, and academics, present evidence before them at four public hearings.

The Committee's final report, published in December 2016, lists four specific recommendations: (1) that the government provide greater transparency in the regulatory system that evaluates GM animals for human consumption; (2) that the government provide support for independent research into the broader effects of new GM technologies (including those to

(2019) 121:12 British Food J 3181. See also Canadian Biotechnology Action Network, "Polls on GM Food Labelling in Canada", online: <https://cban.ca/gmos/issues/labelling/polls-on-gm-food-labelling-canada/>.

140 Bill C-291, *An Act to amend the Food and Drugs Act (genetically modified food)*, 1st Sess, 42nd Parl, 2016 (first reading 14 June 2016). Notably, all 74 Conservative MPs unanimously voted against the Bill, whereas all 35 NDP MPs, all 9 Bloc Québécois MPs, and the lone Green Party MP all voted in favour: House of Commons, "42nd Parliament, 1st Session – Vote No. 283", online: <https://www.ourcommons.ca/Members/en/votes/42/1/283>.

141 Smyth, *supra* note 138 at 199.

142 Standing committees are permanent committees established by Standing Orders of the House of Commons or the Senate, who are mandated to study matters within their areas of responsibility: House of Commons, "Committees", online: <https://www.ourcommons.ca/About/OurProcedure/Committees/c_g_committees-e.htm>.

143 House of Commons, "Standing Committee on Agriculture and Agri-Food", online: <https://www.ourcommons.ca/Committees/en/AGRI>.

produce GM animals); (3) that the government support a mandatory labelling system for GM foods, but only for issues of food health and safety; and (4) that the government work with industry to establish tools to provide traceability for GM animals.[144] The government formally responded to the report in 2017, stating overall that "[t]he Government of Canada agrees with the Committee's commitment to ensure an effective, predictable, and science-based regulatory system when considering the approval of GM animals for human consumption."[145] The government also responded to each of the specific recommendations in further depth, mostly expressing acquiescence to the Committee's views.[146] Based on a more recent study undertaken by the Standing Committee on Agriculture and Agri-Food on Perception of and Public Trust in the Canadian Agricultural Sector,[147] it appears as though there is still work to be done in this respect.

Despite being granted the stamp of approval by regulators, there has been vocal opposition to the AAS by numerous environmental and food safety groups,[148] as well as rejection by industry organizations.[149] Several major grocery chains have declared their intention to

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[144] House of Commons, Report of the Standing Committee on Agriculture and Agri-Food, *Genetically Modified Animals for Human Consumption: Report of the Standing Committee on Agriculture and Agri-Food* (December 2016) (Chair: Pat Finnigan) at 11.
[145] House of Commons, "Government Response to the Report of the Standing Committee on Agriculture and Agri-Food Entitled: Genetically Modified Animals for Human Consumption", online: <https://www.ourcommons.ca/DocumentViewer/en/42-1/AGRI/report-4/response-8512-421-132>.
[146] *Ibid*.
[147] House of Commons, "Perception of and Public Trust in the Canadian Agricultural Sector", online: <https://www.ourcommons.ca/Committees/en/AGRI/StudyActivity?studyActivityId=10499422>. See in particular the brief submitted by the Canadian Biotechnology Action Network, "Three Recommendations for Building Trust in Canadian Regulation of Genetic Engineering", online: <https://www.ourcommons.ca/Content/Committee/421/AGRI/Brief/BR10429098/br-external/CanadianBiotechnologyActionNetwork-e.pdf> (with the three recommendations being (1) establish mandatory GM food labelling; (2) reform GMO regulation for increased transparency and public engagement; (3) maintain Health Canada's role in assessing the safety of GM foods).
[148] The Canadian Biotechnology Action Network is an umbrella group of organizations apprehensive about genetic engineering in food and farming that has been at the forefront of the efforts to raise concerns about the AAS and GM foods more broadly. Canadian Biotechnology Action Network, online: <http://www.cban.ca/>.
[149] Canadian Aquaculture Industry Alliance, "CAIA Position: Genetically Engineered Salmon Product", online: <http://www.aquaculture.ca/news-resources-index/>: "Salmon farmer members of the Canadian Aquaculture

boycott the fish.[150] There have also been legal challenges brought against the regulatory bodies in both Canada[151] and the US[152] with respect to their approval processes. In the US, a federal judge ruled in November 2020 that the FDA's analysis of the potential risk that the AAS pose to the environment was incomplete, and that they must meaningfully assess what might happen to wild salmon populations if an escape of the AAS into open waters was to occur.[153] Judge Chhabria notes that:

> Obviously, as the company's operations grow, so too does the risk of engineered salmon escaping. Thus, it was particularly important at the outset for the agency to conduct a complete assessment of the risks posed by the company's genetic engineering project, including an assessment of the consequences for normal salmon if the engineered salmon established themselves in the wild.[154]

In Canada, the action was brought by Ecojustice on behalf of the Ecology Action Centre and the Living Oceans Society against Canada's Minister of the Environment and Climate Change, Minister of Health, and AquaBounty. Applying a reasonableness standard (as opposed to a correctness standard) to the question of whether the approval decision was reasonable and made in the manner prescribed by statute, Justice Zinn of the Federal Court ruled on December

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Industry Alliance (CAIA), representing virtually all farmed salmon in Canada, do not farm or sell GE farmed salmon, and are not growing or researching GE salmon."

[150] Suzanne Goldenberg, "Major US supermarkets to boycott GM salmon", *The Guardian* (20 March 2013), online: <https://www.theguardian.com/environment/2013/mar/20/major-us-supermarkets-boycott-gm-salmon>.

[151] Ecology Action Centre, "Environmental groups take federal government to court for permitting manufacture of genetically modified salmon in Canada", Press Release (21 January 2014), online: <https://ecologyaction.ca/files/images-documents/file/Marine/Environmental%20groups%20take%20federal%20government%20to%20court%20for%20permitting%20manufacture%20of%20genetically%20modified%20salmon%20in%20Canada.pdf>.

[152] Center for Food Safety, "Lawsuit Challenges FDA's Approval of Genetically Engineered Salmon", Press Release (31 March 2016), online: <http://www.centerforfoodsafety.org/press-releases/4317/lawsuit-challenges-fdas-approval-of-genetically-engineered-salmon>.

[153] Center for Food Safety, "Federal Court Declares Genetically Engineered Salmon Unlawful", Press Release (5 November 2020), online: <https://www.centerforfoodsafety.org/press-releases/6186/federal-court-declares-genetically-engineered-salmon-unlawful>; H Claire Brown, "FDA must reassess potential environmental impact of GM salmon, federal judge rules", *The Counter* (6 November 2020), online: <https://thecounter.org/genetically-modified-salmon-aquabounty-fda-environment/>.

[154] *Institute for Fisheries Resources v. United States Food and Drug Administration*, Order Granting in Part and Denying in Part Plaintiff's Motion for Summary Judgment; Granting in Part and Denying in Part Defendant's Cross-Motion for Summary Judgment, Case No. 16-cv-01574-VC, filed 5 November 2020, online: <https://www.centerforfoodsafety.org/files/2020-10-05-ecf-285--order-granting-in-part-and-denying-msj_03835.pdf>.

23, 2015 that the Ministers were correct to allow the production of the AAS in Canada for commercial use, and that they had arrived at a decision that was "reasonable and made in the manner prescribed by the [*CEPA, 1999*]".[155] With the Federal Court of Appeal's dismissal of the appeal on October 21, 2016,[156] the Federal Court's ruling stands.[157] Thus, future action regarding GE animals in Canada will likely have to come from the executive branch.

6.2.3 GE Animals and Technology Justice

The case of GE animals raises a number of concerns relating to technology justice. In particular, regardless of whether one agrees with the final determination of safety of the AAS for production and human consumption, the decision-making process was highly problematic. Namely, the approval decision was made without consulting many relevant stakeholders—including the public, Aboriginal groups, and Canada's salmon industry—and based on narrow considerations. Indeed, Health Canada explicitly acknowledges that "[i]n order to protect the scientific integrity of the assessment process, socio-economic factors, such as potential market reaction, are not considered in the decision-making process with respect to novel products."[158]

Yet, socio-economic factors are extremely relevant when it comes to the success or failure of GE animals. The importance of the fisheries sector on a global scale cannot be overlooked in assessing the potential impact of the AAS. Aquaculture is among the fastest

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[155] *Ecology Action Centre v Canada (Environment)*, 2015 FC 1412; "AquaBounty's GMO salmon production approval ruled OK by federal court", *CBC News* (30 December 2015), online: <http://www.cbc.ca/news/canada/prince-edward-island/aquabounty-s-gmo-salmon-production-approval-ruled-ok-by-federal-court-1.3384343>.

[156] *Ecology Action Centre v Canada (Environment)*, 2016 FCA 258; "Canadian Court of Appeal upholds genetically modified salmon approval", *Laboratory Focus* (27 October 2016), online: <https://laboratoryfocus.ca/canadian-court-of-appeal-upholds-genetically-modified-salmon-approval/>.

[157] The Supreme Court of Canada has previously expressed reluctance to engage in broader discussions of the moral or social implications of GMOs, preferring instead to leave those issues to Parliament. See e.g. *Harvard College v Canada (Commissioner of Patents)*, 2002 SCC 76, [2002] 4 SCR 45 at para 103; *Monsanto Canada Inc v Schmeiser*, 2004 SCC 34, [2004] 1 SCR 902 at paras 93-94.

[158] Health Canada, "FAQ", *supra* note 136.

growing segments of the global food system, presenting significant opportunities as well as challenges for governance on all scales.[159] The potential large-scale commercialization of GE fish and seafood, which could dramatically change the aquaculture sector, is therefore highly relevant to any considerations of the future of food production and consumption, both domestically and internationally.

Canadian aquaculture production has increased four-fold since the early nineties, and Canada is the fourth-largest producer of farmed salmon in the world.[160] Meanwhile, the role and importance of fish in addressing issues of global food and nutrition security is increasingly a topic of attention.[161] Conventional aquaculture practices are already controversial for the environmental and social problems they pose,[162] and adding GE fish to the equation is sure to magnify existing issues.[163] For example, the AAS may drive down the price of farmed and/or conventionally caught salmon, which could jeopardize the livelihoods of smaller scale fishers and/or force them to adopt the technology to remain viable.[164] According to Fisheries and Oceans Canada, "aquaculture employs about 14,000 people in full-time, well paying jobs that are primarily located in smaller coastal and rural communities. Canada's farmed-salmon industry

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[159] Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture 2014: Opportunities and challenges* (Rome: FAO, 2014), online: <http://www.fao.org/3/a-i3720e.pdf>; Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture 2016: Contributing to food security and nutrition for all* (Rome: FAO, 2016), online: <http://www.fao.org/3/a-i5555e.pdf>.
[160] Fisheries and Oceans Canada, "Aquaculture statistics", online: <http://www.dfo-mpo.gc.ca/aquaculture/sector-secteur/stats-eng.htm> (last modified January 12, 2013).
[161] FAO, *The State of World Fisheries and Aquaculture 2016*, *supra* note 159; The High Level Panel of Experts on Food Security and Nutrition, *Sustainable fisheries and aquaculture for food security and nutrition: A report by The High Level Panel of Experts on Food Security and Nutrition* (Rome: HLPE, 2014), online: <http://www.fao.org/3/a-i3844e.pdf>.
[162] See e.g. Angela Lee & Pierre Cloutier de Repentigny, "Farming the Sea, a False Solution to a Real Problem: Critical Reflections on Canada's Aquaculture Regulations" (2018) 50:1 Ottawa L Rev 33.
[163] Melanie D Power, "Lots of fish in the sea: Salmon aquaculture, genomics and ethics" (2003) Electronic Working Papers Series, CAE Paper No DEG 004, W Maurice Young Centre for Applied Ethics, University of British Columbia, online:
<http://web.archive.org/web/20130513024046/http://www.ethics.ubc.ca/workingpapers/deg/deg004.pdf>.
[164] Le Curieux-Belfond et al, *supra* note 88 at 178.

provides more than 10,000 jobs alone, the majority of which are in coastal areas of British Columbia and New Brunswick."[165] More broadly,

> [n]early 90 percent of the world's estimated 34 million full-time or part-time fishers are estimated to derive their livelihood from the small-scale sector. They are estimated to contribute 80 percent of the total world catch – inland fisheries included – that is used for domestic human consumption. These figures, however, are most likely to be underestimated as they derive from official statistics where small-scale operators are rarely well accounted for.[166]

Beyond economic and social impacts, salmon also plays an important role in the cultural fabric of fishing communities, especially Indigenous ones.[167]

The Codex Alimentarius Guideline on which Health Canada drew also specifies that it "addresses only food safety and nutritional issues", and does not address concerns about "animal welfare; ethical, moral and socio-economical aspects; [and] environmental risks related to the environmental release of recombinant-DNA animals used in food production".[168] Whether or not these concerns were taken into account by regulators, and if so, to what degree, remains in question. Very little information is provided to the public as to how regulators assess the safety of novel foods and what data is used in the evaluation process, apart from brief summaries of product approval decisions posted online after the decision has already been made,[169] ostensibly to protect proprietary information. This lack of transparency effectively serves to shield decision-making in this space from public oversight. Though import-export data indicates that 4.5 tonnes

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[165] Fisheries and Oceans Canada, "Aquaculture statistics", online: <https://www.dfo-mpo.gc.ca/aquaculture/sector-secteur/stats-eng.htm> (last updated January 12, 2013).

[166] The High Level Panel of Experts on Food Security and Nutrition, *supra* note 161 at 34 [references omitted].

[167] See e.g. James R McGoodwin, *Understanding the Culture of Fishing Communities: A Key to Fisheries Management and Food Security*, FAO Fisheries Technical Paper No. 401 (Rome: FAO, 2001) at 43-56; Kira Gerwing & Timothy McDaniels, "Listening to the Salmon People: Coastal First Nations' Objectives Regarding Salmon Aquaculture in British Columbia" (2006) 19:3 Society & Natural Resources 259; Justin Page, "Salmon Farming in First Nations' Territories: A Case of Environmental Injustice on Canada's West Coast" (2007) 12:6 Local Environment 613.

[168] Codex Alimentarius, CAC/GL 68-2008, *supra* note 132 at 57.

[169] Health Canada, "Approved Products", online: <https://www.canada.ca/en/health-canada/services/food-nutrition/genetically-modified-foods-other-novel-foods/approved-products.html> (last updated January 31, 2020).

of GM salmon was delivered to Canada in 2017 alone, information about where exactly that salmon was sold is shrouded in secrecy, which prevents consumers from being able to make informed decisions about their purchasing choices.[170]

Moreover, the fact that there was little to no consultation of relevant stakeholders in the regulatory approval process of the AAS increases the probability that important factors relating to the riskiness of the product were neglected. In the case of this particular product, this omission is deeply troubling for a number of reasons. For one, given that environmental effects are often difficult to anticipate, latent in emergence, impossible and/or challenging to reverse, as well as unpredictably synergistic and cumulative, it is particularly important to be wary of technologies that could have significant environmental ramifications.[171] A reductive and short-sighted approach to evaluation can lead to consequences that are far from favourable, especially given the complexity of ecosystems. The specific risks raised by GE animals are poorly understood, and the Canadian approach to safety assessment "is based on an oversimplified understanding of the complexities entailed in transgenic modification."[172] Although the lessons learned from the regulation of GM crops can be instructive, GE animals present entirely new questions and concerns that require heightened caution.

Independent research has found that, in the case of GE fish, "many traits that appear to confer an advantage in the short-term could have long-term costs that make them overall detrimental."[173] However, the Science Response produced as a result of the DFO's risk

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[170] Alex Gillis, "Canadians ate 4.5 tonnes of unlabelled GM salmon without knowing it this past year", *Maclean's* (5 June 2018), online: <https://www.macleans.ca/society/environment/canadians-ate-4-5-tonnes-of-unlabelled-genetically-modified-salmon-without-knowing-it-were-you-one-of-them/>.

[171] In a report by a special committee of the US National Research Council, environmental concerns were considered among a range of topics related to animal biotechnology to have the greatest potential for long-term impact: *Animal Biotechnology*, *supra* note 84 at 4, 9-11.

[172] Le Curieux-Belfond et al, *supra* note 88 at 175.

[173] *Ibid* at 177. The authors go on to note that "[f]or example, domesticated trout, that grows faster but takes more risk during feeding, do not tend to survive when predators are abundant, compared to wild trout."

assessment of the AAS exhibits several alarmingly reductionist tendencies and a concerning lack of certainty regarding environmental and indirect human health impacts. For example, under the subheading of "Life history, behaviour and reproduction", the document states, *inter alia*, that "[l]imited information about the behaviour of AAS is available. AquaBounty reported normal avoidance, feeding and postural behaviour of juvenile AAS in a hatchery environment … There is no information available about the predatory behaviour of AAS or AAS-relatives in the natural environment."[174] The Science Response also admits that there are gaps in knowledge about the reproductive behavior of female AAS, and that there is a possibility that not all AAS eggs will produce sterile fish that are unable to reproduce.[175] If an AAS were to escape, interbreeding could occur with wild Atlantic salmon and some species of trout, which could lead to genetic contamination and resulting unpredictable ecological consequences.[176]

The fact that such an event has not yet transpired should not be taken as an assurance that it will not occur in the future. Any technological application relies, at least to some extent, on human design and control, which, in turn, opens the door to fallibility and error. Many of the concerns flagged in relation to the AAS are more than hypothetical; for example, "[c]ultivated salmon have escaped into the wild from fish farms and these salmon already pose ecologic and genetic risks to native salmon stocks."[177] Aquatic organisms like the AAS present particularly grave environmental threats, including to biodiversity, "because their mobility poses serious containment problems, and because unlike domestic farm birds and mammals, they easily can

[174] Fisheries and Oceans Canada, *Risk Assessment*, *supra* note 98 at 7.
[175] *Ibid* [emphasis added].
[176] Krista B Oke et al, "Hybridization between genetically modified Atlantic salmon and wild brown trout reveals novel ecological interactions" (2013) 280:1763 Proc R Soc B 1.
[177] *Animal Biotechnology*, *supra* note 84 at 11. See also Amy Smart, "About 20,000 non-native salmon escaped a farm during a fire in B.C., endangering wild Pacific salmon", *National Post* (24 December 2019), online: <https://nationalpost.com/news/canada/escape-of-non-native-salmon-on-b-c-coast-puts-farm-phase-out-plan-in-spotlight>.

become feral and compete with indigenous populations."[178] While these factors weigh heavily in favour of a more precautionary approach, the regulatory framework, in its current state, is clearly undergirded by a relatively lax approach to risk.

There have already been profound apprehensions expressed about existing regulatory processes and the government's failure to appropriately balance competing priorities and/or take broader public concerns about GM foods into account. In 2001, at the request of the federal government, the Royal Society of Canada published an Expert Panel Report that sounded alarms about the safety of new food products being developed through biotechnology.[179] The Report made multiple recommendations in relation to the policies and principles guiding the regulation of agricultural biotechnology in Canada, the substantive regulations and guidelines themselves, the regulatory process, and scientific capacity for the regulation of food biotechnology. For example, the Report recommended the adoption of

> the precautionary regulatory assumption that, in general, new technologies should not be presumed safe unless there is a reliable scientific basis for considering them safe. The Panel rejects the use of "substantial equivalence" as a decision threshold to exempt new GM products from rigorous safety assessments on the basis of superficial similarities because such a regulatory procedure is not a precautionary assignment of the burden of proof.[180]

Despite these clear recommendations, there has been a lack of progress in many of the key areas identified in the Report.[181]

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[178] *Animal Biotechnology*, *supra* note 84 at 4. See also Lingbo Li, Tony J Pitcher & Robert H Devlin, "Potential risks of trophic impacts by escaped transgenic salmon in marine environments" (2015) 42:2 Environmental Conservation 152; Robert H Devlin, L Fredrik Sundstrom & William M Muir, "Interface of biotechnology and ecology for environmental risk assessments of transgenic fish" (2006) 24:2 Trends in Biotechnology 89.
[179] The Royal Society of Canada, *supra* note 86.
[180] *Ibid* at x.
[181] Peter Andrée, "An analysis of efforts to improve genetically modified food regulation in Canada" (2006) 33:5 Science & Public Pol'y 377. See also Peter Andrée, "The Biopolitics of Genetically Modified Organisms in Canada" (2002) 37:3 Journal of Canadian Studies 162; Martin Phillipson, "Are Genetically Modified Crops in Canada Under-Regulated?" (2008) 18:2 JELP 195; André Magnan, "Refeudalizing the Public Sphere: 'Manipulated Publicity' in the Canadian Debate on GM Foods" (2006) 31:1 Can J Sociology 25.

Political economy factors offer a compelling explanation for the federal government's stance on GMOs. In tracing the history of Canadian biotechnology policy, Elisabeth Abergel and Katherine Barrett contend that Canada's interests in the development and commercial expansion of biotechnology have influenced the development of a national biotechnology policy and regulatory system that is overly permissive and favourable to industry.[182] As Abergel further explains,

> [t]he federal government created the economic conditions for the agriculture biotechnology sector to emerge in Canada, first, by providing public funding for research and development in this growing sector, and second, by providing financial incentives to private research corporations in the form of direct grants and research tax benefits, along with legislation to extend patent monopolies, which thus created the conditions for unconstrained access to market. Other tools, such as a favourable policy environment coupled with a relatively streamlined regulatory system, gave new incentives for private corporations to invest in the Canadian biotechnology sector.[183]

Indeed, according to Deloitte and BIOTECanada's 2018 Biotechnology Industry Data Survey, 45 percent of respondents cited government-facilitated programs as a source of capital.[184] Further, 2020 was reported to be a "booming" year for the Canadian biotechnology sector, which raised over $1 billion in venture capital in the first nine months alone.[185] When it comes to the repercussions of this state of affairs, André Magnan has cynically posited that "[h]aving made biotechnology central to its development strategy, the state is limited in its ability to effectively respond to legitimate public concerns about the long-term implications".[186] The case of the AAS

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[182] Elisabeth Abergel & Katherine Barrett, "Putting the Cart Before the Horse: A Review of Biotechnology Policy in Canada" (2002) 37:3 Journal of Canadian Studies 135.
[183] Abergel, *supra* note 106 at 103-104.
[184] Deloitte & BIOTECanada, *Biotechnology Industry Data Survey 2018: Report on key findings* (September 2018), online: <http://www.biotech.ca/wp-content/uploads/2018/06/Biotechnology_Industry_Data_Survey_2018_-_Report_on_key_findings_AODA.pdf> at 19.
[185] Sean Silcoff, "Booming Canadian biotech sector on track for record year after raising $1-billion in venture capital so far in 2020", *The Globe and Mail* (26 November 2020), online: <https://www.theglobeandmail.com/business/article-canadian-biotechnology-sector-raised-103-billion-so-far-in-202/>.
[186] Magnan, *supra* note 181 at 48.

seems to vindicate this analysis, suggesting that continuing scrutiny of biotechnology policy and regulation is abundantly necessary.

Public opinions about new food innovations are hugely significant not only as a matter of democracy, but also as a practical matter of their uptake in the market. Research already indicates that GE animals produced for food consumption appear to generate very little public appetite.[187] In a national poll conducted by Ipsos Reid for the Canadian Biotechnology Action Network in 2015, 45 percent of Canadians responded that they would definitely not eat GM salmon.[188] This suggests not only that GE animals are much more of a technology-push development than a demand-pull one, but also that the public has apprehensions about GE animals that have a real bearing on their reception. Unfortunately, as the experience of GM crops illustrates, public concerns are often trivialized and disqualified as useful contributions to the conversation on the basis that they can be attributed to a lack of understanding.[189] The lack of mandatory labelling requirements in Canada also means that it is impossible to use purchasing decisions as an indicum of consumer sentiment.

The problem has both a procedural and theoretical component. Theoretically, decision-making about GMOs in Canada is guided by a partial understanding of risk, which had led to a situation in which "[p]ublic deliberation has been minimized by the government's insistence on using science as the sole decision-making criterion in the regulatory framework."[190] By strategically limiting the grounds on which decisions are made—even when the science is neither complete nor conclusive—the scope of issues deemed to be of legitimate concern is considerably

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[187] Vàzquez-Salat & Houdebine, *supra* note 91.
[188] Canadian Biotechnology Action Network, "2015 Consumer Poll", online: <https://cban.ca/gmos/issues/labelling/2015-consumer-poll/>. 11 percent of Canadians said they would eat it, 32 percent said maybe, and 12 percent said they did not know or did not have an opinion.
[189] Magnan, *supra* note 181.
[190] Sarah Hartley & Grace Skogstad, "Regulating genetically modified crops and foods in Canada and the United Kingdom: Democratizing risk regulation" (2005) 48:3 Can Pub Admin 305 at 315.

circumscribed, even though "extra-scientific concerns … are of equal interest to the public."[191] If effect is to be given to the full range of public concerns, the question is not merely whether an innovation is safe, but whether it is appropriate, desirable, and/or capable of meeting broader goals like those related to increasing food security. As such, safety, as determined by a narrow scientific assessment, should not mark the end of the analysis when it comes to novel foods.

Procedurally, many stakeholders have been shut out of the ability to meaningfully shape biotechnology policy in Canada. The government has admittedly made some efforts to "engag[e] Canadians in a dialogue on biotechnology",[192] particularly through the establishment of the CBAC. However, as a model for public consultation, the CBAC's work has been harshly criticized. For one, the composition of the committee was weighted heavily in favour of experts in biotechnological sciences, thereby "reproduc[ing] the expert/lay divide characteristic of the technocratic model of science policy."[193] Furthermore, "the exclusion of counter-experts in CBAC's membership also restrict[ed] the range of potential participants … The result has been to marginalized critical voices and compromise dialogue with the NGO sector."[194]

More fundamentally, by adopting the "regulation" of GM food as "the central problem for study … [the CBAC] neglect[ed] the issue of whether or not GM food should be commercially grown at all."[195] In other words, "the CBAC's GM food project was hatched out of an apparent desire to examine how GM foods would be commercially deployed in Canada, not whether this deployment should continue, with public consultation predicated on this premise."[196] The fact that the CBAC was "struck based on an underlying agenda that uncritically

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[191] *Ibid*.
[192] Government of Canada, "Canada's Biotechnology Strategy", *supra* note 104.
[193] Magnan, *supra* note 181 at 39.
[194] *Ibid*.
[195] *Ibid*.
[196] Scott Prudham & Angela Morris, "Making the Market "Safe" for GM Foods: The Case of the Canadian Biotechnology Advisory Committee" (2006) 78:1 Studies in Political Economy 145 at 147.

accepts the purported benefits of biotechnology and promotes industry development as a powerful economic goal … result[ed] in a consultation process that limit[ed] the type of information solicited and, thus, the scope of ideas developed, which ultimately serves to constrict policy options."[197]

Similarly, Abergel argues that "[t]he participation process is rendered meaningless if responses to social demands are not met and remain unaddressed … Such a flawed participatory system means that the discursive potential of the policy system is severely restricted."[198] If public opinions are to be taken seriously, consultations must be undertaken in good faith, with the intention of amounting to more than just sophisticated public relations exercises "designed to ensure public acquiescence to the positions of powerful actors."[199]

It is not a foregone conclusion that lay input will amount to little more than dilettantism. Given the opportunity, the public frequently expresses coherent and commonly held concerns about technologies and risk. For example, public submissions pertaining to the proposed expansion of the AquaBounty hatchery in PEI reflected a number of recurring themes, including concerns about potential escapes of the AAS and the subsequent risk to wild Atlantic salmon populations, concerns about environmental pollution, concerns about the impact on groundwater, and concerns about the environmental assessment process.[200] Based on the evidence, these concerns are all valid, and should have been carefully considered by regulators.

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[197] Wilhelm Peekhaus, *Resistance is Fertile: Canadian Struggles on the BioCommons* (Vancouver: UBC Press, 2013) at 231.
[198] Abergel, *supra* note 106 at 115.
[199] Magnan, *supra* note 181 at 26.
[200] See Prince Edward Island, "Proposed Redevelopment of Snow Island's Atlantic Sea Smolt Ltd. Facility (AquaBounty) in Rollo Bay: Public submissions – June 2017", online: <www.princeedwardisland.ca/sites/default/files/publications/aqua_bounty_eia_public_comments_summary.pdf>. See also Government of Canada, "Summary of information submitted by the public to the New Substances program on the environmental and human health risks of the AquAdvantage® salmon", online: <https://www.canada.ca/en/environment-climate-change/services/managing-pollution/evaluating-new-

Additionally, proactively including the public in conversations about technologies which have the potential to profoundly affect their lives can mitigate cynicism and enhance the legitimacy of policy-making. In the UK, one lay panel that was convened to deliberate on the potential use of transgenic salmon actually ended up with a more positive evaluation by the end of the process.[201] In applying an "Ethical Matrix" approach to discuss key issues raised, the researchers note that "[n]o inherent technophobia seemed dominant in their evaluation and it seemed as if the close examination of this case study … provided an overview that allowed participants to distance themselves from preconceived ideas and judge on the basis of information and principles that are designed to serve the common good."[202]

Thus, skepticism about technology does not necessarily reflect a dogmatic unwillingness to see the other side. When given appropriate and accessible information of the kind they deem relevant and important, citizens are more than capable of contributing to a reasonable appraisal of the advantages and risks of new food innovations.[203] The paternalistic stance towards the public taken by experts and regulators unduly neglects the possibility that a more cooperative process may be mutually beneficial for all stakeholders.

However, increasing the quality and quantity of democratic deliberation does not necessarily solve the problem. It is important to acknowledge that there are insidious and frequently invisible biases that continue to steer the course toward particular outcomes—namely, the preservation of a regulatory status quo. The relatively recent process of developing the

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substances/voluntary-public-engagement-initiative/aquadvantage-salmon/summary-public-comments.html> (last updated April 2, 2019).

[201] Matthias Kaiser et al, "Developing the Ethical Matrix as a Decision Support Framework: GM Fish as a Case Study" (2007) 20 J Agric Environ Ethics 65 at 79. The "Ethical Matrix" approach used emphasized five main properties: (1) inclusion of values at stake; (2) transparency; (3) multiplicity of viewpoints; (4) exposition of case-relevant ethically-relevant aspects; (5) inclusion of ethical arguments. (at 68)

[202] *Ibid*.

[203] Le Curieux-Belfond et al, *supra* note 88 at 183.

Report on Genetically Modified Animals for Human Consumption is telling. Taken together, both the content of the testimony that was heard by the House of Commons Standing Committee on Agriculture and Agri-Food, and how each witness was received, reveals the individual and institutional pathologies that uncritically accept the putative benefits of biotechnology and prioritize industry development as an economic goal.

For instance, Mr. Andrew Casey, President and CEO of BIOTECanada, refers to biotechnology as representing a solution to addressing challenges such that it is "absolutely a social imperative for us as a population, as a society, and we need to get at it as quickly as possible. For Canada, that represents an enormous economic opportunity."[204] As the national industry association representing Canada's health, industrial, and agricultural biotechnology sectors,[205] BIOTECanada has an obvious motive to boost the proliferation of biotechnology, but this sentiment was by no means limited to those with such undisguised affiliations.

Many of the views expressed by the witnesses evidence an interconnected bundle of assumptions about the expert-lay divide, the neutrality of science and scientists, and the promissory potentials of technology that have been challenged in earlier chapters. Andrea Brocklebank, Executive Director of the Canadian Cattlemen's Association, exemplifies this position in her statement:

> In terms of informing the public about biotechnology, a small vocal minority of people will oppose any technology, even those with a demonstrable public benefit. This is true for GMOs, vaccination, and many other technologies, but *reasonable people will accept the informed expert opinion of impartial scientists … The general public gets confused when currently it has to choose between the opinion of a technology advocate and the opinion of industry*.[206]

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[204] House of Commons, Standing Committee on Agriculture and Agri-Food, Meeting 22, 1st Sess, 42nd Parl (4 October 2016), at 11.
[205] BIOTECanada, "About", online: <http://www.biotech.ca/about/home/>.
[206] House of Commons, Standing Committee on Agriculture and Agri-Food, Meeting 20, 1st Sess, 42nd Parl (27 September 2016), at 2 [emphasis added].

In addition to being apparent in the testimony of many of the witnesses, many of the committee members themselves express this unabashedly pro-technology attitude. For example, later in the same session, Mr. Francis Drouin comments: “I think there is a lack of scientific and evidence-based education in Canada. The minority is loud, but we have to ensure that we give the right information.”[207] Relatedly, Mr. Paul Mayers states: “The regulatory system makes no value judgment as to why someone pursued the genetic modification. We just look at safety. The marketplace will decide if a purely aesthetic modification is a worthwhile venture.”[208]

Given these proclivities, it is no surprise that the committee’s response to testimony presented by Lucy Sharratt, representing the Canadian Biotechnology Action Network (CBAN), was much more hostile. Mr. Drouin immediately invalidates the concerns that Sharratt raised with respect to the regulatory system in stating: “I want to make sure that when we talk about GM products, it is a science-based approach.”[209] In terms of recommendations, Sharratt suggested, *inter alia*, assessments of economic impact before the approval of any GM product for release, and the strengthening of environmental risk assessment associated with GM products. Neither of these recommendations are particularly outrageous; yet, they prompted Mr. Bev Shipley to remark: “I’m shocked, quite honestly, at the position taken by Ms. Sharratt and her organization, which quite honestly is funded a lot by Tides Canada and the Sierra Club, which oppose pipelines and any advancement in agriculture.”[210]

The dig about funding and the painting of Sharratt’s testimony as representing some kind of ideological crusade is especially ironic given the power of the agribusiness lobby, which has

[207] *Ibid* at 7.
[208] House of Commons, Standing Committee on Agriculture and Agri-Food, Meeting 21, 1st Sess, 42nd Parl (27 September 2016), at 17.
[209] House of Commons, Standing Committee on Agriculture and Agri-Food, Meeting 22, 1st Sess, 42nd Parl (4 October 2016), at 8.
[210] *Ibid* at 5.

spent substantial amounts of money to fight GM labelling. Specifically, in the US, it expended $45 million in California in 2012 to defeat Proposition 37, a GM labelling bill,[211] and $101.4 million to influence federal GMO legislation in 2015.[212] Though exact figures are not as easily available in Canada, we can presume the existence of similar activity, though not to the same degree. Over and above the issue of labelling, there is evidence that significant resources are expended to advance pro-GM messages and counter any anti-GM ones.[213] Opposition to GM labelling thus appears to be a political position that is more lobbying-based than science-based.

While it is encouraging that the subject was deemed worthy of consideration, the government's recent attempts to improve the regulation of GE animals continues to be hampered by pernicious biases, political influences, and selective blindness as to the ensuing consequences. As a result, the Report on Genetically Modified Animals for Human Consumption produced by the House of Commons Standing Committee on Agriculture and Agri-Food does not go far enough in its recommendations to ensure that all of the associated concerns have been or will be adequately addressed. Calls for greater transparency, traceability, and support for independent research are promising as a starting point, but the restriction of the recommendation for mandatory labelling only to issues of food health and safety is disappointing.

If we are to see less partial decision-making in relation to contentious technologies like GMOs, we need to move beyond the use of technical and abstract discourses that tend to shut out non-expert perspectives and severely limit the scope of legitimate concern. Furthermore, the importance of public interest research and independent, critical science becomes significantly

[211] Suzanne Goldenberg, "Prop 37: food companies spend $45m to defeat California GM label bill", *The Guardian* (5 November 2012), online: <https://www.theguardian.com/environment/2012/nov/05/prop-37-food-gm-bill>.
[212] Rob Coleman, "Food Lobby Spends $101 Million in 2015 to Avert GMO Labeling", *EWG* (25 February 2016), online: <https://www.ewg.org/research/lobbying-anti-labeling-groups-tops-100m>.
[213] See e.g. Allison Vuchnich, "Documents reveal Canadian teenager target of GMO lobby", *Global News* (21 December 2015), online: <https://globalnews.ca/news/2414720/documents-reveal-canadian-teenager-the-target-of-gmo-lobby/>.

diluted when it is "mainly perceived as a form of opposition to private corporations and government".[214] This inappropriately shifts the burden of proof away from the proponents of new technologies and towards those who seek to regulate them, and subverts the objectives of the regulatory system in service of a capitalist imperative.[215]

Public participation in decision-making is one way to better account for different dimensions and perceptions of risk. However, public participation needs to be based on genuinely inclusive processes, rather than being something that is conducted pro forma to ratify a pre-ordained mandate that is more about meeting economic goals than anything else. As R&D in relation to GE animals intensifies, it will be more important than ever before to open up space for more democratic deliberation on the full range of political, economic, environmental, social, and ethical issues involved. This is not only a matter of health considerations, environmental safety, or economic development, but also a matter of justice.

6.3 Smart Agriculture

6.3.1 Overview

In light of the growing threat of climate change-related impacts to food and agriculture, and increasing concerns about global food security, the agri-food sector has faced a reckoning in the past decade. Efforts to adapt to this new reality have included attempts to capitalize on the advancement of digital technologies to improve food systems outcomes. The utilization of science, technology, and the associated rhetoric of "efficiency" and "optimization" has culminated in the emergence of approaches to agriculture that can be grouped together under the heading of "smart agriculture".[216]

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[214] Arnold Pacey, *The Culture of Technology* (Cambridge, MA: The MIT Press, 1983) at 166.
[215] Peekhaus, *supra* note 197 at 153.
[216] But see Peter Newell & Olivia Taylor, "Contested landscapes: the global political economy of climate-smart agriculture" (2018) 45:1 The Journal of Peasant Studies 108 at 114-115 (discussing the blurring between CSA and

The concept of climate smart agriculture (CSA) was developed by the FAO and officially presented at the Hague Conference on Agriculture, Food Security and Climate Change in 2010, in the form of a background paper called *"Climate-Smart" Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation*.[217] The motivations driving the development of CSA practices and technologies relate to both environmental and social goals. According to the FAO, the three objectives of CSA are "sustainably increasing agricultural productivity to support equitable increases in incomes, food security and development; increasing adaptive capacity and resilience to shocks at multiple levels …; and reducing greenhouse gas emissions and increasing carbon sequestration where possible."[218] In short, these pillars can be seen as corresponding to the goals of food security, climate change adaptation, and climate change mitigation.[219]

One definition of CSA posits that it is "a strategy to address the challenges of climate change and food security by sustainably increasing productivity, bolstering resilience, reducing GHG emissions, and enhancing achievement of national food security and development goals."[220] Thus, the linking of agricultural productivity, climate change and food security-related outcomes, and institutional processes, including governance, is a core part of what constitutes CSA. However, CSA goes beyond agricultural practices and technologies to also encompass the

practices like sustainable intensification that has occurred in the literature and policy discourse, and some of the attendant problems).

[217] Food and Agriculture Organization of the United Nations, *"Climate-Smart" Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation* (Rome: FAO, 2010), online: <http://www.fao.org/docrep/013/i1881e/i1881e00.pdf> [*"Climate-Smart" Agriculture*].

[218] Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2016: Climate Change, Agriculture and Food Security* (Rome: FAO, 2016), online: <http://www.fao.org/3/a-i6030e.pdf> at 14.

[219] Stéphane Saj et al, "The way forward: An agroecological perspective for Climate-Smart Agriculture" (2017) 250 Agriculture, Ecosystems and Environment 20 at 20.

[220] Alvin Chandra, Karen E McNamara & Paul Dargusch, "Climate-smart agriculture: perspectives and framings" (2018) 18:4 Climate Policy 526 at 526-527.

identification and development of enabling policies and institutions, including investments and financing.[221]

Another take provides that "CSA was developed to help different stakeholders incorporate [climate change] concerns in planning and investment processes. It lies at the interface between science and policy-making and strives to foster action on the ground and mobilize financing."[222] Indeed, as the FAO notes, "[m]ore productive and resilient agriculture requires a major shift in the way land, water, soil nutrients and genetic resources are managed to ensure that these resources are used more effectively", and "[m]aking this shift requires considerable changes in national and local governance, legislation, policies, and financial mechanisms."[223] To this end, CSA can be seen as comprising "a unified governance framework designed to diffuse agricultural methods and technologies that increase the productivity of a given crop while simultaneously building resilience to climate change and reducing greenhouse gas emissions."[224]

Like the concept of sustainable development, CSA is not constituted by a prescriptive strategy, and CSA interventions are not technology- or practice-specific. Rather, "CSA may be achieved through a number of different pathways, with widely divergent technologies, processes and actors. What actions and activities are rendered 'climate smart', and what triple wins mean and for whom, are in turn shaped by who interprets the term and how it is applied."[225] CSA

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[221] World Bank Group, *Future of Food: Shaping a Climate-Smart Global Food System* (Washington, DC: World Bank Group, 2015), online: <http://documents.worldbank.org/curated/en/2015/10/25128378/future-food-shaping-climate-smart-global-food-system> at 20-21.
[222] Saj et al, *supra* note 219 at 20.
[223] Food and Agriculture Organization of the United Nations, *Climate-Smart Agriculture Sourcebook* (Rome: FAO, 2013), online: <http://www.fao.org/3/a-i3325e.pdf> at ix.
[224] Marcus Taylor, "Climate-smart agriculture: what is it good for?" (2018) 45:1 The Journal of Peasant Studies 89 at 89.
[225] Linus Karlsson et al, "'Triple wins' or 'triple faults'? Analysing the equity implications of policy discourses on climate-smart agriculture (CSA)" (2018) 45:1 The Journal of Peasant Studies 150 at 151.

practices can and have been developed in a diverse range of areas, including soil and nutrient management, water harvesting and use, pest and disease control, genetic resources, and harvesting, processing, and supply chains.[226] CSA originally targeted low- and middle-income countries,[227] but its scope has since expanded to include industrialized countries like Canada. Since its inception, research, policies, and initiatives relating to CSA have multiplied at international and domestic levels.[228]

The concept of "sustainable intensification" (SI)—which focuses on increasing agricultural yields while minimizing pressures on the environment and without expanding the existing agricultural land base—has also gained traction in the past decade, with some dubbing it "the new Green Revolution"[229] or "Agriculture 4.0".[230] Similar rhetoric is detectable in the context of specific developments that can be used in the process of SI, such as artificial/synthetic fertilizers.[231] According to the WEF, "[b]y integrating advances across the biological and physical sciences, the new green revolution holds the promise of further increasing crop production yields, minimizing environmental impact, reducing energy and water dependence, and decreasing the carbon footprint."[232] Though it is not determinative, the use of sophisticated technologies is, in many ways, consonant with the spirit of SI.[233]

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226 Food and Agriculture Organization of the United Nations, *"Climate-Smart" Agriculture*, *supra* note 217 at 1-3.
227 See e.g. Chandra, McNamara & Dargusch, *supra* note 220 at 530.
228 See e.g. Leslie Lipper et al, eds, *Climate Smart Agriculture: Building Resilience to Climate Change* (Cham, Switzerland: Springer, 2018).
229 See e.g. Marc-Olivier Martin-Guay et al, "The new Green Revolution: Sustainable intensification of agriculture by intercropping" (2018) 615 Science of the Total Environment 767.
230 See e.g. David Christian Rose & Jason Chilvers, "Agriculture 4.0: Broadening Responsible Innovation in an Era of Smart Farming" (2018) 2 Frontiers in Sustainable Food Systems 1.
231 World Economic Forum, *Network of Global Agenda Councils Reports 2011-2012*, online: <http://reports.weforum.org/global-agenda-council-2012/councils/emerging-technologies/>. Artificial/synthetic fertilizers are manufactured to contain a relatively high quantity of nutrients such as nitrates, magnesium, phosphorus, and potassium, which means that less of them are needed.
232 *Ibid*.
233 Rose & Chilvers, *supra* note 230.

In addition to the scholarly attention paid to SI,[234] it has emerged as a major focus area for governments[235] and organizations at all scales, including the FAO.[236] The FAO notes that "[i]f global population and food consumption trends continue, by 2050 the world will need 60 percent more food than is available today. Because arable land is limited, most of this additional production will have to come from sustainable agricultural intensification."[237] The idea that production must be substantially increased in order to meet growing global demands for food has been firmly established and regularly repeated through various outlets,[238] such that it has become an almost taken-for-granted starting point in developing policy responses.

Although proponents maintain that SI is a clear way of meeting current and future environmental and social challenges when it comes to food production, the extent to which SI represents a genuine shift in direction for agriculture is in dispute. SI, more than CSA, "has been subject to wide-ranging critique."[239] Critics have contended that the concept of SI is problematic insofar as it focuses narrowly on food production, fails to demonstrate how intensifying food

[234] See e.g. David Tilman et al, "Global food demand and the sustainable intensification of agriculture" (2011) 108:50 PNAS 20260; T Garnett et al, "Sustainable Intensification in Agriculture: Premises and Policies" (2013) 341: 6141 Science 33; HCJ Godfray, "The challenge of feeding 9-10 billion people equitably and sustainably" (2014) 152 Journal of Agricultural Science S2; Jules Pretty & Zareen Pervez Bharucha, "Sustainable intensification in agricultural systems" (2014) 114:8 Annals of Botany 1571; Brian Petersen & Sieglinde Snapp, "What is sustainable intensification? Views from experts" (2015) 46 Land Use Policy 1; Paul C Struik & Thomas W Kuyper, "Sustainable intensification in agriculture: the richer shade of green. A review" (2017) 37 Agronomy for Sustainable Development 39; Johan Rockström et al, "Sustainable intensification of agriculture for human prosperity and global sustainability" (2017) 46:1 Ambio 4; Jules Pretty et al, "Global assessment of agricultural system redesign for sustainable intensification" (2018) 1 Nature Sustainability 441.

[235] See e.g. this report in the EU context: Allan Buckwell et al, *Sustainable Intensification of European Agriculture: A review sponsored by the RISE Foundation* (Brussels: RISE Foundation, 2014), online: <http://www.risefoundation.eu/images/files/2014/2014_%20SI_RISE_FULL_EN.pdf>.

[236] Food and Agriculture Organization of the United Nations, "Sustainable Intensification of Agriculture", online: <http://www.fao.org/policy-support/policy-themes/sustainable-intensification-agriculture/en/>.

[237] *Ibid*.

[238] The Royal Society, *supra* note 88 at 9, 47.

[239] Newell & Taylor, *supra* note 216 at 114.

production will improve human well-being in addition to minimizing environmental impacts, and exhibits a lack of attention to justice and other distributive concerns.[240]

In response, more recent scholarship on SI has taken a more holistic approach to understanding and operationalizing the concept. One group of environmental scholars and scientists recently advanced a definition of SI as "adopting practices along the entire value chain of the global food system that meets rising needs for nutritious and healthy food through practices that build social-ecological resilience and enhance natural capital within the safe operating space of the Earth system."[241] It remains to be seen whether or not SI, in its final form, will be an adequate or a sufficient approach to achieve environmental sustainability and combat global food insecurity.

Meanwhile, "smart farming" (also referred to as "precision agriculture" or "digital agriculture") practices are also being touted by a range of actors as a way to "manage land, animals, and farm personnel more effectively."[242] Smart farming relies explicitly on new and emerging digital technologies to "support efficient production processes".[243] Smart farming turns in large part on gathering, analyzing, and utilizing data collected through ICTs,[244] though other kinds of technologies can also fall within the ambit of smart farming. To name just a few,

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[240] See e.g. Jacqueline Loos et al, "Putting meaning back into "sustainable intensification"" (2014) 12:6 Frontiers in Ecology and the Environment 356; H Charles J Godfray, "The debate over sustainable intensification" (2015) 7:2 Food Security 199; E Diamond Collins & Kirtana Chandrasekaran, *A Wolf in Sheep's Clothing?: An analysis of the 'sustainable intensification' of agriculture* (Amsterdam: Friends of the Earth International, 2012), online: <https://www.foei.org/wp-content/uploads/2013/12/Wolf-in-Sheeps-Clothing-for-web.pdf>.
[241] Rockström et al, *supra* note 234 at 7.
[242] C Eastwood et al, "Managing Socio-Ethical Challenges in the Development of Smart Farming: From a Fragmented to a Comprehensive Approach for Responsible Research and Innovation" (2019) 32 J Agric Environ Ethics 741 at 742.
[243] Manlio Bacco et al, "The Digitisation of Agriculture: a Survey of Research Activities on Smart Farming" (2019) 3-4 Array 1 at 1.
[244] *Ibid*.

"[s]ensors, drones, weather satellites, intelligent software algorithms and robots are examples of technologies that together make farming 'smart'."[245]

Like CSA and SI, smart farming is considered to be a way of addressing both social and environmental issues arising in agricultural production. For example, the World Bank notes that digital technologies "have significant potential to improve efficiency, equity, and environmental sustainability in the food system."[246] At the same time, it is acknowledged that there are associated risks, including "an overconcentration of service provider market power; lack of data security; exclusion and potential job losses for some activities; and cybersecurity breaches",[247] which call for public policy interventions and other kinds of investments to address the multiple constraints that farmers face in using digital technologies to maximum effect, "such as roads, energy, post-harvest shortage, and logistics that can better link farmers to markets."[248]

In sum, the concepts of CSA, SI, and smart farming share many commonalities. They are all relatively recent developments that seek to respond to the interconnected challenges facing agricultural production, which, in many ways, reflect the "pillars" of economy, society, and environment that have been popularized under the sustainable development model. They are characterized by the kind of "'smart' thinking [that] is defined as the production of win-win outcomes in which all parties benefit."[249] They all, to a large extent, put faith in science and technological innovation as being conducive to their goals. Finally, while they have captured the

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[245] Simone van der Burg, Marc-Jeroen Bogaardt & Sjaak Wolfert, "Ethics of smart farming: Current questions and directions for responsible innovation towards the future" (2019) 90-91 NJAS – Wageningen Journal of Life Sciences 1 at 1.
[246] World Bank Group, *Future of Food: Harnessing Digital Technologies to Improve Food System Outcomes* (Washington, DC: World Bank Group, 2019), online: <http://documents.worldbank.org/curated/en/941601554962010560/pdf/Future-of-Food-Harnessing-Digital-Technologies-to-Improve-Food-System-Outcomes.pdf> at 4.
[247] *Ibid*.
[248] *Ibid*.
[249] Taylor, *supra* note 224 at 92.

attention of an expanding contingent of stakeholders—including companies, policymakers, and investors—the broader implications of these concepts for food producers, marginalized groups, and society at large merit further deliberation.

6.3.2 Regulation

Because smart agriculture does not refer to any one technology or approach, identifying a regulatory framework under which it would neatly fall is not straightforward. However, there are some general ways in which regulation and regulatory frameworks are relevant to smart agriculture, especially pertaining to agricultural policies, climate policies, and innovation policies at the national level. A state's international development policies and strategies can also make mention of smart agricultural principles. For example, CIDA's approach to development assistance for increasing food security references a focus on "increasing the availability of food by sustainably increasing agricultural production and productivity",[250] including through research support and partnerships that are expected to lead to "better access to new and locally adapted technologies and specialized expertise for farmers in developing countries."[251]

Whether deployed in the domestic or international context, the main tenets of smart agriculture hew closely with the Canadian government's overall position on food production and the role of technology therein. AAFC has noted that "[g]iven the expected increase in food demand over the next decades, managing emissions associated with food production will be important. Canadian farmers are relatively GHG-efficient and could be a leader in developing

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[250] Canadian International Development Agency, *Increasing Food Security: CIDA's Food Security Strategy*, online: <https://www.international.gc.ca/development-developpement/assets/pdfs/partners-partenaires/key_partners-partenaires_cles/food-security-strategy-e.pdf> at 3.
[251] *Ibid* at 7.

climate-smart agricultural systems."[252] Evidencing this commitment, Canada joined the Global Alliance for Climate-Smart Agriculture (GACSA) in 2015,[253] which was launched in 2014 to act as an inclusive, voluntary, and multi-stakeholder platform on CSA.[254] Members of GACSA include governmental and development agencies, inter-governmental groups, regional alliances, non-governmental organizations, non-profit organizations, civil society organizations, farmers organizations, research and academic institutions, and organizations n the private sector.[255] More recently, the Government of Alberta has enthused about the "triple-win" of CSA in terms of increasing production efficiencies, lowering GHG emissions, and improving adaptation to changing climates.[256]

Apart from these kinds of affirmative statements on the part of governments, there are other indications that the relationship between agricultural production and environmental sustainability is increasingly being mediated through technology in Canada. For example, Sustainable Development Technology Canada (SDTC) is "a foundation created by the Government of Canada to support Canadian companies with the potential to become world leaders in their efforts to develop and demonstrate new environmental technologies that address climate change, clean air, clean water and clean soil."[257] SDTC is currently supporting a number of projects in the agricultural sector, including an Automated Decision Support System for

[252] Agriculture and Agri-Food Canada, "Greenhouse gases and agriculture", online: <http://www.agr.gc.ca/eng/agriculture-and-climate/agricultural-practices/climate-change-and-agriculture/greenhouse-gases-and-agriculture/?id=1329321969842> (last updated January 30, 2020).
[253] Government of Canada, "Canada joins Global Alliance for Climate-Smart Agriculture", News Release (24 July 2015), online: <https://www.canada.ca/en/news/archive/2015/07/canada-joins-global-alliance-climate-smart-agriculture.html>.
[254] Global Alliance for Climate-Smart Agriculture, online: <http://www.fao.org/gacsa/en/>.
[255] Global Alliance for Climate-Smart Agriculture, "Members List", online: <http://www.fao.org/gacsa/members/members-list/en/> (last updated December 2020).
[256] Government of Alberta, "Climate Smart Agriculture in Alberta", online: <http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/cl9706/$FILE/CSA-Intro-July-4-2018.pdf>.
[257] Sustainable Development Technology Canada, "About Us", online: <https://www.sdtc.ca/en/about/about-us/>.

Precision Agriculture with a total project value of $18,484,873, which focuses on the development of a precision agriculture platform "comprising hardware, software and agronomy services" to offer efficiency gains to farmers through new decision support components.[258]

Similarly, in 2018, AAFC sponsored a grant for Scaling Down Precision Agriculture[259] through the Innovative Solutions Canada program.[260] The challenge that the grant seeks to address is to cost-scale "smart farming" technologies appropriately, so that benefits can be realized for smaller-acre operations.[261] Two organizations were awarded $150,000 each through the grant.[262] Evidently, there is both political and economic support for initiatives that seek to advance developments in this area. Taken together, these kinds of measures make it clear that

> the Canadian federal government recognizes the economic gains presented by smart agricultural innovations: it is investing significant public money into the development of innovations in data and machine intelligence applied to agriculture in the hopes that they will help meet sustainability challenges (through emission reductions) and demand for jobs among Canadians.[263]

Despite claims that "[t]he digital transformation of agriculture is underway",[264] it will not all be smooth sailing from this point out. In particular, the growing encroachment of digital technologies in the agri-food sector poses a number of looming questions in relation to

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[258] Sustainable Development Technology Canada, "Automated Decision Support System for Precision Agriculture", online: <https://www.sdtc.ca/en/projects/automated-decision-support-system-for-precision-agriculture/>.
[259] Government of Canada, "Scaling Down Precision Agriculture", online: <https://www.ic.gc.ca/eic/site/101.nsf/eng/00040.html> (last updated December 17, 2018).
[260] The program is administered by Innovation, Science and Economic Development Canada and is intended to "help Canadian innovators by funding R&D and testing prototypes in real-life settings." Government of Canada, "Innovative Solutions Canada", online: <https://www.ic.gc.ca/eic/site/101.nsf/eng/home> (last updated February 12, 2020).
[261] Government of Canada, "Scaling Down Precision Agriculture", *supra* note 264. Smaller farms are defined as those that are below 500 acres in size, or with an annual income below $75,000. According to AAFC data, 40 percent of farms above 500 acres are adopting most precision agriculture technologies, such as AutoSteer (a GPS tractor steering system used to increase efficiency). By contrast, only 13 percent of farms under 500 acres use AutoSteer.
[262] Government of Canada, "Phase 1 award recipients", online: <https://www.ic.gc.ca/eic/site/101.nsf/eng/00065.html#a2> (last updated March 10, 2020).
[263] Kelly Bronson, "Smart Farming: Including Rights Holders for Responsible Agricultural Innovation" (2018) 8:2 Technology Innovation Management Review 7 at 8.
[264] Peter WB Phillips et al, "Configuring the new digital landscape in western Canadian agriculture" (2019) 90-91 NJAS – Wageningen Journal of Life Sciences 1 at 3.

governance that will need to be addressed in the future. For one, "[t]he legal basis for ownership of data is in a state of flux."[265] The lack of clear regulatory frameworks and relevant legislation, plus the use of specialized jargon,

> make it difficult for less resourced stakeholders to remain informed about data frameworks and agreements. Meanwhile, laws and regulations, national standards, guidelines, and infrastructure – alongside powerful lobbying tactics … – influence how and to what degree interoperability can be achieved in the interest of consumers, farmers and less powerful firms and organisations across the food system.[266]

Given the equity-related concerns arising from the marriage of farming and "big data" alone,[267] it will be imperative that the broader implications of smart agriculture be carefully considered from a range of perspectives, including a legal one. Indeed, since "it is already visible that Big Data will … cause major shifts in power relationships between the different players in the Big Data farming stakeholder network",[268] addressing the governance issues arising from big data in agriculture should take priority over ironing out technical kinks or enhancing technical capacity. Collecting more and more data, in and of itself, is of little benefit; all data "must be managed and analysed to extract its full value."[269] Not all of the choices that can be made in this respect are equally defensible or valid, depending in large part on the desired outcomes. To this end, a technology justice lens can help inform conversations about how the principles animating smart agriculture and the application of digital technologies in the agri-food sector can be used in a way that does not simply replicate technocentric thinking and behaviour, along with the attendant pitfalls.

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[265] *Ibid* at 9.
[266] Sarah Rotz et al, "The Politics of Digital Agricultural Technologies: A Preliminary Review" (2019) 59:2 Sociologia Ruralis 203 at 211.
[267] See e.g. Sjaak Wolfert et al, "Big Data in Smart Farming – A review" (2017) 153 Agricultural Systems 69.
[268] *Ibid* at 78.
[269] *Ibid* at 74.

6.3.3 Smart Agriculture and Technology Justice

Considerations of justice have not been left out of embryonic conversations about smart agriculture. All of the concepts outlined above have been contested, to varying degrees, from the outset. For example, in the context of CSA, some concerns that have been raised include that it

> may undermine the livelihoods of smallholder farmers, have negative effects on biodiversity, promote genetically modified (GM) crops at the expense of traditional crop varieties and hence undermine crop genetic diversity and local cultures, or lead to accelerated land grabs by corporate interests and local elites.[270]

Meanwhile, in probing the socio-ethical implications of smart farming, often through an RRI lens, some of the major areas of concern that scholars have identified relate to data ownership, accessibility, sharing, and control; data security; the top-down nature of agricultural technology production and data development; distributions of power; and wider impacts on society.[271]

A technology justice lens can enrich these ongoing conversations in numerous ways. First, it reminds us that how concepts are framed has significant implications when it comes to goals, actions, and policies stemming from them. Because of their plasticity, it is particularly important to be critical about the discourses used in relation to smart agriculture. When it comes to CSA, for instance, critics have pointed out that “equity is rarely defined in the CSA literature, and the broad definition of CSA, notably from the FAO, provides little guidance for addressing fundamental concerns of control over and access to changing resources.”[272] This lack of specificity matters, because CSA discourses are largely “entrenched within existing paradigms and practices, and are likely to reproduce and exacerbate existing inequalities rather than challenge them”.[273] Accordingly, for the purposes of critically evaluating smart agriculture, its

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[270] Karlsson et al, *supra* note 225 at 151.
[271] See e.g. Eastwood et al, *supra* note 247; van der Burg, Bogaardt & Wolfert, *supra* note 250; Kelly Bronson, “Looking through a responsible innovation lens at uneven engagements with digital farming” (2019) 90-91 NJAS – Wageningen Journal of Life Sciences 100294.
[272] Karlsson et al, *supra* note 225 at 167.
[273] *Ibid*. See also Newell & Taylor, *supra* note 216.

methods should be judged not simply by the general principles espoused or the processes adopted, but by the outcomes that they are likely to produce in current conditions.

As previously mentioned, scientific and technological innovation is not an inherent part of the definition of the concepts of CSA and SI, instead representing just one of several strategies to achieve their specified goals. Godfray states that SI "is neutral about how economically efficient and environmentally sustainable responses to price signals might be arrived at, or how sustainable increases in productivity may be encouraged".[274] This purported neutrality in principle, however, belies the broader political economy in which the concepts of CSA and SI and the use of digital technologies emerged.[275] The discussion in Chapter 2 has already revealed the highly contingent way in which the Canadian agri-food sector has developed. Therefore, in looking at future developments in the sector, it is important to remain alert to "the influence of economics on social and political systems" and "the politics and power dynamics that lie behind the use of digital agricultural technologies."[276]

Extrapolating from historical trends, a plausible prediction is that digital agricultural technologies "will bring about greater market integration and corporate concentration that will exacerbate the farmer debt/income crisis and further exclude small, peasant, and agro-ecological farmers from participating in agro-food production."[277] The relationship between the proliferation of digital technologies in agriculture and increasing corporate concentration and control, both within Canada and between high-income and low-income countries, is a mutually reinforcing one of cause and effect. Under the current paradigm, wealthier producers, countries with an export-orientation, and powerful industry actors and associations stand to gain far more

[274] Godfray, "The debate over sustainable intensification", *supra* note 240 at 201.
[275] Rotz et al, *supra* note 266; Newell & Taylor, *supra* note 216.
[276] Rotz et al, *ibid* at 208.
[277] *Ibid*.

from the digitization of agriculture, whereas farmers and populations in the Global South are confronted with an expanding number of risks, from new forms of biopiracy to cultural erosion.[278] This pattern is concerning insofar as it is embedded within a space that is already fraught with asymmetries when it comes to access to information, resources, services, and capital.

Among differently situated actors, rates of uptake of digital technologies in the agri-food sector are clearly unequal. The growing concentration of corporate power in the agri-food system,[279] compounded by forces of industrialization, has meant that "the vast majority of digital technologies developed thus far are aimed at the needs of large-scale, capital rich farmers, which has direct and indirect impacts for small and mid-sized farmers."[280] On one hand, asset constraints "produce inequities in accessing available infrastructure, equipment, resources, and software," which hinders the ability of smaller-scale producers to participate in digital agriculture altogether.[281] Exacerbating the problem, "[m]any proprietary farm management systems focus on very specific production systems …. [E]ach technology tends to solve particular issues and activities, making the bundle of technologies extremely costly and thus inaccessible to smaller-scale, less capital rich farmers."[282] For example, a survey conducted of western Canadian producers in 2017 found that price was among the top ranked barriers to adoption of precision agriculture technologies, with about 40 percent of respondents reporting

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[278] Cédric Leterme, "Digitalization of agriculture: what are the risks for farmers and populations in the Global South?", GRAIN Blog (23 May 2019), online: <https://www.grain.org/en/article/6235-digitalization-of-agriculture-what-are-the-risks-for-farmers-and-populations-in-the-global-south>.
[279] See e.g. Jennifer Clapp, "Mega-Mergers on the Menu: Corporate Concentration and the Politics of Sustainability in the Global Food System" (2018) 18:2 Global Environmental Politics 12; Pat Mooney & ETC Group, "The changing agribusiness climate: Corporate concentration, agricultural inputs, innovation and climate change" (2015) 2:2 Canadian Food Studies 117.
[280] Rotz et al, *supra* note 266 at 210.
[281] *Ibid* at 209.
[282] *Ibid* at 213.

that it was a “Significant Barrier”.[283] A report summarizing the survey’s findings also observes that “[l]arger acreage farms and higher revenue farms had higher adoption rates” of precision agriculture.[284] Similar findings with respect to cost being a barrier were found in a survey of Ontario agricultural service providers, where “[o]ver 60% felt they could not charge fees high enough to generate sufficient returns and around half felt the costs of the technologies were too expensive, resulting in 46% feeling it was difficult to demonstrate the value of precision agriculture to farmers.”[285]

Meanwhile, even those who seemingly benefit from digital technologies in the short term may find themselves disadvantaged in the long run: “[a]s data becomes increasingly valuable, companies move to gain control of the data generated across the food system, leading to further corporate concentration.”[286] As Rotz et al point out, “[w]ithin the current political landscape … farmers … receive few of the benefits of ag-tech development. Instead, these benefits are being accumulated by developers and service providers”.[287] Thus, it is instructive to consider whose interests are being served and whose are being neglected by the new wave of technologies that are being ushered into the agri-food sector under the auspices of smart agriculture.

Another major problem with the concept of smart agriculture is that it “marginalizes the socio-political dimensions of food production and distribution.”[288] If smart agriculture focuses

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[283] Dale Steele (prepared for Agriculture and Agri-Food Canada), “Analysis of Precision Agriculture Adoption & Barriers in western Canada: Producer Survey of western Canada” (April 2017), online: <https://static.agcanada.com/wp-content/uploads/sites/3/2017/05/Final-Report-Analysis-of-Precision-Agriculture-Adoption-and-Barriers-in-western-Canada-April-2017.pdf> at 41.
[284] Agriculture and Agri-Food Canada, “Hitting the Target: Benefits and Barriers to Precision Agriculture in Canada” (July 2017), online: <http://www.r2b2project.ca/wp-content/uploads/2018/05/AAFC-Summary-of-PA-Survey-Results-July_2017.pdf> at 7.
[285] Sean Mitchell, Alfons Weersink & Bruce Erickson, “Adoption of precision agriculture technologies in Ontario crop production” (2018) 98 Can J Plant Sci 1384 at 1386.
[286] Rotz et al, *supra* note 266 at 211.
[287] *Ibid* at 213.
[288] Taylor, *supra* note 224 at 90.

too much on climate mitigation via reducing the environmental impacts of agricultural production, there is a risk that attention will be diverted from other nodes along the chain. As Marcus Taylor elaborates in the context of CSA in particular, the framework

> fails to address how enduring inequalities of access in both production and consumption strongly shape who is rendered vulnerable to climate change and who is left food insecure. At the same time, by refusing to integrate the analysis of production, distribution and consumption, the framework ignores how climate-smart production practices can be used to sustain climate-stupid consumption practices.[289]

This deficiency points to the need for a more comprehensive approach to understanding the underlying problems, the injustices that result, and what kind of changes are needed to move forward, informed by the growing understanding of the complexity of food systems.

A focus on outcomes prompts us to break free from a deterministic mindset that traps us into thinking that the way things are represent the way things always will be, and in so doing, suppresses the development of radically different alternatives. Concepts like CSA and SI are often pitted against agroecological approaches to food production, which are frequently espoused by peasant collectives and other advocates for food sovereignty. The FAO defines agroecology (AE) as "an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems."[290] An expanded definition explains that:

> Agroecological initiatives aim at transforming industrial agriculture partly by transitioning the existing food systems away from fossil fuel-based production largely for agroexport crops and biofuels towards an alternative agricultural paradigm that encourages local/national food production by small and family farmers based on local innovation, resources, and solar energy. This implies access of peasants to land, seeds, water, credit, and local markets, partly through the creation of supportive economic policies, financial incentives, market opportunities, and agroecological technologies.[291]

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[289] *Ibid.*

[290] Food and Agriculture Organization of the United Nations, *The 10 Elements of Agroecology: Guiding the Transition to Sustainable Food and Agricultural Systems* (Rome: FAO, 2018) at 1 [*The 10 Elements of Agroecology*]. See also Food and Agriculture Organization of the United Nations, "Agroecology Knowledge Hub", online: <http://www.fao.org/agroecology/en/>.

[291] Miguel A Altieri, Fernando R Funes-Monzote & Paulo Petersen, "Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty" (2012) 32 Agron Sustain Dev 1 at 2.

AE therefore involves a marked and deliberate turn away from several of the key characteristics of dominant agricultural paradigms, such as a predilection towards large-scale, high-input, resource-intensive production, and an emphasis on particular kinds of knowledge and expertise. Over and above the scientific dimension, which refers to "the application of ecology in agriculture",[292] there is a distinctly social and political dimension to modern understandings of AE. AE is highly collaborative, and is largely driven by the co-creation and sharing of knowledge through exchange between small-scale farmers and producers.[293]

Ostensibly, the end goals of both smart agriculture and AE approaches are to reduce the environmental impacts of food production, increase food security, and help alleviate poverty and address other social injustices, particularly for small-scale and subsistence farmers and fishers, women, youth, Indigenous peoples, and other marginalized groups. Yet, the emphases placed on the role of "science, technology, markets, trade and social and political interventions"[294] vary significantly depending on who is undertaking the analysis. Indeed, the role of science and technology is one of the major points of contention in the smart agriculture versus AE debate.

Rather than a focus on social and political interventions, the productionist rhetoric of increasing "efficiency" is often yoked to a reliance on top-down applications of science and technology. Likewise, there seems to be a strong implication that the concept of "intensification" alludes to a specific kind of approach, regardless of whether or not it is coupled with the concept of sustainability. As Coyle and Morrow observe in the context of sustainable development, the concept "is deeply imbued with technological optimism, proceeding on the assumption that

[292] A Wezel et al, "Agroecology as a science, a movement and a practice. A review" (2009) 29 Agron Sustain Dev 503 at 504.
[293] Food and Agriculture Organization of the United Nations, *The 10 Elements of Agroecology*, *supra* note 290 at 4.
[294] The Royal Society, *supra* note 88 at 9.

science and technology can enable us to ‘enhance the carrying capacity of the resource base.’”[295] Arguably, such an approach does not come anywhere close to representing an emancipatory politics of change. Instead, it exemplifies “the *paradox of reform from above:* since technology is not neutral but fundamentally biased toward a particular hegemony, all action undertaken within its framework tends to reproduce that hegemony.”[296]

Proponents contend that technologies, especially biotechnologies, “are needed to create productive crops that are increasingly climate and pest resistant, to reduce pesticide use, and to improve the efficiency with which crops use nutrients and inputs.”[297] To this end, organizations like the WEF have suggested that “[n]ew technologies present a major opportunity to accelerate food systems transformation”.[298] Conversely, organizations like Friends of the Earth International have argued that such a position, especially in the context of SI, “opens the door for any technology—including those that are specifically adapted to work in large scale commercial, intensive agriculture—to be defined as ‘sustainable’.”[299] Consequently, it is considered to be problematic that SI “claims to include agro-ecological farming approaches but in practice seems to focus primarily on technology-based approaches.”[300] The principles that conceptual frameworks like CSA, SI or AE are predicated on matter and need to be made more explicit,

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[295] Sean Coyle & Karen Morrow, *The Philosophical Foundations of Environmental Law: Property, Rights and Nature* (London: Hart Publishing, 2004) at 203.
[296] Andrew Feenberg, *Transforming Technology: A Critical Theory Revisited* (New York: Oxford University Press, 2002) at 63 [emphasis in original].
[297] Evan Fraser et al, “Biotechnology or organic? Extensive or intensive? Global or local? A critical review of potential pathways to resolve the global food crisis” (2016) 48 Trends in Food Science & Technology 78 at 80.
[298] World Economic Forum (prepared in collaboration with McKinsey & Company), *Innovation with a Purpose: The role of technology innovation in accelerating food systems transformation* (World Economic Forum, 2018), online: <http://www3.weforum.org/docs/WEF_Innovation_with_a_Purpose_VF-reduced.pdf> at 5.
[299] Collins & Chandrasekaran, *supra* note 240 at 5.
[300] *Ibid* at 22.

because "[d]ifferent ideas of social and political life entail different technologies for their realization."[301]

Concerns arise not just in relation to individual technologies, but also in relation to the more systemic and cumulative implications of technological change. Studies have already confirmed that "technology shapes agricultural society at several scales; on-farm, and across farming and non-farming communities."[302] For example, through their ability to shift anchors, the advent of integrated, intensive farming systems affects not only those who willingly adopt these new technologies, but also those that do not: "[w]hen farmers have few if any choices about whom they will sell their production to, they are forced to adopt the processors' preferences regarding on-farm technology. Those preferences have frequently involved technology that has seriously prejudiced the smaller farm operators."[303] As such, "[d]igital technologies have the potential to reduce inequalities in the food system but may also potentially widen inequality."[304]

While technologies and technological systems do not always exacerbate injustice, the beliefs and values that are embedded therein can serve to skew their trajectories in ways that favours dominant interests. As Kelly Bronson writes, "[i]t appears that smart agricultural innovations being developed and deployed in the public sector are being guided by productivist values. Current government investments seem to presuppose, and thus tacitly promote, large-scale capital-intensive farms."[305] Due to this focus on large-scale operations, "[s]mart farming

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[301] Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: The MIT Press, 1978) at 325 [emphasis removed].
[302] Rose & Chilvers, *supra* note 230 at 3.
[303] Anthony Winson, *The Intimate Commodity: Food and the Development of the Agro-Industrial Complex in Canada* (Toronto: Garamond, 1993) at 155.
[304] World Bank Group, *Future of Food: Harnessing Digital Technologies to Improve Food System Outcomes*, *supra* note 251 at 8.
[305] Bronson, "Smart Farming: Including Rights Holders for Responsible Agricultural Innovation", *supra* note 263 at 9.

innovation in Canada currently has a blind spot: the needs and concerns of smaller- and medium-sized labour-intensive farms."[306] Although efforts like the AAFC-sponsored grants for Scaling Down Precision Agriculture mentioned above are attempting to ameliorate these biases, a more fundamental interrogation of the premises underlying technological interventions is needed.

Care also needs to be taken with the implementation of smart agriculture and the application of digital technologies in the agri-food sector so that a business-as-usual model is not simply replicated in a different guise. Technologies that are transferred to end-users "with limited understanding of the local context under which these users operate"[307] often fail to effect the kinds of results that were expected, demonstrating that technology-oriented interventions alone may not be sufficient in the absence of more targeted institutional changes. Technology manufacturers and service providers are frequently out of touch with the experiences of farmers, therefore leading to a disconnect between what is offered or available and what is actually desirable or useful. The methodological problem of the tail wagging the dog is also apparent here, as "part of what's driving the explosion of interest in ag tech is simply the availability of unprecedented quantities of data."[308] Not all of this data is useful or even relevant to farmers, especially if it is collected and consolidated in a way that is divorced from the complex realities of farming. Though the focus of analysis in this part has been on the Distribution of Returns branch of the technology justice framework outlined in Chapter 5, there are obvious interconnections when it comes to both Drivers of Innovation and Discourses of Risk. In particular, if technologies in the agri-food sector are to be motivated by goals other than profit, and produce fairer outcomes, they must necessarily include a range of perspectives.

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[306] *Ibid* at 10.
[307] Edmond Totin et al, "Institutional Perspectives of Climate-Smart Agriculture: A Systematic Literature Review" (2018) 10:6 Sustainability 1 at 2.
[308] Rowan Moore Gerety, "Code Season", *MIT Technology Review* 124:1 (January/February 2021) 50 at 55.

Unfortunately, agricultural R&D today is largely dominated by top-down processes that are typically shaped and directed by corporate interests and "rarely includes relevant stakeholders, such as farmers, at an early stage."[309] If we are to depart from the "ongoing process of 'elite capture', wherein the benefits of new technologies are more easily captured by powerful actors",[310] then we need to support the empowerment of small- and mid-scale farmers and producers, who produce the majority of the world's food.[311] One way to promote this goal is to facilitate access to technologies that can more "effectively or accurately solv[e] the on-farm problems that they are facing."[312] Simultaneously, we need to ensure that the deployment of technologies in the agri-food sector is not eroding or compromising the autonomy of producers and consumers by increasing vertical integration, reducing diversity in crops through the promotion of monocultures, and restricting choice in terms of what and how food is produced and consumed. What this means is that "new governance architectures are required if CSA is to be pursued in ways that are just, socially inclusive, and respectful of tradition and livelihood",[313] both in Canada and internationally.

Given the complexity of agri-food systems and the fact that potential solutions to the problems they face must be crosscutting and multifaceted, focusing too narrowly on points of difference may serve to detract from an approach that strives to acknowledge trade-offs and synergies.[314] The use of technology and digitalization is not irreconcilable with AE

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309 Rose & Chilvers, *supra* note 230 at 4. See also Rotz et al, *supra* note 266 at 212.
310 Rotz et al, *ibid* at 209.
311 See e.g. Vandana Shiva, *Who Really Feeds the World? The Failures of Agribusiness and the Promise of Agroecology* (Berkeley, CA: North Atlantic Books, 2016) at 56: "Despite threats from large companies, local farming communities still produce 70 percent of the world's food. These farming systems that have been around for centuries are governed by small-scale farmers and are steeped in diversity."
312 Rotz et al, *supra* note 266 at 212.
313 Karlsson et al, *supra* note 225 at 169.
314 Jonathan Mockshell & Josey Kamanda, "Beyond the agroecological and sustainable agricultural intensification debate: Is blended sustainability the way forward?" (2018) 16:2 International Journal of Agricultural Sustainability 127.

approaches;[315] even biotechnology, which has been aggressively opposed by environmentalists and others who share different kinds of values, can be a harmonious part of sustainable agricultural production.[316] However, if biotechnology and sustainable agriculture are to be made more compatible, broader reforms are required in "the structure of the political-economy and the public and private institutions that govern agricultural biotechnology research and technology development."[317] In other words, we need more critical reflection on the drivers, processes, and outcomes that are involved, including issues relating to access to and control of technologies over both the short- and long-terms.

Lastly, it is worth reiterating that we cannot rely on technological innovation alone to fix the food system. Looking at "smart agriculture" through a prism of technology justice brings to the foreground "questions over possible *alternatives* and the *directionality* of innovation pathways in addressing problems of sustainable agriculture, which have been shown time and time again to be associated with deeply held public concerns about emerging science and technology."[318] The question is not just how to make agriculture "smarter", but what "smarter" really means in this context, who holds the power to decide, what kind of outcomes we can expect to ensue and/or should seek to pursue, and the acceptability of those outcomes for differently situated groups.

6.4 Conclusion

As the above case studies demonstrate, the law has struggled to grapple with the broader implications of scientific and technological developments in the agri-food sector. For instance,

[315] Rotz et al, *supra* note 266 at 205.
[316] David E Ervin, Leland L Glenna & Raymond A Jussaume Jr, "Are biotechnology and sustainable agriculture compatible?" (2010) 25:2 Renewable Agriculture and Food Systems 143.
[317] *Ibid* at 153.
[318] Rose & Chilvers, *supra* note 230 at 4.

there is no separate regulatory structure in place to fully address the range of health, environmental, social, and ethical consequences of novel products like IVM. Therefore, in its current form, the underdeveloped and piecemeal approach to regulating novel foods is ill equipped to anticipate the array of systemic issues raised by the possibility of a shift away from conventional animal agriculture and toward alternative production methods, such as cellular agriculture.

Substantive problems with the regulatory framework for novel foods are compounded by the fact that decision-making processes are opaque and exclusionary. They provide for little to no meaningful consultation or engagement with affected stakeholders and the Canadian public, and relies primarily on the assessments of safety and risk by scientific "experts", as determined by a circumscribed set of criteria.[319] These kinds of concerns have already been raised by several commentators when it comes to GM crops, and GE animals, which are even more contentious, necessitate a heightened degree of scrutiny. The reductive approach taken by regulators on the AAS is reflective of deeper-rooted issues within the system at large, and it is these that must be targeted by any effectual attempts at reform. Arguing for an expanded scope of consideration is not a call to supplant scientific analyses with populist renditions, but rather, to insist that non-scientific concerns should rightfully influence the policy response to scientific and technological developments for which the full range and impact of potential consequences is not yet clear.

Problems relating to access and exclusion are also apparent in the case of smart agriculture, albeit in different ways. Notably, in present conditions, the development and application of digital technologies in agriculture tilts in favour of the already wealthy and powerful, while opening a door for increased corporate concentration and control in the agri-food

[319] Andrée, "The Biopolitics of Genetically Modified Organisms in Canada", *supra* note 181.

sector. Though high technologies are not automatically incompatible with sustainable agricultural production, many of the normative assumptions that they are expressions of make it difficult to expect different results from those we have already seen. This means that if the use of technologies in the agri-food sector is to align with more transformative paradigms like AE, significant structural shifts and not merely technical advances will be necessary.

The trend whereby technological interventions and increased production are seen to be the only ways to sustainably feed a growing global population,[320] especially in the face of "wicked" problems like climate change,[321] is troublingly simplistic. The cases explored in this chapter show that not only do new and emerging technologies often fail to successfully solve the problems they were targeting, but that they also come with various ancillary effects that can serve to do more harm than good. In accepting that we need more diverse and flexible approaches to innovation and to problem solving writ large, the role of the public sector and grassroots players in fomenting change from both the top-down and the bottom-up cannot be underemphasized. Accordingly, there is a demonstrable need for increased theory and policy attention within this space, so as to better enable us to build environmental, social, and economic concerns about technological development into our systems and structures of governance.

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[320] Eve Fouilleux, Nicolas Bricas & Arlène Alpha, "'Feeding 9 billion people': global food security debates and the productionist trap" (2017) 24:11 Journal of European Public Policy 1658.

[321] Horst WJ Rittel & Melvin M Webber, "Dilemmas in a General Theory of Planning" (1973) 4 Policy Sciences 155; Richard J Lazarus, "Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future" (2009) 94:5 Cornell L Rev 1153; Kelly Levin et al, "Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change" (2012) 45:2 Policy Sciences 123.

7. Recipes for Reform

A large part of effective governance entails determining how to create the best regime for a given set of circumstances. Unfortunately, this is a task much easier said than done, as designing effective mechanisms, tools, and institutions for governing complex systems is a challenge of the highest order. The problem is not attributable to a lack of options, as there is no shortage of tools to utilize. Policy makers can adopt "a legislative approach, featuring enactment of laws; a regulatory approach focused on the addition of new mandatory rules and standards; a guidelines approach promoting best practices; a voluntary approach leaving matters to the self-regulation of industry; or a public consultation approach involving widespread public hearings and information campaigns."[1] Each of these approaches have been leveraged with success in a range of contexts, pointing to the lack of a one-size-fits-all solution.

Regardless of the approach or mix of approaches that is adopted, the devil is often in the details, as different sources of authority come with various advantages and disadvantages. For example, the common law lacks the legitimacy associated with laws created by elected officials.[2] At the same time, the common law has the ability to be responsive to changing societal norms and circumstances, and "by its very nature is uniquely placed to give expression to underlying societal values and priorities in dealing with novel problems that have been brought before it."[3] Furthermore, being grounded in sound theory does not guarantee effectiveness in practice; strong political and ethical leadership is crucial to enhance public buy-in of any policy or governance mechanism and, in turn, the chances of success.

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[1] Michael Howlett & Andrea Riccardo Migone, "The Canadian biotechnology regulatory regime: The role of participation" (2010) 32 Technology in Society 280 at 283.
[2] Allan C Hutchinson, "Making Progress?: Change and the Common Law" (2003) 4 Hibernian LJ 25 at 28.
[3] Sean Coyle & Karen Morrow, *The Philosophical Foundations of Environmental Law: Property, Rights and Nature* (London: Hart Publishing, 2004) at 110.

While recognizing the impossibility of coming to any perfect solutions, this chapter outlines some ideas about how to improve Canadian law and policy in a number of areas relevant to sustainability, technology, and the agri-food sector. Most significantly, I suggest possible improvements at three levels of decreasing granularity: regulation, law and policy, and society and culture, with a specific focus on the intersections between technology, environment, and social goods. At bottom, I argue that any recipe for reform for our future must be guided by a shared vision of where we want to end up. Accordingly, the roadmap of how to materialize this vision should be undergirded by a set of overarching principles, including the primacy of maintaining, protecting, and enhancing ecological integrity; the use of democratic and inclusive decision-making processes; and a dedication to producing just outcomes, particularly for marginalized and vulnerable individuals and groups. By combining firm commitments with flexible methods, we can work towards building the kind of dynamic, adaptive, and resilient regimes that we need to balance competing priorities and further collective goals in an increasingly complex world.

7.1 Responsibility over Restriction: Regulatory Reform

Due to the heterogenous nature and impacts of technology, it is difficult to regulate on any grand scale. Generally, regulation is seen as encompassing "any government measure or intervention that seeks to change the behaviour of individuals or groups",[4] either by conferring rights, or by restricting certain kinds of conduct. Another definition posits that regulation is "the sustained and focussed attempt to alter the behaviour of others according to standards or goals with the intention of producing a broadly defined outcome or outcomes, which may involve mechanisms

[4] Better Regulation Task Force, *Principles of Good Regulation* (London, UK: Better Regulation Task Force, 2003), online: <http://webarchive.nationalarchives.gov.uk/20100407162704/http:/archive.cabinetoffice.gov.uk/brc/upload/assets/www.brc.gov.uk/principlesleaflet.pdf> at 1.

of standard-setting, information-gathering and behaviour-modification."[5] Regulation is "potentially both broader and narrower than 'law'," and offers some advantages in this respect, including by capturing ""soft law" that may be ignored by traditional definitions of 'law', as well as more distributed means of control."[6]

Regulation serves a vital function in the contemporary world. The Supreme Court of Canada recognized as much in the case of *R v Wholesale Travel Group Inc.*, when Cory J wrote that:

> The objective of regulatory legislation is to protect the public or broad segments of the public … from the potentially adverse effects of otherwise lawful activity. Regulatory legislation involves a shift of emphasis from the protection of individual interests and the deterrence and punishment of acts involving moral fault to the protection of public and societal interests.[7]

The task of regulation is thus to attend to "[t]he realities and complexities of a modern industrial society coupled with the very real need to protect all of society and particularly its vulnerable members".[8]

Regulatory schemes both help to prospectively control risks and put mechanisms in place to remedy any harms resulting from human activities. When it comes to risks arising from new and emerging technologies in the agri-food sector (which can pertain to health and safety, the environment, or socioeconomic concerns, among others), the regulatory role of law is particularly important insofar as this is a domain characterized by high degrees of uncertainty, ignorance, and indeterminacy. Though the value of regulation is relatively indisputable,[9]

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[5] Julia Black, "What is regulatory innovation?" in Julia Black, Martin Lodge & Mark Thatcher, eds, *Regulatory Innovation: A Comparative Analysis* (Northampton, MA: Edward Elgar, 2005) 1 at 11.
[6] Lyria Bennett Moses, "How to Think about Law, Regulation and Technology: Problems with 'Technology' as a Regulatory Target" (2013) 5:1 Law, Innovation and Technology 1 at 4.
[7] *R v Wholesale Travel Group Inc*, [1991] 3 SCR 154.
[8] *Ibid*.
[9] Arguments rejecting increased regulation, often based in traditional liberal principles, tend to assume the priority of private responsibility and therefore seek to curtail the scope of governmental influence on citizens' behaviour: Susan Hurley, "The Public Ecology of Responsibility" in Carl Knight & Zofia Stemplowska, eds, *Responsibility and Distributive Justice* (New York: Oxford University Press, 2011) 187 at 189.

regulation “is an instrument that can be used by various actors for diverse purposes”,[10] and the appropriate shape and scope of regulation has been a matter of considerable debate.[11]

Regulatory design can take various forms, from performance-based to prescriptive measures, and can use multiple kinds of instruments, including command, competition, communication, and consensus-based ones.[12] The approach taken differs by country and by sector. According to the Treasury Board of Canada Secretariat, regulations “are used by government as an instrument for mandating or enabling particular behaviours or outcomes in order to achieve public policy objectives.”[13] There are a number of principles guiding federal regulatory policy in order to “ensure that regulations result in the greatest overall benefits to current and future generations of Canadians.”[14] For example, regulations should “protect and advance the public interest”, and to this end, be “justified by a clear rationale in terms of protecting the health, safety, security, social and economic well-being of Canadians, and the environment.”[15]

Given the political and economic costs and consequences that are frequently associated with regulation, it can easily be disparaged as amounting to little more than red tape, presenting unnecessary costs to business and representing an obstacle to innovation, competitiveness, and

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[10] David Levi-Faur, “Regulatory capitalism” in Peter Drahos, ed, *Regulatory Theory: Foundations and Applications* (Acton, Australia: ANU Press, 2017) 289 at 299.
[11] See e.g. Peter Drahos, ed, *Regulatory Theory: Foundations and Applications* (Acton, Australia: ANU Press, 2017); Eric L Windholz, *Governing through Regulation: Public Policy, Regulation and the Law* (New York: Routledge, 2018); Matthew D Adler, “Regulatory Theory” in Dennis Patterson, ed, *A Companion to Philosophy of Law and Legal Theory*, 2d ed (Malden, MA: Blackwell Publishing Ltd, 2010) 590-606.
[12] Karen Yeung, “Towards an Understanding of Regulation by Design” in Roger Brownsword & Karen Yeung, eds, *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Oxford: Hart Publishing, 2008) 79 at 80.
[13] Treasury Board of Canada Secretariat, “Cabinet Directive on Regulation”, online: <https://www.canada.ca/en/treasury-board-secretariat/services/federal-regulatory-management/guidelines-tools/cabinet-directive-regulation.html> (last updated September 7, 2018).
[14] *Ibid*.
[15] *Ibid*.

growth.[16] Increased regulation does not automatically translate to better outcomes, and regulations can have wider ripple effects: either within circumscribed sectors, or more broadly. Good regulations have proportionate impacts and are responsive to changing circumstances, like new and emerging scientific and technological developments. Further, good regulations should be "necessary, fair, effective, affordable and enjoy a broad degree of public confidence."[17] Conversely, poorly designed or overly complex regulation can be onerous and counterproductive by imposing excessive costs, inhibiting productivity, and stifling innovation.

Though some advocate for self-regulation, co-regulation, or other kinds of voluntary approaches as a way of meeting in the middle, establishing obligations but giving regulatees independence and/or flexibility in determining how those will be met,[18] voluntary approaches are not an adequate replacement for the role of the state in most contexts. The limits of voluntary regulation are particularly apparent when it butts up against economic priorities. As Hailemichael Teshome Demissie argues, "[i]ndustry self-regulation is an anomaly in so far as industry's main objective is the pursuit of private interests or profits."[19] Accordingly, "[r]egulation in its wider sense of channelling the development of the technology and including the attendant social and ethical issues certainly requires more than self-regulation. … the channelling of research resources and the setting of priorities to wider problems like sustainable

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[16] This anti-regulatory attitude is especially apparent within the corporate world and the political Right: see e.g. Lisa Heinzerling & Frank Ackerman, "The Humbugs of the Anti-Regulatory Movement" (2002) 87 Cornell L Rev 648; Andrew Rowell, *Green Backlash: Global Subversion of the Environment Movement* (New York: Routledge, 1996); David R Boyd, *Unnatural Law: Rethinking Canadian Environmental Law and Policy* (Vancouver: UBC Press, 2003) at 230, drawing on Neil Gunningham, Peter Grabosky & Darren Sinclair, *Smart Regulation: Designing Environmental Policy* (Oxford: Clarendon Press, 1998) at 8; Daniel A Farber, "Regulatory Review in Anti-Regulatory Times" (2019) 94 Chi-Kent L Rev 383.

[17] Yeung, *supra* note 12 at 80.

[18] Windholz, *supra* note 11 at 161-164.

[19] Hailemichael Teshome Demissie, "Taming Matter for the Welfare of Humanity: Regulating Nanotechnology" in Roger Brownsword & Karen Yeung, eds, *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Oxford: Hart Publishing, 2008) 327 at 348.

development cannot be done without governmental regulation."[20] This means that, when it comes to governing the full range of risks associated with new and emerging technologies, "[r]egulatory reform should be premised on recognition that government regulation is both necessary and inevitable in our complex, technology-based economy."[21]

Properly done, regulation should operate to protect public health, safety, and the environment, while checking the private sector's tendency to privilege profit above all else. In practice, regulation often falls short of these expectations. The public's faith and confidence in regulation is increasingly being eroded by the mounting perception of regulatory capture, which can be defined as "the result or process by which regulation (in law or application) is, at least partially by intent and action of the industry regulated, consistently or repeatedly directed away from a defeasible model of the public interest and toward the interests of the regulated industry."[22] More work is needed as to how to measure and minimize the impact of regulatory capture in different settings, because "if the idea is to improve and not to abandon regulation, then an understanding of the mechanisms of capture is critical."[23]

Part of the problem is that one of the primary functions of the regulatory state has become "to nurture a process of capitalist accumulation and commodification via various regulatory means".[24] The notion of regulatory capitalism "capture[s] the fact that regulation is growing markedly but is less a feature of state rule and enforcement in the name of public good and much more a system of co-regulation between the state, business interests, and firms but also other

[20] *Ibid* at 347.
[21] Douglas M Costle, "Environmental Regulation and Regulatory Reform" (1982) 57:3 Wash L Rev 409 at 410.
[22] Daniel Carpenter, "Detecting and Measuring Capture" in Daniel Carpenter & David A Moss, eds, *Preventing Regulatory Capture: Special Interest Influence and How to Limit It* (New York: Cambridge University Press, 2014) 57 at 60-61.
[23] *Ibid* at 68.
[24] Levi-Faur, *supra* note 10 at 291-292.

non-state interests and networks in support of innovation."[25] In blunter terms, "[d]espite contemporary rhetoric to the contrary, the primary beneficiary of big government in advanced capitalism is private enterprise, which has become inextricably dependent on government for its continued welfare."[26] This situation is evident when it comes to biotechnology in Canada. Consequently, there is a need to approach regulation with an eye to "the inseparable, intimate and interdependent relations between politics, society and the economy."[27]

One way to alter the way we think about and design regulatory schemes is to consciously reject framings that see the primary function of regulation as to restrict private rights or constrain behaviours. Rather, by presenting regulation as an opportunity to inculcate a greater sense of responsibility to aspire toward the public good, it can "acquire positive associations with values such as liberty and freedom, rather than the negative association with constraints."[28] In particular, regulation can temper the appetite for excess that often goes hand in hand with capital-intensive forms of technological innovation. As Winner puts it, "[o]ne primary value of any system of responsibility is that it provides an element of restraint."[29] Restraint in this sense does not necessarily have to be antithetical to economic growth, as "regulation can even be profitable to industry if structured to stimulate productivity and innovation."[30] For this to be the case, there needs to be more pointed reflection on interdependencies, synergies, and conflicts among regulatory instruments.[31]

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[25] G Bruce Doern, David Castle & Peter WB Phillips, *Canadian Science, Technology, and Innovation Policy: The Innovation Economy and Society Nexus* (Montreal: McGill-Queen's University Press, 2016) at 36.
[26] Iris Marion Young, *Justice and the Politics of Difference* (Princeton, NJ: Princeton University Press, 1990) at 68.
[27] Levi-Faur, *supra* note 10 at 289.
[28] *Ibid* at 295.
[29] Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: The MIT Press, 1978) at 303.
[30] Costle, *supra* note 21 at 410.
[31] Charles D Raab & Paul De Hert, "Tools for Technology Regulation: Seeking Analytical Approaches Beyond Lessig and Hood" in Roger Brownsword & Karen Yeung, eds, *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Oxford: Hart Publishing, 2008) 263 at 271.

As I will discuss in further detail below, principles-based regulation offers a way to alternative to more rigid ways of guiding behaviour. In focusing on preferred outcomes rather than specific obligations,[32] "[t]he reliance on more general principles rather than detailed rules can provide greater flexibility for adjustments in response to new developments without the need to promulgate new regulations."[33] Further, principles-based regulation can "encourage more collaborative approaches and focus on finding solutions to problems instead of being overburdened by attempts to stay in compliance with an inflexible rules-based system."[34]

I am cautious about making any sweeping claims that all regulation should proceed along specific lines. There is no singular approach that will be ideal in all circumstances, and there are a number of tensions engaged in the process of designing regulatory schemes that are not easy to reconcile. However, using technology regulation as an example illuminates some important factors for which responsive regulatory schemes should account.

7.1.1 Technology Regulation

New and emerging technologies are notoriously difficult regulatory targets, posing problems relating to "regulatory connection, regulatory effectiveness, regulatee compliance, and regulatory legitimacy."[35] Technologies also raise unique considerations because they do not have a unidirectional relationship with regulation. Despite the ways in which they can function as regulatory instruments, technologies are not subjected, as a matter of course, to public appraisals as to whether or not the norms that they enforce are appropriate and acceptable. The impact of

[32] Ruth B Carter & Gary E Marchant, "Principles-Based Regulation and Emerging Technology" in Gary E Marchant, Braden R Allenby & Joseph R Herkert, eds, *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem* (New York: Springer, 2011) 157 at 158.
[33] Gary E Marchant, "The Growing Gap Between Emerging Technologies and the Law" in Gary E Marchant, Braden R Allenby & Joseph R Herkert, eds, *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem* (New York: Springer, 2011) 19 at 30.
[34] Carter & Marchant, *supra* note 32 at 158.
[35] Roger Brownsword, *Rights, Regulation and the Technological Revolution* (Oxford: Oxford University Press, 2008) at 1.

technologies on inequality is not typically considered to be an area where the law should intervene.

For some, this is because "technology is just one more way of accomplishing ends that would once have been attained via slower or less efficient cultural or social methods."[36] Pasquale dubs this line of thought one of "complacent continuumism".[37] However, as he further points out, "[t]echnology is often far more sudden, effective, and commodifiable than social or cultural methods of accomplishing ends."[38] The latter also offers "more opportunities to regulate, more 'pressure points,' and more cultural traditions of access"[39] than the former. Thus, we cannot place the implications and impacts of technologies outside of the "rigors of democratic debate."[40] Passivity in the face of technological change is not sufficient, because "[e]ffectively, to do nothing is often to make a decision … In so far as law expresses prohibitions supported by sanctions that uphold the command of a sovereign power, silence may … imply consent or at least non-prohibition."[41] In other words, the failure to legally proscribe an activity may carry an implicit message that the activity is morally permissible.

At the same time, "permission from the law is not alone sufficient to elucidate or to resolve complex questions of a technology's social acceptability."[42] Indeed, a fundamental concern is that "a reckless adoption of a technology-led regulatory style will erode the conditions

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[36] Frank Pasquale, "Technology, Competition, and Values" (2007) 8:2 Minn JL Sci & Tech 607 at 618.
[37] *Ibid*.
[38] *Ibid*.
[39] *Ibid*.
[40] Daniel Sarewitz, "Anticipatory Governance of Emerging Technologies" in Gary E Marchant, Braden R Allenby & Joseph R Herkert, eds, *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem* (New York: Springer, 2011) 95 at 98.
[41] Michael Kirby, "New Frontier: Regulating Technology by Law and 'Code'" in Roger Brownsword & Karen Yeung, eds, *Regulating Technologies: Legal Futures, Regulatory Frames and Technological Fixes* (Oxford: Hart Publishing, 2008) 367 at 375.
[42] Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (Cambridge, MA: Harvard University Press, 1995) at 158.

that are essential for [a] community to make sense of its moral mission."[43] In response to this concern, more recent efforts at developing anticipatory modes of governing technologies "are rooted in the idea that, by making the human choice contexts implicated in innovation processes visible and open to multiple perspectives, conscious governance can emerge at earlier stages, when more options are available and when uncertainty about future impacts is higher."[44] Though it is often the path of least resistance, neglecting to critically engage with questions of appropriate regulatory design when it comes to new and emerging technologies amounts to a unacceptable shirking of both legal and moral responsibilities.

As explained in Chapter 4, issues relating to time and scale are highly pertinent when it comes to technologies and their regulation. Efforts at regulating technologies must contend with the fact that "[i]Innovation is simply too fast, too pervasive, too decentralized to yield to approaches that demand comprehensive knowledge as a basis for taking action."[45] Among other difficulties, this creates a tension "between the need for flexibility (if regulation is to move with the technology) and the demand for predictability and consistency (if regulatees are to know where they stand)."[46] Failure to deal with the "pacing problem" can also lead to an oversight gap if legal structures, institutions, and processes do not adequately increase their capacity to adapt to rapidly evolving technologies.[47]

In this context, more rules are not necessarily optimal, as the rigidity of rules does not make them conducive to responding to new or altered circumstances without having to go back to the drawing board. Furthermore, "[r]egulators who opt for legal rules often find that, despite

[43] Brownsword, *supra* note 35 at 286.
[44] Sarewitz, "Anticipatory Governance of Emerging Technologies", *supra* note 40 at 99.
[45] *Ibid* at 95.
[46] Brownsword, *supra* note 35 at 287.
[47] Marchant, "The Growing Gap Between Emerging Technologies and the Law", *supra* note 33.

careful attention to the drafting of rules, they may nevertheless fail to bring about the desired policy objectives owing to the imperfect match between the rule and its purpose, and to uncertainty in applying the rule to individual circumstances."[48] Attempts at codifying rule-based approaches to regulating technologies may thus be frustratingly futile. Another downside is that rule enforcement is a resource-intensive activity, as "rule violation cannot be sanctioned unless and until compliance with the rule is actively monitored and enforced."[49]

By contrast, the relative dynamism of principles-based regulation is a significant advantage when it comes to "fast-changing regulatory subjects such as emerging technologies."[50] For example, different versions of the precautionary principle might be called for at different times, and for different technologies. Principles can also offer guidance as to how to adjudicate between conflicting goals, such that uncertainty is minimized without having to rely on overly prescriptive directives.

Accurately predicting either the effects of law on technology or of technology on law is not just difficult, but impossible. Existing approaches to governing technological change have largely proven to be "inadequate to provide effective, meaningful and timely oversight of the current and future generations of emerging technologies."[51] Regulatory systems often reflect a preoccupation with a narrow conception of risk that is measured based on quantitative methods like cost-benefit analysis, which does not capture the multi-dimensional task of "simultaneously managing risk, coping with uncertainty, combatting ambivalence, and building trust, all while

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[48] Yeung, *supra* note 12 at 91.
[49] *Ibid* at 93.
[50] Carter & Marchant, *supra* note 32 at 161.
[51] Gary E Marchant, "Addressing the Pacing Problem" in Gary E Marchant, Braden R Allenby & Joseph R Herkert, eds, *The Growing Gap Between Emerging Technologies and Legal-Ethical Oversight: The Pacing Problem* (New York: Springer, 2011) 199 at 199.

encouraging the delivery of those instrumental outputs that we value/demand".[52] However, this does not mean that we do not have a responsibility to continue to try to develop mechanisms to engage with technological systems and technological change, or that we do not have tools to draw on in so doing.

Soft law instruments can be especially advantageous in efforts at developing responsive regulatory regimes insofar as "(i) they are usually based on cooperative rather than adversarial models of engagement; (ii) they can be adopted or revised relatively quickly; (iii) many different soft law/governance concepts can be attempted simultaneously; and (iv) such measures can be gradually 'hardened' into more formal regulatory instruments."[53] In addition to embracing a variety of mechanisms, enlisting a diverse and multi-disciplinary group of stakeholders in the regulatory endeavour can also assist in protecting and promoting a range of interests by ensuring that at all stages of the process—from development and design through to disposal—a range of values, priorities, and experiences are appropriately considered.

More polycentric modes of regulation[54] work best when all participants in the regulatory regime "have convergent interests in achieving the regulatory objective."[55] As such, clearly defined agreement as to the ends to which technologies should be put is an important precondition for shaping regulatory design for the public good. The challenge of mediating between divergent interests renders it essential for regulators to become "more imaginative, breaking the deadlock between those who advocate more regulation and those who advocate less, abandoning any idea that 'one regulatory size fits all', developing a sensitivity to the differing

[52] Shawn HE Harmon, Graeme Laurie & Gill Haddow, "Governing risk, engaging publics and engendering trust: New horizons for law and social science?" (2013) Science and Public Policy 25 at 31.
[53] Marchant, "Addressing the Pacing Problem", *supra* note 51 at 203.
[54] Windholz, *supra* note 11 at 162-165.
[55] *Ibid* at 165.

motivations and attitudes of regulatees, and recognizing the limits of single instrument approaches."[56] Framing the goal to be one of reflecting responsibilities rather than restricting rights may aid in developing more creative approaches to regulating technologies that have a wide range of potential impacts for multiple stakeholders.

7.2 Getting to Good Governance: Law Reform

A shift from thinking about "government" to "governance" is premised on the idea that "there are limits to the capability of the state and of the law and … in view of these limits, there is a space for coexisting and sometimes competing forms of governance, including alternatives to law".[57] As such, governance can be defined as "the intersection of power, politics and institutions. This includes both private and public institutions – and the market, political and civil processes in which these are embedded, as well as relationships around knowledge and power."[58]

Contrasted with the traditional mode of governing via "government", which is usually equated with the fiat of the state, governance is "experimental and innovative; decentralized and more diverse; more flexible and revisable; it allows for improved participation and the coordination of multiple levels of government; and it fosters greater deliberation."[59] Governance accounts for both legal and non-legal issues, it involves novel forms of authority, and it derives from a multi-disciplinary foundation.[60] In this way, governance is both a structure and a process of which law is a product and a source.

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[56] Brownsword, *supra* note 35 at 12.
[57] Kernaghan Webb, "Sustainable Governance in the Twenty-First Century: Moving beyond Instrument Choice" in Pearl Eliadis, Margaret M Hill & Michael Howlett, eds, *Designing Government: From Instruments to Governance* (Montreal: McGill-Queen's University Press, 2005) 242 at 248.
[58] Melissa Leach, Ian Scoones & Andy Stirling, *Dynamic Sustainabilities: Technology, Environment, Social Justice* (Washington, DC: Earthscan, 2010) at 65.
[59] Louis J Kotzé, *Global Environmental Governance: Law and Regulation for the 21st Century* (Cheltenham: Edward Elgar, 2012) at 14.
[60] *Ibid* at 10.

Beyond law alone, governance "refers to the deployment of a much more varied array of policy instruments … This includes the traditional tools of spending, taxation, and regulation but also softer more exhortative instruments of governing through guidelines and codes of behaviour".[61] Embracing this more expansive understanding of governance should not be seen as endorsing abdication of the state's legitimate responsibilities. Rather, it grants that there are ways in which non-state actors can usefully supplement the state's mandate to advance the public interest.[62]

Here, Kernaghan Webb's notion of sustainable governance is instructive. While accepting that "the state has certain significant advantages in terms of governing when compared with nonstate actors," it acknowledges, at the same time, that the state does not "have a monopoly on effective, efficient, and responsive governance approaches".[63] Thus, it "recognizes and draws on the largely untapped potential of the private sector, the third (voluntary) sector, and individual citizens to assist in governing."[64] What this means is that "the best approach to governing in the twenty-first century is a combination of conventional and innovative institutions, rule instruments, and processes that plays to the strengths of each while attempting to minimize and counter their weaknesses."[65]

Growing interest in governance, as a way of regulating human behaviour, reflects the need for improved responses to major societal challenges. A key part of creating a more sustainable future will be moderating human conduct vis-à-vis the environment, which does not have to be limited to coercive law alone. Taking environmental law as an example demonstrates

[61] Doern, Castle & Phillips, *supra* note 25 at 7.
[62] Webb, *supra* note 57 at 242.
[63] *Ibid* at 246.
[64] *Ibid*.
[65] *Ibid* at 249.

how all institutions and actors have contributions to make in facilitating the process of getting to good governance.

7.2.1 Environmental Law Reform

As previously discussed, the endeavour of environmental law suffers from a number of conceptual and practical deficiencies.[66] Notably, "the global community's *de facto* governance structure lacks legal and policy regimes that would allow hard ecological truths to carry determinative weight."[67] Given the gravity of anthropogenic environmental harm, there needs to be a demonstrable shift "in the way that we use law to lay down a framework for decision-making about whether human activities should be permitted, and, if so, how they might be conducted."[68] For example, the degree of discretion that is currently built into Canadian environmental law is a serious cause for concern. To this end, the concept of environmental governance "recognizes that environmental issues require regulation with a view to achieving an acceptable/sustainable standard of living, health and well-being in an environment of which the ecological integrity is intact."[69]

In Canada, it is clear that environmental law needs modernization. Despite some promising language found in statutory instruments, and the government's ostensible commitment to environmental health, David Boyd's analysis of environmental law and policy in 2003 found that "on most environmental issues Canada is performing poorly."[70] Boyd attributes the failure of Canadian environmental laws and policies to six particular weaknesses, namely: missing laws;

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[66] See Chapter 4.1.2.
[67] Geoffrey Garver, "The Rule of Ecological Law: The Legal Complement to Degrowth Economics" (2013) 5:1 Sustainability 316 at 317.
[68] Olivia Woolley, *Ecological Governance: Reappraising Law's Role in Protecting Ecosystem Functionality* (Cambridge, UK: Cambridge University Press, 2014) at 15.
[69] Kotzé, *supra* note 59 at 63.
[70] David R Boyd, *Unnatural Law: Rethinking Canadian Environmental Law and Policy* (Vancouver: UBC Press, 2003) at 228.

excessive discretion; the failure to reflect contemporary science; inadequate implementation and enforcement; lack of meaningful opportunities for public participation or enforcement; and an overly narrow approach.[71] There is credible evidence that many of these problems remain unresolved today. Indeed, a more recent review of the *CEPA, 1999* by ECCC identified numerous, wide-ranging issues that need to be addressed to strengthen Canada's approach to protecting the environment and human health.[72]

This is no small task—the barriers to change are numerous and considerable, and lack of capacity, lack of data, and lack of political will act as persistent bugbears. However, we do have useful templates from which to work. Beyond the general need to reorient environmental law discussed in Chapter 4.1.2, many scholars have offered more specific recommendations as to how to improve environmental law and governance in Canada. For instance, Boyd has identified five common features of strong environmental laws: clear jurisdiction or cooperation between different levels of government; clear, measurable, enforceable standards; mandatory language; effective compliance and enforcement mechanisms, including incentives and penalties; and sufficient resources for implementation and enforcement.[73] Though it is not possible to do the entirety of the existing literature on environmental law reform justice here, it is useful to quickly consider what some of the major flaws and proposed fixes are, in order to build a more robust

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[71] *Ibid* at 228-250.

[72] Environment and Climate Change Canada, *Canadian Environmental Protection Act, 1999 – Issues & Possible Approaches*, Discussion Paper (May 2016), online: <http://www.ourcommons.ca/Content/Committee/421/ENVI/WebDoc/WD8320863/421_ENVI_reldoc_PDF/ENVI_Chair_CEPA-e.pdf>. See also David R Boyd, *Cleaner, Greener, Healthier: A Prescription for Stronger Canadian Environmental Laws and Policies* (Vancouver: UBC Press, 2015); World Wildlife Fund Canada, Living Planet Report Canada 2020: Wildlife At Risk (Toronto: World Wildlife Fund Canada, 2020), online: <https://wwf.ca/wp-content/uploads/2020/08/WWF-FINAL-EN-1.pdf>; Environmental Commissioner of Ontario, *Good Choices, Bad Choices.: Environmental Rights and Environmental Protection in Ontario – 2017 Environmental Protection Report* (Toronto: Environmental Commissioner of Ontario, 2017), online: <http://docs.assets.eco.on.ca/reports/environmental-protection/2017/Good-Choices-Bad-Choices.pdf>.

[73] Boyd, *Unnatural Law*, *supra* note 70 at 219.

understanding of problems and possibilities in connecting issues relating to technology, the environment, and society in the context of the agri-food sector.

For one, the effectiveness of any legal system depends on political, public, and fiscal support, which means that "[b]udgets for environmental protection in Canada need to be increased, both federally and provincially, so that funds and staff are adequate to implement and enforce environmental laws and policies."[74] If we are to do better when it comes to environmental stewardship, "[g]overnments need to recognize that increased spending on environmental protection will pay social, economic, and environmental dividends in the long run."[75]

Legislatures, for their part, need to be more proactive about implementing and improving laws and policies that guard against environmental harm. Changes need to be made not just to substantive laws and policies themselves, but also to their underpinnings. For example, when it comes to pollution, Canada adopts a "permissive regulation" approach in terms of its treatment of scientific and legal uncertainty,[76] which means that "the regulation of hazardous substances and activities generally occurs only when there is clear evidence that a hazard actually exists."[77] The failures of the permissive regulation approach "demands a comprehensive rethinking and restructuring of existing legislation, as well as a basic reorientation of judicial decision making."[78] Fundamentally, this would turn on a formal recognition of the "inescapable presence

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[74] *Ibid* at 293.
[75] *Ibid*.
[76] As contrasted with a "preventative design" approach: see R Michael M'Gonigle et al, "Taking Uncertainty Seriously: From Permissive Regulation to Preventative Design in Environmental Decision Making" (1994) 32:1 Osgoode Hall LJ 99. See also Boyd, *Cleaner, Greener, Healthier*, *supra* note 72.
[77] M'Gonigle et al, *ibid* at 115. The permissive regulation paradigm is based on a number of faulty assumptions about uncertainty and causation, including "the common but ill-considered and incorrect assumptions about how the environment assimilates waste, how scientific research is done, how reliable the results of such research are, and how regulatory agencies operate." (at 129)
[78] *Ibid* at 168.

of uncertainty" and the concomitant implications of this recognition on burdens and standards of proof.[79]

When it comes to the judiciary and regulatory or administrative bodies charged with enacting, upholding, and/or enforcing environmental laws, chronic deference to the legislature—often enabled by the wording of the legislation itself—inhibits more robust action. Indeed, as Professors Collin and Sossin (as he then was) point out, "Canadian environmental law is characterized by profound and pervasive discretion at every level of decision making."[80] The distinction between "the *power* to take action or meet specified standards" and the "*duty* to take action or meet those standards"[81] is one that needs to be addressed through re-drafting of framework environmental legislation to reduce the gap between what can be done in theory and what will be done or must be done in practice.

Legislative reform is often slow and extremely political, which is not ideal when urgent action is required. However, the importance of judicial education for sustainability is receiving growing attention,[82] which is another possible avenue for change. Although judicial education originally focused on "ensuring that judges were up to date with recent decisions and substantive legal issues, over the past few decades, improving judicial competence with regards to awareness of social context has become much more common. Yet, there are few programs for judges that focus on environmental sustainability."[83] Seeing as courts often function as central venues for addressing pressing social issues, a more robust understanding on the part of the judiciary when

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[79] *Ibid* at 168-169.
[80] Lynda Collins & Lorne Sossin, "In Search of an Ecological Approach to Constitutional Principles and Environmental Discretion in Canada" (2019) 52:1 UBC L Rev 293 at 295. See also Jocelyn Stacey, "The Environmental Emergency and the Legality of Discretion in Environmental Law" (2015) 52:3 Osgoode Hall LJ 985.
[81] Boyd, *Unnatural Law*, *supra* note 70 at 231.
[82] Laurel Besco, "Judicial Education for Sustainability" (2018) 14:1 MJSDL 1; Lynda M Collins, "Judging the Anthropocene: Transformative Environmental Adjudication for the Anthropocene Era" in Louis Kotzé, ed, *Environmental Law and Governance for the Anthropocene* (Oxford: Hart Publishing, 2017) 309-328.
[83] Besco, *ibid* at 7.

it comes to the myriad issues at play in environmental law and policy, environmental litigation, and issues relating to sustainability writ large has the potential to demonstrably inform progress in this area.

In particular, as lawsuits targeting the causes and consequences of climate change[84] are multiplying in courts in Canada[85] and elsewhere around the world, the judiciary's treatment of climate change science and their acknowledgement of the enormous environmental and human impacts of climate change can have real bearing on the outcomes.[86] For instance, courts can opt to take judicial notice of facts that are "clearly uncontroversial or beyond reasonable dispute".[87] Taking judicial notice of the realities of climate change and its ensuing consequences dispenses with the need to formally prove such facts, thereby reducing the evidentiary burden placed upon litigants.

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[84] See generally Jacqueline Peel & Hari M Osofsky, *Climate Change Litigation: Regulatory Pathways to Cleaner Energy* (Cambridge, UK: Cambridge University Press, 2015); Joana Setzer & Lisa C Vanhala, "Climate change litigation: A review of research on courts and litigants in climate governance" (2019) 10:3 WIREs Climate Change e580.

[85] As of the time of writing, according to an online database maintained by the Sabin Center for Climate Change Law at Columbia Law School and the law firm of Arnold & Porter, there were 22 documented cases of climate change litigation in Canada: Climate Change Litigation Databases, "Canada", online: <http://climatecasechart.com/non-us-jurisdiction/canada/> (last visited April 14, 2020). For academic writing on climate litigation in Canada, see e.g. Dustin W Klaudt, "Can Canada's "Living Tree" Constitution and Lessons from Foreign Climate Litigation Seed Climate Justice and Remedy Climate Change?" (2018) 31:3 JELP 185; Cameron Jefferies, "Filling the Gaps in Canada's Climate Change Strategy: 'All Litigation, All the Time…'?" (2015) 38:5 Fordham Int'l LJ 1371; Andrew Gage, "Climate Change Litigation and the Public Right to a Healthy Atmosphere" (2013) 24 JELP 257; Julia Schatz, "Climate Change Litigation in Canada and the USA" (2009) 18:2 Review of European Community & International Environmental Law 129. On the topic of carbon pricing and policy more specifically, see e.g. Nathalie J Chalifour, "Jurisdictional Wrangling over Climate Policy in the Canadian Federation: Key Issues in the Provincial Constitutional Challenges to Parliament's *Greenhouse Gas Pollution Pricing Act*" (2019) 50:2 Ottawa L Rev 197; Nathalie J Chalifour, "Canadian Climate Federalism: Parliament's Ample Constitutional Authority to Legislate GHG Emissions through Regulations, a National Cap and Trade Program, or a National Carbon Tax" (2016) 36:2 NJCL 331.

[86] See Jason MacLean & Chris Tollefson, "Climate-Proofing Judicial Review after Paris: Judicial Competence, Capacity, and Courage" (2018) 31:3 JELP 245.

[87] *R v Find*, 2001 SCC 32, [2001] 1 SCR 863 at para 48.

The nascent jurisprudence contains some signals that Canadian courts are grasping that climate change is an important environmental issue that merits legal intervention.[88] In the case of *Syncrude Canada Ltd v Attorney General of Canada*, the Federal Court of Appeal conceded that "it is uncontroverted that GHGs are harmful to both health and the environmental and as such, constitute an evil that justifies the exercise of the criminal law power".[89] Similarly, in the more recent constitutional challenges to the federal carbon tax, the Ontario Court of Appeal[90] and the Saskatchewan Court of Appeal[91] recognized the gravity of climate change, noting that "climate change caused by anthropogenic greenhouse gas [GHG] emissions is one of the great existential issues of our time."[92] By accepting the state of climate change science as sufficient to establish climate change as a matter of fact, courts can invest their energies into determining who should be held liable for its impacts, and applying judicial remedies that can subsequently shape regulation both "directly through mandate and indirectly through influencing corporate behavior and social norms."[93] In turn, the impacts of agri-food technologies and practices on climate change and vice versa can become more relevant on the law and policy stage.

Meanwhile, the literature has explored the question of what responsibilities individuals hold with respect to environmental sustainability in several different ways. Some of the environmental law scholarship from the past few decades has focused on targeting personal norms as a way of stimulating more sustainable behaviour, the hope being that improved knowledge and understanding of the aggregate impact of individual actions will trigger systemic

[88] Brenda Heelan Powell, "Judicial Notice of Climate Change" in Allan E Ingelson, ed, *Environment in the Courtroom* (Calgary: University of Calgary Press, 2019) 646 at 650-651.
[89] *Syncrude Canada Ltd v Attorney General of Canada*, 2016 FCA 160 at para 62.
[90] *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 ONCA 544.
[91] *Reference re Greenhouse Gas Pollution Pricing Act*, 2019 SKCA 40.
[92] *Ibid* at para 4.
[93] Peel & Osofsky, *supra* note 84 at 2.

changes in public policies.[94] Others have developed notions of environmental citizenship, which utilizes the discourse of rights and duties to "make[] demands on people to act differently for the sake of the environment."[95] Cultivating conceptions of citizenship that are "based on notions of interconnectedness and reciprocality"[96] can encourage individuals to act in ways that are mindful of our obligations to each other and to the Earth.

To be clear, responsibility for reform does not rest chiefly on the shoulders of individuals. In many ways, environmental problems are structural in nature, which demands structural solutions. That being said, getting to good governance requires that all actors be on board with the desired outcomes. Responsibility for behaving more sustainability is not tied to blameworthiness or degree of fault, and "where there are structural injustices, finding that some people are guilty of perpetrating specific wrongful actions does not absolve others whose actions contribute to the outcomes from bearing responsibility in a different way."[97] Creating a stronger framework of environmental law is therefore crucial insofar as it will empower actors to exercise differential capacities and coordinate our actions to participate, together, in the process of striving towards an ecological common good.

7.3 Perceptions and Paradigms: Societal and Cultural Reform

Legal and economic incentives and sanctions, or carrots and sticks, are but one part of any holistic recipe for reform. Our individual and collective conduct is influenced not just by what is permitted or prohibited through formal laws and policies, but also by what is encouraged or

[94] See e.g. Jason J Czarnezki, *Everyday Environmentalism: Law, Nature and Individual Behavior* (Washington, DC: ELI Press, 2011); Hope M Babcock, "Assuming Personal Responsibility for Improving the Environment: Moving Toward a New Environmental Norm" (2009) 33:1 Harv Envtl L Rev 117; Michael P Vandenbergh, "From Smokestack to SUV: The Individual as Regulated Entity in the New Era of Environmental Law" (2004) 57 Vand L Rev 515; Michael P Vandenbergh, "Order Without Social Norms: How Personal Norm Activation Can Protect the Environment" (2005) 99:3 Nw UL Rev 1101.
[95] Derek R Bell, "Liberal Environmental Citizenship" (2005) 14:2 Environmental Politics 179 at 179-180.
[96] Woolley, *supra* note 68 at 192.
[97] Iris Marion Young, *Responsibility for Justice* (New York: Oxford University Press, 2006) at 106.

discouraged through informal social and cultural norms and practices. Shifting our perceptions and paradigms to effect broad-ranging societal and cultural changes will mandate sustained reflection on the full range of our institutions and the values and behaviours that they entrench. Indeed,

> state-led enforcement mechanisms will be insufficient to stave off grave environmental harms in the near and medium future. If the environment is to be protected to at least a minimally decent level, then agents must do more than seek to pursue their self-interest within a context of rules and regulations that constrain or incentivize their behavior toward environmental goods. Instead, the pursuit of environmental justice requires that an *ecological ethos* is widely shared, both domestically and internationally.[98]

In cultivating such an ethos, it is not just societal understandings of law that require reconfiguration, but also ideas about economics, especially the fallacy of limitless growth and the singular focus on economic development that a growth orientation inspires. As Herman Daly noted in 1996, "[e]cological criteria of sustainability, like ethical criteria of justice, are not served by markets. Markets singlehandedly aim to serve allocative efficiency. Optimal *allocation* is one thing; optimal *scale* is something else."[99]

Similarly, Tim Jackson argues that we need to rethink our understandings of prosperity, as well as how these understandings are actualized through our technologies, our economy, and our social aspirations.[100] Rather than coupling prosperity and growth (as measured through crude expenditures), Jackson instead contends that prosperity should be understood as a capability for social, psychological, and material flourishing, bounded by ecological limits and the scale of the global population.[101] Buttressing the societal dimension, he quotes Zia Sarder, who notes that

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[98] Daniel Butt, "Law, Governance, and the Ecological Ethos" in Stephen M Gardiner & Allen Thompson, eds, *The Oxford Handbook of Environmental Ethics* (New York: Oxford University Press, 2017) 51 at 57.
[99] Herman E Daly, *Beyond Growth: The Economics of Sustainable Development* (Boston: Beacon Press, 1996) at 32.
[100] Tim Jackson, *Prosperity without Growth: Economics for a Finite Planet* (Washington, DC: Earthscan, 2011).
[101] *Ibid* at 45.

"[t]he good life of the good person can only be fully realised in the good society. Prosperity can only be conceived as a condition that includes obligations and responsibilities to others."[102]

To realize this aspiration of a different kind of "good society", economic reform is not enough, because "advocates of economic reform ask policy makers and bureaucrats to, in essence, regulate from nowhere, as if they perceive and respond to environmental policy issues from an impartial viewpoint in which the fact of the government's identity, relationality, and responsibility is ignored."[103] The endogenous relationship between laws and policies and beliefs and attitudes means that "laws and policies should not be seen merely as instrumental tools for serving human 'patients'; they should be recognized as repositories of cultural value and meaning that both flow from and help to form human 'agents,' including even the collective agency formed by a political community."[104] To this end, laws can be used to both foster greater "affection for the earth and our fellow beings",[105] and to establish a better sense of inherent limits when it comes to the environment by more explicitly acknowledging and safeguarding ecological boundaries and the immeasurable value of preserving ecological integrity for the sake of all life on Earth.

In large part, environmental degradation "has its conceptual ground in views that separate human beings from the rest of nature and perceive the natural world as a usable resource for humanity."[106] The ability to manipulate and otherwise exert control over Nature has been vastly enhanced by strides in science and technology, which has generated unprecedented problems

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[102] *Ibid* at 35.
[103] Douglas A Kysar, *Regulating from Nowhere: Environmental Law and the Search for Objectivity* (New Haven: Yale University Press, 2010) at 126.
[104] *Ibid* at 223.
[105] John Borrows, "Earth-Bound: Indigenous Resurgence and Environmental Reconciliation" in Michael Asch, John Borrows & James Tully, eds, *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (Toronto: University of Toronto Press, 2018) 49 at 61.
[106] Topi Heikkerö, *Ethics in Technology: A Philosophical Study* (Toronto: Lexington Books, 2012) at 18.

while simultaneously establishing a central position for technology in providing "the material framework of modernity."[107] As such, "the most important part of any cultural revolution – the biggest shift in perceptions and paradigms – could be a reconstruction of world views so that the irrationality of our present pattern of technological progress is no longer hidden."[108]

7.3.1 Technocentrism v. Ecocentrism

Approaches to addressing complex problems can be classified along a continuum from technocentric to ecocentric. Technocentric worldviews reflect faith in human ability to control the environment to suit human wants and needs.[109] Technocentric value systems place considerable faith in "the usefulness of classical science, technology, conventional economic reasoning (e.g. cost-benefit analysis), and the ability of their practitioners."[110]

Technocentrism inherently relies on the expertise and authority of a corps of professional elite, thereby favouring a particular point of view. Technocentric worldviews are also fundamentally anthropocentric, in that they prioritize human life and well-being above all else. The pervasive anthropocentricism that is built into many prevailing concepts of law, economy, society, and technology represents a major barrier to more thoughtful environmental stewardship.

Conversely, ecocentric attitudes are underpinned by value systems centred on ecology, seeing Nature as something with more than just instrumental value.[111] Unlike technocentrists, ecocentrists do not take for granted that humans have (and should have) control over Nature to

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[107] Andrew Feenberg, *Transforming Technology: A Critical Theory Revisited* (New York: Oxford University Press, 2002) at 19.
[108] Arnold Pacey, *The Culture of Technology* (Cambridge, MA: The MIT Press, 1983) at 172.
[109] Anke Arnaud & Dawna L Rhoades, "Creating a Climate for Long-term Ecological and Organizational Sustainability" in Eddie N Laboy-Nieves et al, eds, *Environmental Management, Sustainable Development and Human Health* (New York: CRC Press, 2008) 133 at 136.
[110] David Pepper, *Eco-socialism: From Deep Ecology to Social Justice* (New York: Routledge, 1993) at 33-34.
[111] Patrick Curry, *Ecological Ethics*, 2d ed (Malden, MA: Polity Press, 2011) at 57-60.

be exploited for human benefit, nor do ecocentrists place unmitigated faith in "the usefulness of classical science, technology, conventional economic reasoning (e.g. cost-benefit analysis), and the ability of their practitioners."[112] Additionally, "[a] specifically ecological ethic is one which values nonhuman as well as (not instead of) human nature."[113]

In sum, technocentrism and ecocentrism are motivated by different assumptions, reflect different values and priorities, and generate different outcomes. For example, in the context of energy use, Ian Bailey and Geoff Wilson note that "neoliberal technocentric behaviour change is characterised, by and large, by *economic* incentive structures and the adoption of more energy-efficient technologies rather than reduced demand for energy services. In contrast, radical ecocentric action is more likely to be driven by *personal or social values* and to include reduced demand for energy".[114] Technocentric approaches therefore align much more closely with neoliberal and market-oriented interventions, whereas ecocentric approaches call for more fundamental changes based on ethical or moral considerations.

Between these two ends of the spectrum, Anke Arnaud and Dawna Rhoades have advocated for what they "sustaincentrism", which "rejects the moral monism of technocentrism and ecocentrism and embraces moral pluralism."[115] They assert that "[e]cocentrism fails as a practical view for long-term sustainability because ecological sustainability is necessary, but not sufficient for long-term sustainable development. … Ecocentrism ignores fundamental relationships bearing upon human security and therefore, ecological integrity."[116] I part with

[112] Pepper, *supra* note 110 at 33-34.
[113] Curry, *supra* note 111 at 11.
[114] Ian Bailey & Geoff A Wilson, "Theorising transitional pathways in response to climate change: technocentrism, ecocentrism, and the carbon economy" (2009) 41 Environment and Planning A 2324 at 2328 [emphasis in original].
[115] Arnaud & Rhoades, *supra* note 109 at 137.
[116] *Ibid*.

them in their rejection of ecocentrism on these grounds, but concur that it is not necessary to draw a sharp line between the two approaches that relies on a binary mode of thinking.

Identifying a distinction between technocentric and ecocentric approaches highlights the fact that neither is value-neutral, which means that (re)defining our values is an important part of (re)defining our approaches to problem solving. This is both an ethical and a political task. The omission of broader ecological considerations from our ethical thinking has serious ramifications, because "[e]thics that is only concerned with humans encourages our powerful susceptibility to limited sympathies, short-termism and greed, rather than checking it. It also denies any responsibility for the effects of our behaviour on the millions of other species and many millions of living individuals with whom we share the Earth".[117]

Advocating for a more ecocentric ethic does not mean that human considerations must or should fall by the wayside. Instead, it urges us to expand the scope of moral considerability (nonhuman animals, to be sure, have interests in living their lives free from molestation, and have value beyond their utilitarian contributions to meeting human wants and needs), and reminds us of the responsibilities that come with being a citizen of a shared planet.

Above all, there needs to be a change in our collective and individual attitudes towards our relationships with each other, our relationship with Nature, and how these are manifested in our behaviours. New technologies or changed policies will not be enough to inspire a meaningful sense of ecological citizenship, which must be predicated on "citizens understanding the reasons for change rather than obeying a set of instructions or responding to financial incentives in a utilitarian model of action."[118] Accordingly, we need to see a

[117] Curry, *supra* note 111 at 3.
[118] Mark J Smith & Piya Pangsapa, *Environment and Citizenship: Integrating Justice, Responsibility and Civic Engagement* (New York: Zed Books, 2008) at 49.

> reappraisal of ethical positions (and of laws whose contents reflect them) that are founded on a view of humanity as a species apart from the natural world, on confidence in our ability to know how ecosystems work and to address any environmental problems we encounter through technological fixes, and on a valuation of the environment primarily as a repository of resources for our use.[119]

The resolution of complex but common problems demands more humility and more humanity, which, within prevailing paradigms, are currently conceptualized as anathema. The artificial separation between objective and subjective knowledge, between science and ethics, between experts and the laity, and between humans and Nature can no longer be justified. It is only through dismantling the bifurcation between technoscientific and ethical approaches to governance that we can move beyond the stagnant rhetoric of sustainable development and the shallow promises of technological innovation to determine how to live more harmoniously in a shared ecosystem.

7.4 Policy Recommendations

Policy is significant insofar as it "affects the nature and extent of state action in a wide variety of areas."[120] Unfortunately, the Canadian approach to the process of policymaking provides "no assurance that government policy will reflect the public will."[121] The absence of any procedural guarantees to this effect in the form of binding legislative or judicial constraints makes it even more imperative for future policymaking efforts to, at least, try "to ensure the democratic legitimacy and instrumental soundness of the policies that result."[122]

Public policy frameworks "arise from understandings of past experience with actions, reflections on contemporary challenges and perceptions of future potentials for action."[123]

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[119] Woolley, *supra* note 68 at 17.
[120] Alice Woolley, "Legitimating Public Policy" (2008) 58 UTLJ 153 at 157.
[121] *Ibid* at 184.
[122] *Ibid* at 165.
[123] Johan Schot & W Edward Steinmueller, "Three frames for innovation policy: R&D, systems of innovation and transformative change" (2018) 47 Research Policy 1554 at 1554.

Accordingly, they work to shape expectations, define the roles of actors, and identify areas for intervention. Framings can naturally evolve and change over time, but this is not a process that has to or should be left to chance. More deliberate reflection on framing can aid in the process of "designing and implementing effective policy solutions for complex policy problems."[124]

As previous chapters have demonstrated, attitudes towards both the agri-food sector and STI are revealing of specific historical contexts, socio-economic circumstances, and political power structures. The conditions engendered through prevailing policy priorities have been, in many ways, both unsustainable and unjust. Thus, if modern agri-food policy and innovation policy are to advance public as opposed to private interests, they need to provide better "guidance for managing the substantial negative consequences of the socio-technical system of modern economic growth to which they have contributed and of which they are a part."[125]

Feeding a burgeoning global population and improving environmental sustainability are complementary and closely interdependent goals, and the growth of agri-food policy and innovation policy as discrete areas of study and practice have created productive conditions in which to develop strategies that can capitalize on the interactions between them. To this end, some more specific recommendations in these respective areas are articulated below.

7.4.1 Agri-Food Policy

The breadth and depth of harms associated with current modes of industrial agriculture are plainly deleterious, but it is not inevitable that agricultural production must be unsustainable.[126] According to Alastair Iles et al, "industrialized variants of agriculture are imbued with particular

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[124] *Ibid*.
[125] *Ibid*.
[126] Miguel A Altieri, *Agroecology: The Science of Sustainable Agriculture* (Boulder, CO: Westview Press, 1995); C Clare Hinrichs & Thomas A Lyson, eds, *Remaking the North American Food System: Strategies for Sustainability* (Lincoln, NE: University of Nebraska Press, 2009).

political, economic—and *epistemic*—power in contemporary societies; over the course of the twentieth century, they have encroached on, destabilized, and displaced preexisting systems with less power, and they continue to do so in many parts of the world."[127] In other words, industrial agricultural models have been cultivated with various degrees of intention, and reflect specific patterns of authority. Understanding the processes by which industrial agricultural models have come to dominate—as outlined in Chapter 2.3 in the Canadian context—can aid us in challenging their supremacy.

Laws and policies have played a significant role in shaping the agri-food sector. Contrary to the notion that our current food system is a product of the free market, "[p]ublic law and policy drives … food choices and, in turn, fosters environmental degradation."[128] As Czarnezki observes, "[t]he existing industrial food model, heavy on chemicals, fossil fuels, and industrial processing, has been created, in part, by laws that have also impeded the creation of new agriculture."[129] Meanwhile, the integral role of preserving ecological health continues to be severely discounted through a whole host of laws, policies, and programs in other areas, such as trade. If we are to strive for an agri-food sector that works to the "benefit of all Canadians" and minimizes harm to others around the world, then we need to be much more serious about maintaining planetary viability, both within our borders and beyond.

Furthermore, in Canada, a persistent national discourse of abundance leads to a peculiar disjuncture between the rhetoric and the reality that food insecurity is a significant and growing problem for a large number of Canadians. Many have pointed out that the way that food security

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[127] Alastair Iles et al, "Agriculture Systems: Co-producing Knowledge and Food" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: MIT Press, 2017) 943 at 945.
[128] Jason J Czarnezki, "Food, Law & the Environment: Informational and Structural Changes for a Sustainable Food System" (2011) 31:2 Utah Envtl L Rev 263 at 264.
[129] *Ibid* at 266.

issues are conceptualized have been coloured by "the backdrop of an emergent neoliberalism, which fundamentally re-shaped the national and international political and economic context within which food security issues were discussed."[130] Again, it is important to emphasize that many problems relating to the adequacy of and access to food are structural and distributional in nature, and will not easily be solved by technological fixes (if at all). Conceptions of food security that neglect to account for the enduring, violent legacy of colonialization and the myriad factors that have led to ongoing and worsening food insecurity for Canada's Aboriginal/Indigenous and Northern populations "can have material consequences for Canadians … because they impact how resources are distributed (or not distributed) and programs designed."[131] Though Canada's new national Food Policy does include supporting food security in Northern and Indigenous communities as a priority action area, this represents but a small step in the right direction after years of documented failures in this respect.[132] There still needs to be more done to advance research and policy that supports the development of programs and services for Indigenous farmers and land managers; facilitates knowledge-sharing and knowledge-mobilization, including traditional knowledge about food cultivation practices and relationships to the land, and; creates more opportunities for productive, community-led partnerships.[133]

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[130] Sarah Wakefield, Kaylen R Fredrickson & Tim Brown, "Food security and health in Canada: Imaginaries, exclusions and possibilities" (2015) 59:1 The Canadian Geographer 82 at 83.
[131] *Ibid* at 90.
[132] See e.g. Laurie Chan et al, *First Nations Food, Nutrition & Environment Study: Final Report for Eight Assembly of First Nations Regions, Draft Comprehensive Technical Report* (Ottawa: Assembly of First Nations, University of Ottawa, Université de Montréal, 2019) at 6, online: <http://www.fnfnes.ca/docs/FNFNES_draft_technical_report_Nov_2__2019.pdf>, finding that "[t]he prevalence of food insecurity is very high in First Nations communities (48%)".
[133] Melissa M Arcand et al, "Sowing a way towards revitalizing Indigenous agriculture: creating meaning from a forum discussion in Saskatchewan, Canada" (2020) 5:1 FACETS 619 at 636-637.

Rethinking our approaches to food production must begin with addressing some of the root causes of unsustainability within dominant paradigms, including issues relating to scale. While scaling up production is often seen as an obvious way to maximize outputs, this yield-based perspective severely discounts the often counterintuitive costs associated with such a blinkered focus. Accordingly, among other suggestions, the EAT-Lancet Commission proposes that policymakers "engineer[] agricultural policies toward a greater emphasis on nutritious foods and sustainable food production practices rather than a singular focus on producing greater quantities of food."[134] This requires a reassessment and better alignment of things like subsidies, taxes, and incentives for food and agricultural production and infrastructure, such that quantity and efficiency is not the only salient metric.

Agricultural systems that are based on smaller farms "that use fewer off-farm inputs, integrate animal and plant production where appropriate, maintain a higher biotic diversity, emphasize technologies that are appropriate to the scale of production, and make the transition to renewable forms of energy" produce better environmental, social, and ethical outcomes.[135] In this way, systems based around diversified agroecological farming offer "a genuine and holistic alternative to industrial agriculture."[136] AE therefore merits further attention at the institutional level if we are serious about transitioning toward more just and sustainable food systems. However, as the FAO notes, "[t]o harness the multiple sustainability benefits that arise from agroecological approaches, an enabling environment is required, including adapted policies,

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[134] EAT-Lancet Commission, "EAT-Lancet Commission Brief for Policymakers" (2019), online: <https://eatforum.org/content/uploads/2019/01/EAT_brief_policymakers.pdf/>.

[135] Leo Horrigan, Robert S Lawrence & Polly Walker, "How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture" (2002) 110:5 Environmental Health Perspectives 445 at 446. See also Tony Weis, *The Global Food Economy: The Battle for the Future of Farming* (Halifax: Fernwood Publishing, 2007).

[136] IPES-Food, *From Uniformity to Diversity: A paradigm shift from industrial agriculture to diversified agroecological systems* (International Panel of Experts on Sustainable Food Systems, 2016), online: <http://www.ipes-food.org/_img/upload/files/UniformityToDiversity_FULL.pdf> at 10.

public investments, institutions and research priorities."[137] The concept of technology justice offers one lens through which to think through how to reorient relevant policies, institutions, and research and funding priorities to create the requisite enabling environment, with a focus on process as well as on substance.

For one, rather than relying primarily on new technologies and/or trying to develop new policy tools and strategies for governance, existing laws and policies should be regularly evaluated to determine whether they are stymieing the kind of transformative shifts that are necessary. The current state of Canadian agri-food law and policy produces less than optimal outcomes in numerous ways. For example, agricultural subsidies provided by the government help ensure profitability in the sector by artificially lowering the costs of intensive production methods.[138] These distorting subsidies directly and indirectly contribute to a range of detrimental consequences, including monocropping, waste, and the severe discounting of so-called environmental "externalities" like soil erosion.[139]

The IPBES estimates the level of financial support in OECD countries to agriculture that is potentially harmful to the environment as amounting to $100 billion in 2015.[140] In Canada, agricultural subsidies have been a part of the agri-food policy landscape for a long time, but legacy is an unsatisfactory reason to maintain programs or policies that may be excessive,

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[137] Food and Agriculture Organization of the United Nations, "Agroecology Knowledge Hub – Overview", online: <http://www.fao.org/agroecology/overview/en/>.

[138] Douglas Hedley et al, *Understanding Agricultural Support: Summary Report* (Ottawa: The Canadian Agri-Food Policy Institute, 2017) at 12. In Canada, the sources of major domestic agricultural support programs are AgriStability, AgriInvest, and AgriInsure programs administered through the CFIA as part of the Canadian Agricultural Partnership, as well as provincial deficiency support payments and market price support for dairy. The AgriInvest program alone is a $3 billion investment.

[139] Jules Pretty et al, "Policy Challenges and Priorities for Internalizing the Externalities of Modern Agriculture" (2001) 44:2 Journal of Environmental Planning and Management 263.

[140] Sandra Diaz et al, "Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services", Advance Unedited Version (6 May 2019), online: <https://www.ipbes.net/sites/default/files/downloads/spm_unedited_advance_for_posting_htn.pdf> at 19.

unnecessary, or counterproductive in the changed circumstances in which we now find ourselves.[141] Relatedly, the impact of trade agreements,[142] Canada's supply management systems,[143] and the immense lobbying power of agricultural industry organizations also warrant further investigation and critique, including in the form of empirical analysis. These issues are beyond the scope of this current project, but are worthy topics for future publicly-funded research.

Production and export subsidies do not have to be eradicated outright, but could be converted to subsidies that generate multiple benefits, such as subsidies for ecosystem services.[144] Given that "[o]rganic producers foster biodiversity, improve soil structure, and use no chemicals[,] [t]here could be financial compensation for the value this provides to society at large."[145] Yet, there are currently few supports for organic innovations in Canada, as "Canadian governments favour agro-biotechnology specifically, and conventional agriculture more generally, through their funding policies."[146] However, the tides may be turning. Interestingly, since the COVID-19 pandemic started in March, "13% more Canadians are buying local food more often and almost three-quarters are deliberately buying Canadian."[147] At the same time,

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[141] Jason Warick, "'It's a strong and vibrant industry right now': $368M farm subsidies unnecessary, says professor", *CBC News* (14 March 2017), online: <http://www.cbc.ca/news/canada/saskatoon/farm-subsidies-agriculture-saskatchewan-budget-1.4018441>.
[142] See e.g. Amanda Connolly, "Dairy farmers, supply-managed sectors to get $3.9B in compensation for CETA, CPTPP – but not NAFTA", *Global News* (19 March 2019), online: <https://globalnews.ca/news/5073069/federal-budget-2019-dairy-farmer-compensation-3-9-billion/>; Elizabeth Ann Smythe, "Food for thought: How trade agreements impact the prospects for a national food policy" (2018) 5:3 Canadian Food Studies 76.
[143] Sylvain Charlebois, "The many failings of Canada's supply-management system are government's fault, not farmers'", *The Globe and Mail* (23 April 2017), online: <https://www.theglobeandmail.com/report-on-business/rob-commentary/the-many-failings-of-canadas-supply-management-system-are-governments-fault-not-farmers/article34793275/>.
[144] Rod MacRae, "A Joined-Up Food Policy for Canada" (2011) 6 Journal of Hunger & Environmental Nutrition 424 at 454.
[145] Alison Blay-Palmer, "Growing innovation policy: the case of organic agriculture in Ontario, Canada" (2005) 23 Environment and Planning C: Government and Policy 557 at 568.
[146] *Ibid*.
[147] Agriculture and Agri-Food Canada, "Helping organic growers meet demand for Canadian-made organics", News Release (10 September 2020), online: <https://www.canada.ca/en/agriculture-agri-food/news/2020/09/helping-organic-growers-meet-demand-for-canadian-made-organics.html>.

retail sales of certified organic products in Canada continue to grow, reflecting an increase in consumer demand.[148] In light of these trends, in September 2020, Agriculture and Agri-Food Canada "announced an investment of over $640,000 to the Canadian Organic Growers (COG) to help get more Canadian consumers buying Canadian-made organics produced locally by Canadian organic farmers."[149] Beyond these kinds of straightforward investments alone, agricultural policy could be used to encourage greater sustainability in numerous additional ways, including through offering greater economic incentives for producers who adopt more sustainable practices.

An overhaul or update of regulatory regimes that no longer appropriately balance a range of considerations could go a long way toward encouraging sustainability in our food systems without relying on a treadmill of technology. As Nathalie Chalifour and Heather McLeod-Kilmurray point out, "[a]t the very least, the policy framework should not create an uneven playing field between sustainable and conventional or industrial agriculture."[150] This entails, from an upstream perspective, a reconsideration of incentive structures such as agricultural subsidies for particular crops, and from a downstream perspective, a reconsideration of regulatory requirements such as rules around the marketing and labeling of plant-based alternatives to animal products.

The problem is not just that regulations can be unduly onerous, but also that they can be disproportionately burdensome to producers who are smaller and/or not as well-resourced. In the context of innovation in the Ontario organic industry, Blay-Palmer has noted that compliance

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[148] *Ibid*.
[149] *Ibid*. See also Agriculture and Agri-Food Canada, "Supporting the Growth of Canada's Organic Sector", News Release (26 January 2018), online: <https://www.canada.ca/en/agriculture-agri-food/news/2018/01/supporting_the_growthofcanadasorganicsector.html>.
[150] Nathalie J Chalifour & Heather McLeod-Kilmurray, "The Carrots and Sticks of Sustainable Farming in Canada" (2016) 17 Vt J Envtl L 303 at 330.

with federal regulations is a substantial obstacle, as "[p]roducers, suppliers, and distributors are not generally large enough to deal with the complexities of the regulatory environment."[151] Similarly, despite flourishing consumer demand for plant-based alternatives to animal products, archaic rules and protocols around nutrition and labelling (along with the lack of clarity and consistency in how these are applied and enforced) currently act as significant hurdles to the development, marketing, and commercial availability of these options.[152] As such, regulatory reforms are necessary for ameliorating the bias towards larger operations that is otherwise generated through the rules of the market, insofar as the costs and barriers for entry are unduly high for smaller producers.

Additionally, policies and regulatory frameworks should better account for other kinds of market failures within the sector. For instance, as others have focused on in greater depth,[153] food loss and waste is a serious leakage point along all nodes of the food system, and making substantial reductions in this area has been identified as "essential for the global food system to stay within a safe operating space."[154] In Canada alone, nearly 60 percent of food produced is estimated to be lost and wasted annually.[155] Although a range of technologies could be leveraged to help achieve waste reduction targets—from food-sharing apps that connect food with a short

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[151] Blay-Palmer, *supra* note 145 at 569.
[152] Angela Lee, "The Stakes in Steak: Examining Barriers to and Opportunities for Alternatives to Animal Products in Canada" (2018) 41:1 Dalhousie LJ 219.
[153] See e.g. the work of the Food Systems Lab, online: <https://foodsystemslab.ca/>. For academic literature, see e.g. Christian Reynolds et al, eds, *Routledge Handbook of Food Waste*, 1st ed (London: Routledge, 2020).
[154] EAT-Lancet Commission, *Food, Planet, Health: Healthy Diets From Sustainable Food Systems* (Summary Report, 2019) at 25.
[155] Lori Nikkel et al, *The Avoidable Crisis of Food Waste: The Roadmap* (Ontario: Value Chain Management International and Second Harvest, 2019), online: <https://secondharvest.ca/wp-content/uploads/2019/01/Avoidable-Crisis-of-Food-Waste-The-Roadmap-by-Second-Harvest-and-VCMI.pdf>; Martin Gooch et al, *The Avoidable Crisis of Food Waste: Technical Report* (Ontario: Value Chain Management International and Second Harvest, 2019), online: <https://secondharvest.ca/wp-content/uploads/2019/01/Avoidable-Crisis-of-Food-Waste-Technical-Report-January-17-2019.pdf>; Environment and Climate Change Canada, *Taking Stock: Reducing Food Loss and Waste in Canada* (Gatineau: Environment and Climate Change, 2019), online: <https://www.canada.ca/content/dam/eccc/food-loss-and-waste/Taking%20Stock%20Report%20EN%20Final.pdf>.

self-life to those that need it most, to advanced storage systems that reduce spoilage—improved policy responses[156] in and of themselves could address this problem without expanding our dependence on technologies and their corresponding infrastructures, and reducing the need to expand production. Further, reducing food loss turns, to a large extent, on raising awareness and increasing motivation on the part of all who are involved.

Ultimately, "transforming food systems requires interventions that go beyond technology innovation."[157] Strong state interventions on both the production and consumption sides of the equation will be essential in steering the process of recalibrating policies and practices along every point in the food chain. As such, the next section will consider how an improved understanding of innovative practices and innovation policy can complement ongoing efforts to improve agri-food law and policy to make it more just and sustainable.

7.4.2 Innovation Policy

Innovation is a topic of interest across the political spectrum, with more innovation generally being considered to be favourable. However, it is important to bear in mind that "the notion of innovation and empirical descriptions of innovation continue to be strongly influenced by their technical and industrial roots and remain market-focused."[158] Even the most basic definitions of innovation are often grounded in normative assumptions that can function to channel state-sanctioned innovation to particular ends when imbricated with law and policy. Thus, if innovation policy is to effectively mobilize diverse kinds of innovation toward a range of social

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[156] National Zero Waste Council, *A Food Loss and Waste Strategy for Canada* (May 2018), online: <http://www.nzwc.ca/focus/food/national-food-waste-strategy/Documents/NZWC-FoodLossWasteStrategy.pdf>.
[157] World Economic Forum (prepared in collaboration with McKinsey & Company), *Innovation with a Purpose: The role of technology innovation in accelerating food systems transformation* (World Economic Forum, 2018), online: <http://www3.weforum.org/docs/WEF_Innovation_with_a_Purpose_VF-reduced.pdf> at 10.
[158] Dirk Meissner, Wolfgang Polt & Nicholas S Vonortas, "Towards a broad understanding of innovation and its importance for innovation policy" (2017) 42 J Technol Transf 1184 at 1191.

goals, policy makers must make conscious efforts to expand both their understandings of innovation and the role of the state therein.

Innovation as a discrete area of policymaking and research is relatively new.[159] When it comes to policymaking, the *implementation* aspect of innovation is the primary focus. Though innovation policy traditionally "lies within the remit of industry, education, or economy ministries", more specialized approaches to innovation policymaking and innovation governance have emerged in recent years, including in the form of agencies dedicated to this mandate.[160] Concurrently, there has been a "gradual broadening of the concept of innovation and of corresponding policy."[161]

In Canada, ISED is the federal institution responsible for the Innovation, Science and Economic Development portfolio, which includes seventeen different departments and agencies.[162] The institution's name alone reflects expectations about both a driver (science) and a purpose of innovation (economic development). ISED notes that it "works with Canadians in all areas of the economy and in all parts of the country to improve conditions for investment, enhance Canada's innovation performance, increase Canada's share of global trade and build a fair, efficient and competitive marketplace."[163] ISED's articulated mission is "to foster a growing, competitive and knowledge-based Canadian economy."[164] This mission suggests that,

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[159] Jakob Edler & Jan Fagerberg, "Innovation policy: what, why, and how" (2017) 33:1 Oxford Review of Economic Policy 2 at 2.
[160] *Ibid* at 14.
[161] Meissner, Polt & Vonortas, *supra* note 158 at 1185.
[162] Government of Canada, "Innovation, Science and Economic Development portfolio", online: <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/h_00022.html> (last updated November 14, 2018).
[163] Government of Canada, "Innovation, Science and Economic Development Canada", online: <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/home> (last updated March 20, 2020).
[164] Innovation, Science and Economic Development Canada, "About us", online: <https://www.ic.gc.ca/eic/site/icgc.nsf/eng/h_07017.html> (last updated August 28, 2018).

in relation to ISED's work, the rhetoric of innovation hews closely to usual ideas about unfettered economic growth being the decisive measure of progress.

The closer attention that is being paid to innovation and innovation policy opens up more space for disrupting and reconsidering established narratives about and strategies for innovation. In particular, "there are choices to be made within innovation that do not just relate to its acceptance or rejection but rather to the multiplicity of mechanisms and arenas through which and within which innovation is constituted and governed."[165] From a technology justice perspective, an important consideration that arises with respect to innovation "is not that it is desired by society or is generally acceptable but rather that (a) individuals can choose whether or not to engage with it and (b) its creation and use do not cause harm to other individuals, either directly or indirectly."[166] Consequently, questions related to law and governance are highly relevant to innovation policy. The issue is not simply how to make innovation policy more efficacious, but also how it can be structured such that it does not exacerbate injustice.

There is no hard law at any level of government that speaks directly to innovation. Rather, Canada's approach to innovation to date has largely taken shape through *ad hoc* policies and strategies. The federal government is undoubtedly a primary player through institutions like ISED, but provinces and territories also have constitutional authority over many areas that have a significant impact on STI, including education, natural resources, health care, and agriculture. Yet, there has been "little sustained provincial focus or strategic organization vis-à-vis S&T and

[165] Jack Stilgoe & David H Guston, "Responsible Research and Innovation" in Ulrike Felt et al, eds, *The Handbook of Science and Technology Studies*, 4th ed (Cambridge, MA: The MIT Press, 2017) 853 at 859.
[166] David Grant & Lyria Bennett Moses, *Technology and the Trajectory of Myth* (Northampton, MA: Edward Elgar Publishing, Inc., 2017) at 225.

innovation; most efforts are embedded in provincial departments and regional or sectoral strategies with little or no legislative power or engagement."[167]

This is a notable gap, as the success or failure of any innovation can be closely connected to context specific factors, including regional and sectoral priorities. For example, grain, oilseed, and pulse production in western Canada, grown with a "strong export orientation", has "led to a sharpened focus among producers and provincial ministries on innovation".[168] Indeed, industry organizations like the Canada Grains Council,[169] CropLife Canada,[170] and Pulse Canada[171] all speak of a commitment to innovation in both technology and trade, to enhance profitability while reducing environmental impacts. Though these kinds of commitments are to be commended, they also cannot be considered in isolation from the broader domestic and international law and policy landscape. As such, applying the principle of subsidiarity to innovation policy and adopting policy interventions "informed by influences from the regional, national, and global scales could bolster … innovative capacity … in a meaningful way."[172] The agri-food sector is an ideal site of experimentation in this context, because "[a]griculture is arguably local, regional, and global simultaneously, and … offers fertile ground for a study of the merits of a multiple-scaled approach."[173] In particular, a multi-scaled approach can help clarify what kind of barriers exist at what levels, what institutional and financial supports are needed to dismantle or ameliorate those barriers, and where they should be directed to be most impactful.

The principle of subsidiarity can be defined as "the proposition that law-making and implementation are often best achieved at a level of government that is not only effective, but

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167 Doern, Castle & Phillips, *supra* note 25 at 32-33.
168 *Ibid* at 269.
169 Canada Grains Council, online: <https://canadagrainscouncil.ca/>.
170 CropLife Canada, online: <https://croplife.ca/>.
171 Pulse Canada, online: <http://www.pulsecanada.com/>.
172 Blay-Palmer, *supra* note 145 at 558.
173 *Ibid* at 562.

also closest to the citizens affected and thus most responsive to their needs, to local distinctiveness, and to population diversity."[174] What this means for innovation is that, while the federal government should set the overarching goals and priorities of innovation, regional, provincial/territorial, and otherwise more local forms of government should be responsible for the particulars of operationalization.

In relation to food and agriculture more specifically, "locally-appropriate policy should support ecologically driven agricultural innovation through both programing and resource provision."[175] To this end, an expert panel report commissioned by the Cornell Atkinson Center for Sustainability in 2020 submits that the co-creation of bundled social and technological innovations that are locally contextualized to specific agri-food system contexts is essential, and necessarily requires multi-party cooperation among the public and the private sector.[176] There is also an important role that grassroots actors and organizations can play in terms of identifying local and regionally-specific problems, priorities, and possibilities for intervention.

That being said, a national system of innovation is beneficial in that it provides an overarching "context for innovation through its emphasis on a technical direction, related training and educational institutions, associational capacity, social capital, and the nature of the investment and entrepreneurial climate that is fostered."[177] Acknowledging the value of a national system of innovation does not preclude embracing multi-scalar approaches, especially

[174] *114957 Canada Ltée (Spraytech, Société d'arrosage) v. Hudson (Town)*, 2001 SCC 40, [2001] 2 SCR 241 at para 3.
[175] Sarah Rotz et al, "The Politics of Digital Agricultural Technologies: A Preliminary Review" (2019) 59:2 Sociologia Ruralis 203 at 220.
[176] Christopher B Barrett et al, *Socio-technical Innovation Bundles for Agri-Food Systems Transformation*, Report of the International Expert Panel on Innovations to Build Sustainable, Equitable, Inclusive Food Value Chains (Ithaca, NY: Cornell Atkinson Center for Sustainability and Springer Nature, 2020).
[177] Blay-Palmer, *supra* note 145 at 560.

those focusing on community-level solutions and different configurations of regional and sectoral alliances.

Although innovation consistently appears on the national policy agenda, it has rarely been considered a major priority.[178] The last dedicated STI strategy, *Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation* (the 2014 STI Strategy),[179] was developed in 2014 under the Harper government, replacing the previous strategy from 2007 (*Mobilizing Science and Technology to Canada's Advantage*[180]). More recently, an Innovation and Skills Plan was launched as part of Budget 2017, targeting six key areas, including agri-food (with a particular emphasis on boosting exports to meet the growing global demand for protein-based foods).[181] In 2019, ISED released a report titled *Building a Nation of Innovators*[182] elaborating on the Plan's intent and progress. The report sets out a framework for supporting innovation that is described as "a new approach to drive growth and create good jobs – one that aims to succeed by building a culture of innovation and a globally recognized brand for Canada as one of the most innovative and competitive countries in the world."[183] In terms of what is new about the Plan, it emphasizes partnerships with "industry, post-secondary institutions, not-for-

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[178] Doern, Castle & Phillips, *supra* note 25 at 361.
[179] Government of Canada, *Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation 2014* (Ottawa: Industry Canada, 2014), online: <https://www.ic.gc.ca/eic/site/113.nsf/vwapj/Seizing_Moment_ST_I-Report-2014-eng.pdf/$file/Seizing_Moment_ST_I-Report-2014-eng.pdf> [*Seizing Canada's Moment*].
[180] See Government of Canada, *Mobilizing Science and Technology to Canada's Advantage: Summary* (Ottawa: Industry Canada, 2007), online: <https://www.competitionbureau.gc.ca/eic/site/113.nsf/vwapj/STsummary.pdf/$file/STsummary.pdf>. The three convictions on which the 2007 strategy was based were: (1) Canada needs a strong private-sector commitment to S&T; (2) Canada must continue to strengthen its knowledge base; and (3) Canada must be a magnet for talent.
[181] Government of Canada, *Budget 2017: Building a Strong Middle Class* (March 22, 2017) (tabled in the House of Commons by the Honourable William Francis Morneau, PC, MP, Minister of Finance), online: <https://www.budget.gc.ca/2017/docs/plan/budget-2017-en.pdf> at 44.
[182] Innovation, Science and Economic Development Canada, *Building a Nation of Innovators* (Ottawa: ISED, 2019), online: <https://www.ic.gc.ca/eic/site/062.nsf/vwapj/ISEDC_19-044_INNOVATION-SKILLS_E_web.pdf/$file/ISEDC_19-044_INNOVATION-SKILLS_E_web.pdf> [*Building a Nation of Innovators*].
[183] *Ibid* at iv.

profits, and provinces and territories”,[184] as well as “fostering the participation of traditionally underrepresented groups in the innovation economy.”[185]

Innovation is described as being “the key to competitiveness, productivity, economic growth, creating good jobs, and overall making life better for all Canadians.”[186] Although the most common form of innovation relies heavily on science and technology, especially in wealthy, Western countries, other forms of innovation do exist.[187] Indeed, the 2014 STI Strategy acknowledges that “[a] strong science and technology base supports innovation but alone is not its *cause* and not all innovation has a base in science and technology.”[188]

The 2014 STI Strategy adopts the OECD’s definition of innovation as expressed in the *Oslo Manual*:[189] innovation is the “implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.”[190] *Building a Nation of Innovators* also notes that “[i]nnovation can be manifested in four distinct areas”: product innovation, market innovation, process innovation, and organizational innovation.[191] Hence, there is clearly latitude for a more capacious understanding of innovation and knowledge

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[184] *Ibid* at v.
[185] *Ibid* at iv.
[186] *Ibid* at iii.
[187] David Feige, “Fundamentals of Innovation Policy for Growth and Development” in Nicholas S Vonortas, Pheobe C Rouge & Anwar Aridi, eds, *Innovation Policy: A Practical Introduction* (New York: Springer, 2015) 5 at 5-6.
[188] Government of Canada, *Seizing Canada’s Moment*, *supra* note 179 at 7.
[189] First published in 1992, and now in its 4th edition, the Oslo Manual is an international reference guide for collecting, reporting, and using data on innovation. OECD, *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation*, 4th ed (Luxembourg: OECD Publishing, 2019), online: <https://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm> [*Oslo Manual 2018*].
[190] *Seizing Canada’s Moment*, *supra* note 179 at 8.
[191] *Building a Nation of Innovators*, *supra* note 182 at 9.

(including Traditional Indigenous Knowledge[192]) to be developed and applied within existing policy frameworks relating to technology, society, and the environment.[193]

However, a mere acknowledgment of the distinction between different types of innovation[194] does not translate into a strong grasp of what they each entail, the challenges and possibilities associated with each, and how they interrelate. Product innovations might be relatively straightforward, whereas system innovations necessarily involve "many actors and may involve organizational and institutional change. Institutional change … refers to the changes in rules, knowledge, norms and (legal) procedures that inhibit the introduction and diffusion of new products."[195] Presently, the Canadian approach to innovation lacks this kind of more precise thinking that can inhibit a multi-dimensional appreciation of the dynamics of innovation and the subsequent policy implications. Creativity in innovation can also be exercised in various ways. For example, AAFC recently announced funding worth up to $2.1 million to support community-led Indigenous agriculture and food initiatives under the Indigenous Agriculture and Food Systems Initiative.[196] While the objective of the initiative is purportedly "to increase economic development opportunities of Indigenous Peoples and communities in Canada",[197]

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[192] Traditional Indigenous Knowledge is "commonly understood to refer to collective knowledge of traditions used by Indigenous groups to sustain and adapt themselves to their environment over time": Assembly of First Nations, "Traditional Knowledge", online: <https://www.afn.ca/uploads/files/env/ns_-_traditional_knowledge.pdf>.

[193] See e.g. Government of Canada, "Indigenous Knowledge Policy Framework for Proposed Project Reviews and Regulatory Decisions", online: <https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews/environmental-assessment-processes/discussion-paper-development-indigenous-knowledge-policy-framework.html> (last updated May 16, 2019).

[194] See e.g. Meissner, Polt & Vonortas, *supra* note 158 at 1190, Table 2.

[195] Luke Brander et al, "Triggering Innovation" in Christoph Erdmenger, ed, *Buying into the Environment: Experiences, Opportunities and Potential for Eco-Procurement* (New York: Routledge, 2017) 94 at 108.

[196] Agriculture and Agri-Food Canada, "Government of Canada announces three projects under the Indigenous Agriculture and Food Systems Initiative", News Release (9 October 2020), online: <https://www.canada.ca/en/agriculture-agri-food/news/2020/10/government-of-canada-announces-three-projects-under-the-indigenous-agriculture-and-food-systems-initiative.html>.

[197] *Ibid*.

there is a valuable learning opportunity here that should not be overlooked in terms of recognizing and scaling up different ways of seeing, knowing, and doing.

Policy instruments used to foster innovation can range widely in type and design, but the range of tools used to incentivize innovation in Canada has been rather limited. The 2014 STI Strategy notes that "[r]elative to peer countries, Canada relies much more on R&D tax incentives, compared to direct spending programs that support innovative firms and public-private collaborations".[198] According to another assessment, "[t]ax incentives and R&D subsidies are generous, and financial support for "innovation sectors" in the form of grants and contributions has been expanded and enhanced."[199] Recognizing that "a reliance on indirect support has not improved Canada's innovation performance and incentivized business investment in R&D to scale," the current iteration of the Innovation and Skills Plan aims "to encourage more business investment in R&D through increased direct support, and not just through tax incentives."[200] Not only should the scope of incentives for innovation be expanded, so too should the recipients and the goals.

Though there are signs that this is changing, Canadian innovation policy has focused too much on the generation and creation of knowledge, technology, and innovation as typically understood, paying too little attention to demand-side considerations.[201] This represents a significant conceptual, analytical, and policy deficiency, as "innovations contribute to welfare and greater productivity only if they diffuse throughout the economy and society."[202] Remedying this problem will require "a new mindset and willingness to organize innovation policy

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[198] *Seizing Canada's Moment*, *supra* note 179 at 10.
[199] Jakob Edler, *A Costly Gap: The Neglect of the Demand Side in Canadian Innovation Policy*, IRPP Insight 28 (Montreal: Institute for Research on Public Policy, 2019) at 5.
[200] *Building a Nation of Innovators*, *supra* note 182 at 19.
[201] Edler, *supra* note 199.
[202] *Ibid* at 2.

differently in order to realize the potential benefits of connecting demand, R&D investments, productivity and societal problem solving."[203] It should be readily apparent why a better understanding of demand-side factors and diffusion is not necessarily facilitated by a top-down approach to policymaking; collaborative engagement is called for in articulating needs-based and demand-driven rationales for policy interventions. Citizens should feel as though their perspectives and contributions are not only heard and seen, but genuinely taken into account in an iterative process.

Additionally, the state needs to recognize that "the use of a wide array of instruments (regulations, innovative public procurement processes, measures that promote diffusion) are necessary if policies are to be formulated that are able to address the largest challenges facing our societies."[204] Taking a more holistic approach to innovation means that innovation should be couched within a contextualized landscape that "may include knowledge infrastructures, structures for corporate financing (e.g. availability of venture capital), the organization of research and education, the characteristics of labour markets, tax regimes or patent legislation."[205] Within this landscape, state influence can be utilized in a variety of open-ended ways. For example, when it comes to education and training,

> [r]ather than simply learning how to *do* technology, students should be encouraged to think critically about how particular technologies shape the way their lives are led and the manner in which the broader society operates … They should also be encouraged to imagine technologies for a future world that they want to live in, a world in which their agency, autonomy and responsibility are preserved.[206]

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[203] *Ibid* at 16-17.
[204] Meissner, Polt & Vonortas, *supra* note 158 at 1205.
[205] K Matthias Weber & Harald Rohracher, "Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspectives in a comprehensive 'failures' framework" (2012) 41 Research Policy 1037 at 1038.
[206] Grant & Bennett Moses, *supra* note 166 at 226.

Meanwhile, given the amount of public sector spending on goods and services, leveraging purchasing power to influence suppliers and service providers can be a valuable tool in the pursuit of greater environmental sustainability and other societal goals.[207] As Matthias Weber and Harald Rohracher explain, "[g]overnment and public administration are major investors and can use innovation-oriented procurement mechanisms to directly stimulate the advancement of novel solutions from the demand side."[208] Procurement policies and practices can also have indirect impacts, including providing an incentive for technological development towards more sustainable products.[209] However, "[s]trategic innovation procurement requires public bodies at all levels to think about future demand, articulate it to the market, interact with the market, use the appropriate procurement processes and be ready to actually absorb and use innovations."[210] Thus, to harness the potentials of public procurement as an instrument of innovation policy, there needs to be a wider engagement with innovation throughout the public sector.[211]

Regardless of the type or types of innovations envisioned or the specific sectors that are involved, a comprehensive innovation policy should contemplate how innovation will be quantified, since "[s]ound measurement of innovation and the use of innovation data in research can help policy makers better understand economic and social changes, assess the contribution (positive or negative) of innovation to social and economic goals, and monitor and evaluate the

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[207] See e.g. Charles Edquist et al, eds, *Public Procurement for Innovation* (Northampton, MA: Edward Elgar Publishing, Inc., 2015); Max Rolfstam, *Public Procurement and Innovation: The Role of Institutions* (Northampton, MA: Edward Elgar Publishing, Inc., 2013); Charles Edquist & Jon Mikel Zabala-Iturriagagoitia, "Public Procurement for Innovation as mission-oriented innovation policy" (2012) 41:10 Research Policy 1757.
[208] Weber & Rohracher, *supra* note 205 at 1043.
[209] Brander et al, *supra* note 195.
[210] Edler, *supra* note 199 at 14.
[211] Luke Georghiou et al, "Policy instruments for public procurement of innovation: Choice, design and assessment" (2014) 86 Technological Forecasting and Social Change 1.

effectiveness and efficiency of their policies."[212] In addition to gauging impact, improved understandings of how innovation is defined, measured, and evaluated are crucial for assessing what kinds of R&D are currently sanctioned and funded, and what kind of rationale is used to justify these decisions. Arguments grounded in a technology justice framework can help make a case for public policy interventions in R&D where social returns for a broader public outweigh private benefits for a select few. For example, while precision agriculture, as discussed in Chapter 6.3, offers a number of potential environmental and efficiency advantages that have therefore led to growing interest in R&D investments, a lack of attention to capacity has served to disadvantage smaller-scale producers.

Issues that must be addressed in a measurement strategy for innovation include "the choice of a subject or object approach, the collection of qualitative and quantitative data, data sources, and responsibility for data collection."[213] Developing an effective innovation measurement framework also "requires an understanding of what needs to be measured and awareness of what can be reliably measured."[214] Further, the structure of a measurement strategy can "vary over time as user needs and the types of data that can be collected evolve in response to new opportunities or challenges."[215]

Some efforts have already been made at measuring the impacts of innovation in Canada. The Conference Board of Canada periodically produces a report card of innovation performance across nine indicators: public R&D, researchers engaged in R&D, scientific articles, entrepreneurial ambition, venture capital investment, business enterprise R&D, ICT investment,

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[212] *Oslo Manual 2018*, *supra* note 189 at para 1.1.
[213] *Ibid* at para 2.77.
[214] *Ibid* at para 1.2.
[215] *Ibid* at para 2.78.

patents, and labour productivity.[216] The latest version of the report card, from 2018, finds that "Canada continues to exhibit the same weak performance that has caused so much concern in recent years."[217] In *Building a Nation of Innovators*, ISED similarly identifies a number of weaknesses along the innovation continuum in Canada.[218] Though ISED is currently tracking progress towards reaching the goals established under the Innovation and Skills Plan,[219] all of the metrics are quantitative. There needs to be a more conspicuous effort made to collect and make use of qualitative data, and to account for a range of social and environmental considerations relating to innovation.

The current Innovation and Skills Plan notes that it "will continue to take a partnership-driven approach in understanding the challenges that innovators face and in developing the next steps to address them."[220] The insights gained from conversations with stakeholders will supplement the engagement efforts that ISED has previously undertaken. In 2016, ISED released a report titled *Innovation for a Better Canada: What We Heard*, which enumerates findings gathered during six months of public consultations with more than 100,000 Canadians.[221] Among the findings from the consultations, "Canadians stressed the active role that government can play in fostering innovation by setting ambitious, big-horizon goals, then making strategic investments and targeting resources in specific areas to fulfill that mission."[222] Thus, Canadians are clearly not opposed to state-led innovation in pursuit of societal goals. However, the fact that

[216] The Conference Board of Canada, "Innovation Report Card" (May 2018), online: <https://www.conferenceboard.ca/hcp/provincial/innovation.aspx>.
[217] *Ibid*.
[218] *Building a Nation of Innovators*, *supra* note 182.
[219] Government of Canada, "Tracking progress and results: The Innovation and Skills Plan", online: <https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00083.html> (last updated March 5, 2019).
[220] *Building a Nation of Innovators*, *supra* note 182 at 18.
[221] Innovation, Science and Economic Development Canada, *Innovation for a Better Canada: What We Heard* (2016), online: <https://www.ic.gc.ca/eic/site/062.nsf/vwapj/Innovation-for-a-better-Canada.pdf/$file/Innovation-for-a-better-Canada.pdf>.
[222] *Ibid* at 12.

the consultations were framed around six pre-determined themes[223] may have prematurely "closed down" rather than "opened up" the process of appraisal.[224]

It is important to remember that "[m]atters of power and agency play an important role in the definition of any vision, as well as for the subsequent activities and policies [that] may be in line or not with the key features of a vision."[225] Given the inherently normative and political dimensions of seeking to define societal challenges and missions, the democratic legitimacy of the agenda-setting process depends on sound procedures and broad participation from diverse types of actors.[226] For example, as highlighted by the case study on GE animals in Chapter 6.2, Indigenous communities, subsistence fishers, and members of the general public all should have had their voices heard in decisions about the appropriateness and acceptability of producing the AAS on a large scale in land-based aquaculture facilities.

Furthermore, the process of technical change and innovation "has to be investigated by disclosing its double nature: first understanding the meaning, purpose and motivation for that change (for example, 'Why do we want to change?'), and second, questioning the direction and outcomes of change (for example, 'What do we want to change?')."[227] Insofar as innovation policy reflects preferences about desired future states, it must be predicated on answers to these questions that do not accept technological means or existing power structures as a given.

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[223] *Ibid* at 6. The themes were: (1) Entrepreneurial and Creative Society; (2) Global Science Excellence; (3) World Leading Cluster and Partnerships; (4) Grow Companies and Accelerate Clean Growth; (5) Compete in a Digital World; and (6) Ease of Doing Business.
[224] Andy Stirling, ""Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology: (2008) 33:2 Science, Technology & Human Values 262.
[225] Weber & Rohracher, *supra* note 205 at 1043.
[226] Wouter Boon & Jakob Edler, "Demand, challenges, and innovation. Making sense of new trends in innovation policy" (2018) 45:4 Science and Public Policy 435 at 443.
[227] Richard Owen & Mario Pansera, "Responsible innovation: process and politics" in René von Schomberg & Jonathan Hankins, eds, *International Handbook on Responsible Innovation: A Global Resource* (Northampton, MA: Edward Elgar Publishing, Inc., 2019) 35 at 42.

When it comes to agri-food technologies and innovations in particular, having a distinct vision toward which STI efforts are directed can provide clarity as to the outcomes that are sought, thereby facilitating more strategic action. Mission-oriented research has recently taken a more prominent place in debates about innovation policy.[228] Mission-driven or mission-oriented research and innovation is a process through which "[t]he democratic state, representing societal interests, … mobilize[s] the generation and use of innovation to achieve societal goals."[229]

As Klerkx and Begemann further explain, "[m]ission-oriented innovation policy brings together elements of innovation policy, which traditionally aims to create economic growth, and transition policy, which principally aims to create change that is beneficial for society at large."[230] In addition to the commitment to a transformative purpose, mission-oriented policy requires the clear articulation of "a particular direction of transformative change" that can be defined "by the identification of major societal problems or challenges, for which solutions need to be developed with the help of research and innovation."[231] To this end, "reflexive and participatory processes, supported by scientific evidence, may help in [the] process of creating shared expectations, enabling open coordination, and defining joint agendas for action."[232] The next section will elaborate on the importance of principles and processes in greater detail.

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[228] See e.g. Mariana Mazzucato, *Mission-Oriented Innovation Policy: Challenges and opportunities* (Royal Society for the encouragement of Arts, Manufactures and Commerce & UCL Institute for Innovation and Public Purpose, September 2017), online: <https://www.thersa.org/globalassets/pdfs/reports/mission-oriented-policy-innovation-report.pdf>.
[229] Edler, *supra* note 199 at 8.
[230] Laurens Klerkx & Stephanie Begemann, "Supporting food systems transformation: The what, why, who, where and how of mission-oriented agricultural innovation systems" (2020) 184 Agricultural Systems 1 at 2 [references omitted].
[231] Weber & Rohracher, *supra* note 205 at 1042.
[232] *Ibid* at 1043.

7.5 Principles and Processes

An ethically informed framework of principles and processes can help drive mission-oriented policies forward by focusing decision-making at all levels in the service of specific ends, even when social, economic, or political situations change. For example, the concept of permaculture was originated as an approach to land management that relies on a set of twelve design principles derived from systems thinking.[233] However, its principles can also act as a broader "blueprint for the way we live our lives",[234] enabling us to work with rather than against both Nature and each other.

Regardless of their content, the articulation of guiding principles is also beneficial in that they can give legal form to recurring themes and concerns that cut across a number of different fields and contexts. Thus, though they are similar to the principles of anticipation, reflexivity, inclusion, and responsiveness adopted by RRI frameworks,[235] the mutually reinforcing principles and processes outlined below take a more explicitly systems-oriented perspective on the potentials and pitfalls of drawing on different forms of innovations to generate transformative change.

7.5.1 Coordination and Integration

Many different reports and academic publications have emphasized the critical importance of coordination and integration in governance and policymaking at the national and international

[233] See generally David Holmgren, *Permaculture: Principles and Pathways Beyond Sustainability* (Holmgren Design Services, 2002). The twelve principles are: (1) observe and interact; (2) catch and store energy; (3) obtain a yield; (4) apply self regulation and accept feedback; (5) use and value renewable resources and services; (6) produce no waste; (7) design from patterns to details; (8) integrate rather than segregate; (9) use small and slow solutions; (10) use and value diversity; (11) use edges and value the marginal; and (12) creatively use and respond to change.
[234] Elizabeth Waddington, "The 12 Principles of Permaculture: A Way Forward", *Ethical.net* (23 April 2019), online: <https://ethical.net/ethical/permaculture-principles/>.
[235] See Chapter 3.5.2.

levels.[236] Adopting a harmonized approach is especially apposite when it comes to nebulous areas like food, which invoke multiple and diffuse areas of concern. The “EAT-Lancet Commission brief for Policymakers” advocates for multi-faceted interventions and a multi-sectoral approach that spans all levels of governance and includes representation from a broad range of actors.[237] It tasks policymakers to use “the range of ministerial and departmental portfolios to ensure coherent food system actions.”[238]

Likewise, the “Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services” stresses the need for a “fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values.”[239] It adds that “[s]ectoral policies and measures can be effective in particular contexts, but often fail to account for indirect, distant and cumulative impacts, which can have adverse effects, including exacerbating inequalities.”[240]

Policy coordination failures that take the form of “temporal mismatches related to the timing of interventions by different actors” can also “result in undesirable outcomes and collective lock-in into sub-optimal technological trajectories.”[241] Thus, adopting a systems perspective when it comes to the development and deployment of technologies in the agri-food

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[236] See e.g. Foresight, *The Future of Food and Farming: Challenges and choices for global sustainability – Final Project Report* (London: The Government Office for Science, 2011), online: <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/288329/11-546-future-of-food-and-farming-report.pdf> at 165; IPES-Food, *From Uniformity to Diversity*, *supra* note 138 at 61,73-74.
[237] EAT-Lancet Commission, *supra* note 154 at 2.
[238] *Ibid*.
[239] Diaz et al, *supra* note 140 at 5, note 3.
[240] *Ibid* at 27.
[241] Weber & Rohracher, *supra* note 205 at 1044.

sector is important for promoting "the cultivation of distributed responsibilities across wider innovation ecologies, as opposed to thinking about particular … technologies in isolation."[242]

Greater efforts towards coordination and integration are necessary and unavoidable in an increasingly complex world characterized by an expansion of the regulatory state. In practice, however, interagency coordination has been referred to as "one of the central challenges of modern governance."[243] The tangle of actors at multiple levels of government that is currently responsible for governing agri-food law and policy in Canada evidences some of the difficulties and inefficiencies that can result.[244] That being said, overlapping agency delegation can also "create distinct advantages, including the potential to harness the expertise and competencies of specialized agencies."[245]

If these advantages are to be made the most of, agencies must be enabled "to bring their relative competencies to bear while ensuring that they do not pursue conflicting or incompatible policies that would undermine their larger shared mission."[246] This necessarily starts with a commitment to a common undertaking that acknowledges the public nature of food, the importance of preserving ecological integrity, and the corresponding need for a comprehensive governance strategy that "reflect[s] fully the essential reality of our biological and social dependence on food and the resources needed to produce it sustainably."[247] Issues related to food consumption—such as the massive problem of food waste—also need to made more central in our food policy paradigms.

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[242] David Christian Rose & Jason Chilvers, "Agriculture 4.0: Broadening Responsible Innovation in an Era of Smart Farming" (2018) 2 Frontiers in Sustainable Food Systems 1 at 4.
[243] Jody Freeman & Jim Rossi, "Improving Interagency Coordination in Shared Regulatory Space" (2013) 38:4 Admin & Reg L News 11 at 11.
[244] See Chapter 2.3. See also MacRae, "A Joined-Up Food Policy for Canada", *supra* note 77 at 429-430.
[245] Freeman & Rossi, *supra* note 243 at 11.
[246] *Ibid*.
[247] MacRae, "A Joined-Up Food Policy for Canada", *supra* note 77 at 425.

Canada's new national Food Policy presents a constructive opening to "shift the language and practice of food system governance"[248] in order to build coherence and capacity to deal with complexity. It encourages policymakers "to think seriously about the food system as a *system*, and to engage with its interconnections and mutually interdependent areas of governance", and "to articulate what norms, values, or principles we want as the foundation of our food system."[249] However, the existence of the national food policy, in and of itself, is not sufficient to produce change. Dedicated efforts are required to ensure that the Food Policy's vision can be brought to life.

At the horizontal level, there needs to be greater coordination between different departments and areas of policymaking, including in the areas of tax policy, environmental policy (including sustainable development policy), and STI policy. In particular, the connections between the agri-food sector, STI, and (in)justice should be more explicitly front of mind in the policy-making process, which could help spur "the development of scale-appropriate technologies and supported access for a diverse range of farmers".[250] Additionally, coherence needs to be built between international and national policies, between the public and the private sectors, as well as "between the activities of national, regional, sectoral and technological institutions".[251] The work of FPCs already demonstrates how actors from multiple backgrounds and sectors can come together to build long-term strategies for meeting food-related goals, and their efforts can be looked to as a model for what may work at larger scales in terms of bringing together diverse stakeholders to advance common purposes.

[248] Berger Richardson & Lambek, *supra* note 81 at 41 [emphasis in original].
[249] *Ibid*.
[250] Rotz et al, *supra* note 175 at 216.
[251] Weber & Rohracher, *supra* note 205 at 1043.

At the vertical level, efforts need to be directed at reducing fragmentation between the various levels of government that "regulate aspects of the food system concurrently but not necessarily in a coordinated fashion."[252] Likewise, "since policy-makers in many different setting (and levels) influence the various factors that matter for innovation, better coordination and alignment of policies are required, so that the various activities those policy-makers engage in complement rather than counteract each other."[253] By acknowledging the opportunities presented by cooperative and collaborative governance, including the sharing of useful information,[254] creating "spaces for creativity, innovation, and experimentation",[255] and fostering institutional learning,[256] we can improve our ability to "co-ordinate system transformations that serve broad societal objectives."[257]

7.5.2 Reflexivity and Adaptivity

The principles and processes of reflexivity and adaptivity speak to the need for an iterative approach to governance that is continuously refined based on observation and feedback. Though embracing reflexivity and adaptivity can be beneficial in virtually all contexts, it is especially useful for staying on course whilst treading in unchartered territory. As Weber and Rohracher note, "the long-term character of transformative change, associated with the uncertainty

[252] Berger Richardson & Lambek, *supra* note 81 at 29.
[253] Jan Fagerberg, "Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy" (2018) 47 Research Policy 1568 at 1574.
[254] MacRae, "A Joined-Up Food Policy for Canada", *supra* note 77 at 431: "A significant amount of economic and social data is collected, but environmental, health promotion, and cultural information is limited. Equally significant are the failures regarding sharing of useful information. A significant amount of environmental data is private, held by farmers or farm organizations or private data collection agencies working for agri-food firms. It is not shared with public agencies (often for fear of legal action if the data reveal poor performance) or is sold at a price that public agencies are unwilling to pay. Given the competitive mechanisms related to jurisdictional divisions …, information and analysis does not flow easily across relevant public agencies."
[255] Berger Richardson & Lambek, *supra* note 81 at 43.
[256] Mazzucato, *supra* note 228 at 3.
[257] *Oslo Manual 2018*, *supra* note 189 at para 2.11.

surrounding innovation and change requires a continuous monitoring with respect to progress towards the transformation goals and the development of adaptation strategies."[258]

Because law, as a discipline, is charged with providing answers, it sometimes deals with uncertainty in unsuitable ways, including through an overreliance on science. In accepting that uncertainty is an inherent part of life, we need to be "willing to embrace the imperfections of law. It is our misguided yearning for completeness and perfection in law that drives us to look for rescue in the form of science."[259] This means that, when it comes to environmental law, for example, we must jettison the notion that the environment and its response to disturbances is precisely predictable in its behaviour, and therefore amenable to regulatory approaches rooted in a "reductionist, linear, predictivist mentality".[260] The scope and character of technological change necessitates similarly flexible treatment when it comes to regulation.

An adaptive policy approach that is suited to cope with uncertainty "means that options are kept open and parallel developments admitted … In line with a more experimental approach to policy learning, adaptivity also means the ability to stop innovation trajectory and associated policy initiatives, if they turn out to be less promising than initially expected."[261] Making minor or even major adjustments in light of new information need not be characterized negatively as backpedaling from previously expressed commitments. Instead, in developing the kinds of policies necessary to tackle the multifaceted challenges that we face, "we must choose developmental variants that do not close off the future, but transform the modernization process itself into a *learning process*, in which the revisability of decisions makes possible the revocation

[258] Weber & Rohracher, *supra* note 205 at 1044.
[259] Robin Feldman, *The Role of Science in Law* (New York: Oxford University Press, 2009) at 17.
[260] JB Ruhl, "Thinking of environmental law as a complex adaptive system: How to clean up the environment by making a mess of environmental law" (1997) 34:4 Houston L Rev 933 at 940.
[261] Weber & Rohracher, *supra* note 205 at 1044.

of side effects discovered later."[262] As Olivia Woolley points out, the dynamism and complexity of natural and socio-ecological systems makes it difficult to predict how actions may affect their behaviour; consequently, an approach that seeks to reduce risks and enhance a system's ability to absorb shocks when confronted with disturbances is the best available way to preserve resilience and therefore maintain them in states that we regard as desirable.[263]

The physical and social sciences have much to offer by way of analytic techniques for coping with complex and uncertain facts and values.[264] Adaptive management is already a well-established concept in the environmental sciences,[265] and it has also been applied in the context of environmental law.[266] From the existing literature, it is apparent that adaptive management efforts can vary in efficacy.[267] To maximize learning, a rigorous approach to adaptive management requires "clear and measurable objectives, indicators, hypotheses, thresholds, and commitments with respect to monitoring, follow up and adjustment"[268]

Locally situated, traditional, and Indigenous knowledge systems are valuable sources of information that can enrich adaptive learning processes and enable new forms of cooperation between stakeholders. Themes that have emerged from recent research on meeting community-defined goals in Indigenous agriculture include centring Indigenous knowledge and traditional relationships to the land; capacity building; building respectful partnerships and relationships;

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[262] Ulrich Beck, *Risk Society: Towards a New Modernity* (London: SAGE, 1992) at 178 [emphasis in original].
[263] Woolley, *supra* note 68 at 37-38.
[264] Alyson C Flournoy, "Coping with Complexity" (1994) 27 Loy LA L Rev 809.
[265] See e.g. Byron K Williams, "Adaptive management of natural resources—framework and issues" (2011) 92:5 Journal of Environmental Management 1346.
[266] See e.g. CS Holling, ed, *Adaptive Environmental Assessment and Management* (Chichester, UK: John Wiley and Sons, 1978); Martin ZP Olszynski, "Adaptive Management in Canadian Environmental Assessment Law: Exploring Uses and Limitations" (2010) 21 JELP 1; Ruhl, *supra* note 260.
[267] Rebecca J McLain & Robert G Lee, "Adaptive management: Promises and pitfalls" (1996) 20 Environmental Management 437.
[268] Olszynski, *supra* note 266 at 5.

financing farming and equitable economies, and; translating research to policy and legislation.[269] More data and statistics are needed to drive effective policy change, especially in terms of articulating a better understanding of the relevant barriers and opportunities. For example, "[l]ack of access to credit, limited economic valuation, post-secondary institutions that are slow to adapt to Indigenous student needs, and low representation of Indigenous people in the prairie farming sector hinders capacity building and decision-making that is inclusive of Indigenous values."[270] Relatedly, even though co-management regimes involving Indigenous peoples and local communities provide different models for configuring relationships in a more decentralized manner,[271] while also supporting the principles of collaboration and participation and relationality and reconciliation, care must be taken to ensure that that co-management agreements are genuinely cooperative instead of serving to escalate conflicts and/or worsen marginalization.[272]

7.5.3 Collaboration and Participation

Espousing more and better collaboration and participation in decisions that affect us all is predicated on a guiding principle that "accepts many alternatives and diverse responses at cultural and disciplinary levels: [I]ndigenous knowledge systems and governance; new forms of community governance and responsibilities for the commons; and new ways of living in

[269] Arcand et al, *supra* note 133.
[270] *Ibid* at 635.
[271] See e.g. Fikret Berkes, Johan Colding & Carl Folke, "Rediscovery of Traditional Ecological Knowledge as Adaptive Management" (2000) 10:5 Ecological Applications 1251; Derek Armitage, Fikret Berkes & Nancy Doubleday, eds, *Adaptive Co-Management: Collaboration, Learning, and Multi-Level Governance* (Vancouver: UBC Press, 2007); Fikret Berkes, *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*, 3d ed (Philadelphia, PA: Taylor & Francis, 2012); Graham White, *Indigenous Empowerment through Co-management: Land Claims Boards, Wildlife Management, and Environmental Regulation* (Vancouver: UBC Press, 2020).
[272] See e.g. Alfonso Peter Castro & Erik Nielsen, "Indigenous people and co-management: implications for conflict management" (2001) 4:4-5 Environmental Science & Policy 229.

community and nature."[273] Notably, "the emphasis is not in building a final consensus but in exploring systematic divergences of perspective."[274] In other words, the point is not to agree or to come to unitary prescriptions, but rather, to "pose[] alternative questions, focus[] on neglected issues, include[] marginalized perspectives, triangulate[] contending knowledges, test[] sensitivities to different methods, consider[] ignored uncertainties, examine[] different possibilities, and highlight[] new options."[275]

Meaningful engagement in decisions related to technological design, deployment, and policymaking by a range of stakeholders offers numerous benefits. For one, the privileging of certain perspectives not only unduly narrows the range of potential solutions, but also undermines the significance of a host of other issues. The difficulty in quantifying a concern (for example, those relating to cultural threats presented by agri-food technologies) does not render it immaterial, and an overemphasis on empirical considerations may "overshadow[] or devalu[e] costs—ideological, esthetic, moral, psychological, or otherwise—that are less tangible, more disseminated, and often unquantifiable."[276]

When it comes to the design of technologies and innovations of all kinds, Sasha Costanza-Chock's concept of design justice is illustrative. Design justice is defined as

> a framework for analysis of how design distributes benefits and burdens between various groups of people. Design justice focuses explicitly on the ways that design reproduces and/or challenges the matrix of domination (white supremacy, heteropatriarchy, capitalism, ableism, settler colonialism, and other forms of structural inequality). Design justice is also a growing community of practice that aims to ensure a more equitable distribution of design's benefits and burdens; meaningful participation

[273] Peter Horsley, "Property Rights Viewed from Emerging Relational Perspectives" in David Grinlinton & Prue Taylor, eds, *Property Rights and Sustainability: The Evolution of Property Rights to Meet Ecological Challenges* (Leiden, The Netherlands/Boston: Martinus Nijhoff Publishers, 2011) 87 at 107.
[274] Stirling, *supra* note 224 at 282.
[275] *Ibid* at 280.
[276] Daniel Sarewitz, *Frontiers of Illusion: Science, Technology, and the Politics of Progress* (Philadelphia: Temple University Press, 1996) at 159-60.

> in design decisions; and recognition of community-based, Indigenous, and diasporic design traditions, knowledge, and practices.[277]

In other words: "Don't start by building a new table; start by coming to the table."[278] Inclusion of, accountability to, and control by people "with direct lived experience of the conditions designers claim they are trying to change"[279] is crucial for reducing the systematic reproduction of injustice through all manner of socio-technical innovations, and the normative assumptions that are often embedded within.

In terms of policymaking, facilitating public participation and effectively integrating public concerns into the process is undoubtedly a challenge. Beyond the creation of formal participatory processes, we will need more comprehensive changes in our governance structures and the assumptions that inform them. For example, the "commercialization approach" of current Canadian STI policy "pushes for the conversion of … research into marketable products, a process which requires only very limited forms of public engagement rather than consultation on policy goals."[280] The internal tension between the federal government's role in promoting and regulating biotechnology, in particular, represents a significant conflict of interest that threatens the integrity of the regulatory process.[281] Moreover, as evidenced in the case study of GE animals and the experience of CBAC referenced therein, public engagement efforts can backfire if they amount to little more than insincere, performative gestures designed to ratify a predetermined mandate. Thus, participatory processes that are engaged before any major

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[277] Sasha Costanza-Chock, *Design Justice: Community-Led Practices to Build the Worlds We Need* (Cambridge, MA: The MIT Press, 2020) at 23.
[278] *Ibid* at 84.
[279] *Ibid* at 25.
[280] Michael Howlett & Andrea Riccardo Migone, "The Canadian biotechnology regulatory regime: The role of participation" (2010) 32 Technology in Society 280 at 286.
[281] See e.g. Wilhelm Peekhaus, *Resistance is Fertile: Canadian Struggles on the BioCommons* (Vancouver: UBC Press, 2013) at 154-156.

decisions related to investment, design, and approval of agri-food technologies must be prepared to generate the full range of conclusions, including rejection and denial.

Further, acknowledging a broader range of concerns and a variety of perspectives can have positive consequences as well as helping to avoid negative ones. As Sarewitz puts it:

> When problems lack neat solutions, when environmental and ethical aspects of the issue are prominent, when the phenomena themselves are ambiguous, and when all research techniques are open to methodological criticism, then the debates on quality are not enhanced by the exclusion of all but the specialist researchers and official experts. The extension of the peer community is then not merely an ethical or political act; it can positively enrich the processes of scientific investigation.[282]

Rather than viewing democratic engagement as merely adding noise to the authoritative voices of experts, we should embrace the plurality of our frames of reference as a means of expanding the pool of potentially enlightening contributions. In this way, we can enhance both the quality and the legitimacy of policymaking.

Alternative outlooks are not only valuable in their own right, but can also improve public debate by making it more nuanced, more reflective of reality, and less antagonistic. Accordingly, it is important to fully internalize, respect, and reflect a broad array of stakeholder perspectives and concerns in a non-hierarchized structure of decision-making that does not turn on "a self-referential, self-validating definition of goals and evaluation of results."[283] One-off consultations will generally not be sufficient, as "[p]ublic engagement should not just be a snapshot of current opinion but rather an enduring dialogue between publics and policy-makers."[284] The context, aims, and mechanisms of public engagement must always be considered and reconsidered on an ongoing basis. This is not only a matter of justice, but also a matter of making sound, comprehensive, and democratic law and policy.

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[282] Silvio O Funtowicz & Jerome R Ravetz, "Science for the post-normal age" (1993) Futures 739 at 752-753.
[283] Luigi Pellizzoni, "Responsibility and Environmental Governance" (2004) 13:3 Environmental Politics 541 at 558.
[284] Harmon, Laurie & Haddow, *supra* note 52 at 28.

7.5.4 Relationality and Reconciliation

Finally, within any project of reform, we need to rethink and reimagine how we conceive of relationships, because "human beings become who they are … through the relationships in which they participate."[285] This means that "[o]ur fundamentally social, relational nature—and thus our dependency—cannot be set to one side when we think of any of the core puzzles of law or politics, such as justice, mutual obligation, or the good life."[286] The implications of this line of reasoning are that "justice debates are best structured around a relational inquiry",[287] and that "transformative projects … involve restructuring relations."[288]

Law plays a key role in structuring and shaping our relationships. As Jennifer Nedelsky has contended:

> Law is a powerful means of structuring human relations, and it is also an important way in which concepts like self and autonomy take shape in the world. Law is itself also in constant relation with other social norms and frameworks of thought. Thus, a deep shift in relational habits of thought will have to exceed the context of law. But law can both reveal the importance of such a transformation and participate in it.[289]

Similarly, in the context of the environmental and human rights harms associated with extractive industry operations, Sara Seck has remarked that "relational approaches to the reimagining of constructs and legal tools can serve to focus our attention on cultivating relationships among people and the material world, including relationships in the international sphere, that are essential for environmental and climate justice."[290]

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[285] Jennifer Nedelsky, *Law's Relations: A Relational Theory of Self, Autonomy, and Law* (New York: Oxford University Press, 2011) at 4.
[286] *Ibid* at 28.
[287] *Ibid* at 10.
[288] *Ibid* at 307.
[289] *Ibid* at 4.
[290] Sara L Seck, "Relational Law and the Reimagining of Tools for Environmental and Climate Justice" (2019) 31:1 CJWL 151 at 175-176.

The task that is called for is twofold: first, "we need to be vigilant and guard against unconscious acceptance of legal structures that invoke the bounded autonomous liberal individual."[291] In so doing, "[w]e need to be attentive to how asymmetrical power relationships have enabled conventional Western knowledge to produce hierarchies of knowledge that too often mute modes of understanding the world as deeply relational and interconnected."[292] At the same time, "we must actively seek relational laws and practices".[293] Drawing on non-Western epistemologies and "ways of relating with one another, animals, and the environment, and with past and future generations" can facilitate both of these tasks by helping us to "question the hegemony of Western thought", thereby "liberat[ing] us from the need to engage Western sources, institutions, and concepts in constituting ourselves politically."[294]

Our conceptions of relationships and the values that they express are not only instructive in terms of how we relate to one another, but also in terms of how we understand technologies and their impacts, seeing as "[b]oth technology and humanity are necessarily implicated in and bound together within complex social relationships."[295] These ideas about technologies, society, and relationships are then channelled through legal systems and legal concepts. The Western system of property, in particular, supports the illusion of humans having "a relationship of mastery, control, and often conquest [with the Earth]. It also brings with it an attitude of

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[291] *Ibid* at 177.
[292] Gina Starblanket & Heidi Kiiwetinepinesiik Stark, "Towards a Relational Paradigm – Four Points for Consideration: Knowledge, Gender, Land, and Modernity" in Michael Asch, John Borrows & James Tully, eds, *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (Toronto: University of Toronto Press, 2018) 175 at 181.
[293] Seck, *supra* note 290 at 177.
[294] Starblanket & Stark, *supra* note 292 at 194.
[295] Arthur Cockfield & Jason Pridmore, "A Synthetic Theory of Law and Technology" (2007) 8:2 Minn JL Sci & Tech 475 at 491.

towering and unquestionable superiority over Indigenous peoples and of the so-called civilizing duty to impose this system over them and their lands."[296]

Meanwhile, the legal systems of many Indigenous cultures features the idea that there is a set of reciprocal rights and responsibilities between humans, other species, and the Earth. The powers enabled by science and technology should not be taken as a way of abdicating these responsibilities, but should instead be seen as heightening them. By manipulating natural processes to our benefit, we incur obligations of assistance in turn,[297] not only as a moral imperative but also as a practical reality.

Feminist critiques have also been instrumental in uncovering biases in Western laws, epistemologies, and ethics. In contrast with traditional, male-oriented conceptions of ethics, in which moral reasoning is viewed through a framework of rules, rights, universality, and impartiality,[298] feminist ethics[299] presents a different model of citizenship, informed by different values. In particular,

> [a]n important contribution of feminist moral theory has been to question the deeply held assumption that moral agency and full citizenship require that a person be autonomous and independent. Feminists have exposed this assumption as inappropriately individualistic and derived from a specifically male experience of social relations, which values competition and solitary achievement.[300]

Moving away from championing rugged individualism and solitary achievement leads us to see that "dependence itself is not necessarily problematic, it is simply an inevitable part of the fabric

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[296] James Tully, "Reconciliation Here on Earth" in Michael Asch, John Borrows & James Tully, eds, *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (Toronto: University of Toronto Press, 2018) 83 at 104.
[297] Wyatt Galusky, "Technology as Responsibility: Failure, Food Animals, and Lab-grown Meat" (2014) 27 J Agric Environ Ethics 931.
[298] Alison M Jaggar, "Feminist Ethics" in Hugh LaFollette & Ingmar Persson, eds, *The Blackwell Guide to Ethical Theory*, 2d ed (Malden, MA: Blackwell Publishing, 2013) 433-460.
[299] Kathryn Norlock, "Feminist Ethics" in Edward N Zalta, ed, *The Stanford Encyclopedia of Philosophy* (Summer 2019 Edition), online: <https://plato.stanford.edu/archives/sum2019/entries/feminism-ethics/>; Marilyn Friedman & Angela Bolte, "Ethics and Feminism" in Linda Martín Alcoff & Eva Feder Kittay, eds, *The Blackwell Guide to Feminist Philosophy* (Malden, MA: Blackwell Publishing, 2007) 81-101 .
[300] Young, *Justice and the Politics of Difference*, *supra* note 26 at 55.

of life."[301] To this end, an ethic of care emphasizes the interconnections between humans, nonhuman animals, and Nature more broadly, as opposed to a focus on individual rights.[302]

An ethic of care also situates these interconnections relationally to one another, which allows the full scope of the complexity of socio-ecological matrix to emerge. Relationality is a key tenet of ecofeminism: "an ecofeminist ethic involves a reconception of what it means to be human, and in what human ethical behavior consists. Ecofeminism denies abstract individualism. Humans are who we are in large part by virtue of the historical and social contexts and the relationships we are in, including our relationships with nonhuman nature."[303] Accordingly, ecofeminists advocate for a cosmology that recognizes the foundational importance of co-operation and mutual care and love.[304]

The project of restructuring relations has special relevance to Canada, given its status as a settler colonial nation. The narrative of reconciliation "has risen in recent years at all levels of government and in many pockets of civil society to educate Canadians about [Canada's settler colonial] history and to start to systematically address colonialism's effects."[305] The aims of reconciliation do not pertain only to addressing historic social harms, but also environmental ones. As Borrows points out, "[r]econciliation between Indigenous peoples and the Crown requires our collective reconciliation with the earth."[306]

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[301] Christopher J Preston & Fern Wickson, "Broadening the lens for the governance of emerging technologies: Care ethics and agricultural biotechnology" (2016) 45 Technology in Society 48 at 52.
[302] Linda A Malone, "Environmental Justice Reimagined through Human Security and Post-Modern Ecological Feminism: A Neglected Perspective on Climate Change" (2015) 38 Fordham Int'l LJ 1445 at 1467.
[303] Karen J Warren, "The Power and the Promise of Ecological Feminism" (1990) 12 Enviro Ethics 125 at 143.
[304] Maria Mies & Vandana Shiva, *Ecofeminism* (Halifax: Fernwood Publications, 1993) at 6.
[305] Maneesha Deckha, "Unsettling Anthropocentric Legal Systems: Reconciliation, Indigenous Laws, and Animal Personhood" (2020) 41:1 Journal of Intercultural Studies 77 at 77.
[306] Borrows, *supra* note 105 at 49. However, he adds the qualification that "[t]urning towards Indigenous law does not automatically solve our environmental and relational crises. There must be a revitalization of Indigenous law based on seasonal relationships and structural reform to generate reconciliation." (at 51)

Relationality and reconciliation both require significant transformations in the way that we think about and enact broad categories of relationships. For instance, the relationship between settler colonial and Indigenous legal orders has been one of blatant hierarchy and domination. The alienation that the Indigenous peoples of Canada have experienced and continue to experience from their land and waters can be directly traced to historic processes of legal and regulatory dispossession.[307] Giving back the land and allowing for Indigenous self-determination is thus central to righting these wrongs. Long-term stewardship of land and water, based on worldviews that internalize principles like reciprocal responsibility, have also been found to generate more sustainable outcomes.[308] Hence, the recognition and acceptance of "Indigenous jurisdiction can … help mitigate the loss of biodiversity and climate crisis."[309]

7.6 Conclusion

In tackling the defining challenges of our time, it will be inadequate to keep existing legal, political, economic, epistemological, and ethical frameworks intact and rely exclusively on technologies to try to repair resulting problems as they arise. As such, a wide variety of elements will have to go into any comprehensive recipe for safeguarding our future on Earth. Realizing transformative shifts towards greater sustainability will "require many different sectors to rethink themselves, and to work together in dynamic and interconnected ways."[310] There will certainly need to be changes to substantive laws and policies, especially those that bear on the environment. There also need to be corresponding changes to the assumptions that underlie them, including those about STI, progress, and the role of the state.

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[307] Yellowhead Institute, *Land Back: A Yellowhead Institute Red Paper* (October 2019), online: <https://redpaper.yellowheadinstitute.org/wp-content/uploads/2019/10/red-paper-report-final.pdf> at 6.
[308] *Ibid* at 64.
[309] *Ibid* at 12.
[310] Mazzucato, *supra* note 228 at 6.

In addition to structural changes to law and governance, "[s]tructural changes to economies are also key to shifting action over long time scales, including technological and social innovation regimes and investment frameworks that internalize environmental impacts such as externalities of economic activities, including by addressing environmental impacts in socially just and appropriate ways."[311] The closer attention that is being paid to agri-food policy and innovation policy presents a timely opportunity to put them on a more sustainable and equitable course. By underscoring the importance of taking a coordinated, reflexive, collaborative, and relational approach to policymaking and policy implementation, we can encourage the development of an orientation that is more systemic, long-term, and inclusive, and therefore better equipped to integrate a broader range of considerations beyond narrow economic indicia of success.

Though law and policy has been part of the problem when it comes to the environmental, social, and ethical issues that we are contending with today, it also has a significant role to play in stimulating change, especially if used to inculcate "a powerful sense of global citizenship, interdependence, and shared responsibility".[312] For example, law could recognize and establish inherent limits related to the environment, and through an emphasis on intergenerational justice and interpersonal equity, could be used "to embody affection for the earth and our fellow beings."[313] The ultimate aim would not merely be to reactively address the harms arising from "[r]elating to the living earth as a storehouse of commodifiable resources",[314] but to re-embed

[311] Diaz et al, *supra* note 140 at 31.
[312] James Gustave Speth, *The Bridge at the Edge of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability* (New Haven: Yale University Press, 2008) at 225.
[313] Borrows, *supra* note 105 at 61.
[314] Tully, *supra* note 296 at 105.

ourselves in “the webs of interdependent ecological relationships that sustain the natural and human world”.[315] This means that no less than a paradigm shift is needed.

Paradigm shifts are exceedingly difficult to effect, battling as they are against institutional inertia, powerful interests vested in maintaining the status quo, and culturally and socially entrenched habits. Yet, there are glimmers of hope that the time is ripe for a major revolution to take root. Though more radical transformations in the way that we think and behave will likely take a long time to percolate at the systemic level, there are many ways by which we can begin to take small steps at the individual level: “As people act in participatory, interdependent, and mutually sustainable ways in more and more relationships, the way that the world is perceived and disclosed to them begins to change accordingly.”[316] Technologies are not shortcuts to or stand-ins for this more demanding but more meaningful process.

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[315] *Ibid*.
[316] *Ibid* at 111.

8. Conclusion

Food is a staple of life for all of us, rendering it imperative that the conditions for producing sufficient quantities of healthy, nutritious, culturally appropriate food for a growing population remain viable. Unfortunately, as established in Chapter 1, the global food system currently faces extraordinary challenges across multiple dimensions, including public health concerns relating to malnutrition and social justice concerns relating to food insecurity. To make matters worse, we are staring down an environmental catastrophe that threatens our very existence and survival.

In addition to the ongoing spectre of climate change, unprecedented modern events like the global COVID-19 pandemic of 2020 further threaten the food system—but also present concomitant opportunities for change.[1] If nothing else, the evidence that everything in the world is interconnected is mounting. The precariousness of our economies and modern industrial systems is becoming blatantly clear, as is the importance of strong governance, particularly on the part of the state (as opposed to private initiatives on the part of specific sectors or corporations). Simultaneously, the value of the views, concerns, and contributions of those who have traditionally considered as being at “the bottom” —by virtue or race, class, gender, or other characteristics—is becoming ever more apparent. Elaborate technological systems designed to produce commodities more efficiently are of little use if demands shift, labour flows stop, supply chains break, or ecosystems collapse.

On the upside, the appetite for food systems reform has grown in recent decades. Governments, corporations, CSOs/NGOs, and other stakeholders are all expressing interest in

[1] Lawrence Haddad et al, “The COVID-19 Crisis and Food Systems: addressing threats, creating opportunities”, News Release (23 March 2020), online: Global Alliance for Improved Nutrition <https://www.gainhealth.org/media/news/covid-19-crisis-and-food-systems-addressing-threats-creating-opportunities>; IPES-Food, “COVID-19 and the crisis in food systems: Symptoms, causes, and potential solutions”, Press Release (14 April 2020), online: <http://www.ipes-food.org/_img/upload/files/COVID-19%20Press%20Release%20EN%281%29.pdf>.

shifting away from production systems that prioritize yield above all else. Food systems have significant impacts on environmental and human health, as elaborated on in Chapter 2, and there are many ways in which the Canadian agri-food sector could be made more sustainable.

However, multiple and conflicting narratives about the direction food systems reform should take have arisen in the literature, and scholars have subsequently found themselves divided by "polarized approaches that become entrenched around very distinctive technological, social, and ideological perspectives."[2] Because proponents of various paradigms tend to come from different economic, epistemic, and ethical positions, informed by divergent assumptions, "debates about the most appropriate solutions … have resulted in acrimony and, in many cases, a policy stalemate".[3] For example, while the clear failings when it comes to the governance of food systems have generated the proposal of numerous alternatives, none of these have gained universal buy-in, nor is this an outcome that can be reasonably expected. To more effectively inform policymaking and promote better outcomes, we need to break free from the trappings of silos of all kinds, and accept that "no single pathway will work in every situation."[4]

Existing approaches to transforming food systems can be conceptualized under three orientations: food system reform, food justice, and food sovereignty.[5] Without going into depth into the particulars of any of these approaches or their points of divergence, it suffices to say that

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[2] Evan Fraser et al, "Biotechnology or organic? Extensive or intensive? Global or local? A critical review of potential pathways to resolve the global food crisis" (2016) 48 Trends in Food Science & Technology 78 at 79. In the context of the literature on food security, Fraser et al found at least four key pathways to change presented: Technology for Production; Equity and Distribution; Local Food Sovereignty; and Market Failures, Policy and Regulation.
[3] *Ibid* at 83.
[4] *Ibid* at 84.
[5] Constance Gordon & Kathleen Hunt, "Reform, Justice, and Sovereignty: A Food Systems Agenda for Environmental Communication" (2019) 13:1 Environmental Communication 9; Eric Holt-Giménez, "Food security, food justice, or food sovereignty" in Alison Hope Alkon & Julian Agyeman, eds, *Cultivating Food Justice: Race, Class, and Sustainability* (Cambridge, MA: The MIT Press, 2011) 309-330. The concept of food justice was discussed in depth in Chapter 4.3.4.

they each offer helpful insights into the failings of the corporate food regime, the roots of food insecurity, and the components of agendas for change. Yet, among these existing approaches, there has been a lack of specific attention paid to issues relating to the expanding use of technology in the agri-food sector.

While issues relating to technology are by no means the only salient or pressing concerns when it comes to agri-food law and policy, the growing ubiquity of science and technology in our daily lives renders the need for critical reflection on this trend more urgent than ever. Technologies undoubtedly have an important role to play in addressing some of the most vexing challenges of our time, including those pertaining to food, but they are not cure-alls in and of themselves, especially as they are presently understood. Further, there are distinct ways in which technologies and the ways in which they are regulated (or not) can enact, exacerbate, or assuage intersecting oppressions, such as by favouring the views, priorities, and experiences of those who are already privileged.

As explained in Chapter 3, in the Western cultural context, there is a strongly ideological dimension to technology that axiomatically connects technological progress with social progress. Technologies also tend to operate within a certain kind of unreflexive logic that denies their own role in the problems they then claim to be able to solve, as revealed by the case study of cellular agriculture discussed in Chapter 6.1. When technocentrism is implicitly coded as the default stance, there is a concomitant failure to acknowledge that there is a plethora of reasons to be skeptical of technologies, regardless of (or even because of) their purported intents.

For one, many scientific and technological developments that were birthed amid grand expectations have left promises unfulfilled. This certainly does not mean that technologies are never capable of living up to their original claims, or that their contributions are to be discredited on this basis. However, it does remind us that the rhetoric around new and emerging technologies is susceptible to being used by entrepreneurs and others with vested interests to fuel potent illusions. The continual invocation of the mantra of "innovation" belies the fact that innovation does not invariably lead to improved environmental, social, and economic outcomes for all. Accordingly, our expectations of technologies should be tempered with a recognition that there are often as many unpredictable, counterintuitive, and unequitable consequences of technologies as there are beliefs, hopes, and promises.

Given their various entanglements, technologies are not merely devices that deliver specific ends in isolation, but can trigger profound transformations of material and social structures.[6] Processes like lock-in, path dependence, and reverse adaptation can make it more difficult to change course later down the line, making it all the more imperative that the full range of the implications of new and emerging technologies are carefully considered at the outset. The Green Revolution is an instructive case in point. Technology assessment and regulation thus needs to proceed with a stronger grasp of the various blind spots, limitations, and weaknesses associated both with individual technologies and with broader technological systems. These are not simply "externalities" to be managed through regulation, but are, in many ways, problems that are internal to technologies themselves.

In particular, technologies that are especially amenable to exploitation, commercialization, and capitalization via patent regimes and other forms of private and exclusionary property rights should attract greater scrutiny, such that protections can not only be effected through legal regimes, but also be better built into socio-technical architectures, such as by facilitating increased discourse around their deployment and ensuring greater democratization

[6] Christopher J Preston & Fern Wickson, "Broadening the lens for the governance of emerging technologies: Care ethics and agricultural biotechnology" (2016) 45 Technology in Society 48 at 49.

in their design. Taking a wider systems perspective also encourages us to be attentive to factors like the increasing convergence of different kinds of technologies, which can accelerate the pace of change and amplify the resulting consequences. From a social perspective, this can occur when underlying advantages or disadvantages or compounded; from an environmental perspective, this can occur through the "rebound effect" discussed in Chapter 3.4.

Rather than seeing science, technology, and innovation as neutral tools to propel society onward toward ever greater heights, they are better understood as unavoidably normative practices and processes that are co-produced with society and its most powerful actors and institutions, including law. Yet, as I elaborate in Chapter 4, law and policy are also socially constructed. This contingency is frequently obscured by the fact that "policy is often set out as objective, neutral and value-free, and is often phrased in legal or scientific language."[7] In this way, the myriad assumptions and political choices that go into policymaking are rendered invisible, which makes it difficult to identify and disrupt entrenched and biased patterns of thinking and action.

Insofar as establishing a less partial understanding of the underlying problems is an essential precondition to formulating more effective solutions, theory is an invaluable tool to help us better evaluate various alternatives. Critical theories of law "illuminate not only channels of critique but also a multiplicity of avenues for action through dialogic engagement with the law, its structures, and its normative discourses."[8] Though law is deeply implicated in the perpetuation of many injustices, there is real potential to use law to enable and enshrine other

[7] Melissa Leach, Ian Scoones & Andy Stirling, *Dynamic Sustainabilities: Technology, Environment, Social Justice* (Washington, DC: Earthscan, 2010) at 132.
[8] Carys J Craig, "Critical copyright law and the politics of 'IP'" in Emilios Christodoulidis, Ruth Dukes & Marco Goldoni, eds, *Research Handbook on Critical Legal Theory* (Northampton, MA: Edward Elgar Publishing, Inc., 2019) 301 at 319-320.

forms of social ordering. Although law is part of the problem, it can and must be a part of the solution, including by giving expression to a variety of perspectives and furnishing opportunities for dissent.[9] As such, law and policy also have the counter-hegemonic capacity to help direct technological systems towards common aims.

Drawing on STS and insights from critical feminist theory, critical race theory, and postcolonial theory usefully shows us that technologies and their impacts generally track to power. Thus, it is important to acknowledge that achieving or moving towards technology justice is a profoundly political project. Many technologies are steeped in long legacies of inequality, and have troublingly sexist, racist, and colonial pasts. Even today, there is something lopsided about the deleterious impacts of technologies that is conveniently ignored in the excitement about their achievements. Numerous examples can be offered in support of this statement, including the case studies presented in Chapter 6.

Moreover, the scope of what constitutes legitimate technology has been constricted by the fact that the power to define, create, and use technology has been held by a specific group. Namely, science and technology have long been the domains of men. What has excluded a large part of women's work and material contributions from the usual definition of technology "is not only the simplicity of the equipment used, but the fact that it implies a different concept of what technology is about."[10] Though we must be cautious about slipping into essentialist characterizations, the automatic association of innovation with large-scale, "high tech", and industrial systems, as opposed to smaller-scale, "low tech", and domestic systems, such as seed-saving and conservation initiatives, unduly privileges one specific perspective to the exclusion of

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[9] Karen Morrow, "Genetically Modified Organisms and Risk" in Luc Bodiguel & Michael Cardwell, eds, *The Regulation of Genetically Modified Organisms: Comparative Approaches* (New York: Oxford University Press, 2010) 54 at 75.
[10] Arnold Pacey, *The Culture of Technology* (Cambridge, MA: The MIT Press, 1983) at 104.

other useful and significant contributions and forms of knowledge. Innovative change is not only possible in the form of disruptive new developments, but can also come about from a different way of looking at the same issue, which can be facilitated by including a diversity of voices in conversations about technological development, design, and regulation.

Meanwhile, we must avoid the deterministic trap of assuming that just because a technology is being promoted or can be developed, it should be adopted or supported. Questions of technical capacity should not be conflated with questions of ethical appropriateness. In today's world, innovation is not something that should not be pursued for its own sake, and only by a limited range of actors, but should be driven by a coherent mission directed at meeting major societal problems. Ideally, such missions would be informed by the identification and articulation of shared commitments and aspirations. The overarching goal of technological adaptation and innovation should be minimizing harms to the environment and meeting the needs of all people and life forms, as opposed to maximizing gains and manufacturing wants. In other words, the needs, aspirations, and experiences of people must form the central basis for action, as opposed to those of corporations, economies, and machines.

The situation is grim, but it is not a lost cause. It is possible to "create systems of production, energy, transportation, information handling, and so forth that are compatible with the growth of autonomous, self-determining individuals in a democratic polity."[11] In order to do so, we must first ask the right questions. As Langdon Winner put it: "Even though one commits oneself to ends radically different from those in common currency, there is no real beginning until the question of means is looked straight in the eye."[12] To this end, a technology justice

[11] Langdon Winner, *Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought* (Cambridge: The MIT Press, 1978) at 325.
[12] *Ibid* at 329.

framework, as set out in Chapter 5, can structure and enrich the conversation about strategies, substitutes, and shortcomings, in order to better link technological means with equitable ends.

For technology justice to be realized, we need to rethink the way we govern technologies at each stage of the life cycle. The goal is not only to mitigate the impacts of technologies, but to more fundamentally question the paradigms that dictate how and why technologies are developed, designed, deployed, used, and regulated. Consequently, we need a governance system that can "manage and reduce the very real and substantial environmental risks that stem from today's use of technology, while simultaneously steering innovation processes to deliver the new green technologies needed to keep humankind safely within the planetary boundaries."[13]

As I outline in Chapter 7, this will require a whole of government approach that transcends disciplinary conventions, fractious politics, and the limitations of traditional policy instruments. Many have already identified the need for more holistic governance when it comes to agri-food law and policy in Canada, and the burgeoning prominence of new and emerging technologies within the agri-food sector strengthens the case for taking a more coordinated, reflexive, collaborative, and dynamic approach. Policies at the federal level, like a national food policy and a national innovation policy, can serve to establish general goals, principles, and metrics for assessment, while more local levels of government are better positioned to establish the particulars of implementation. Recent initiatives in these areas are encouraging, but there is much more that remains to be done, especially in terms of accounting for a comprehensive range of concerns for differently situated groups.

The role of the state is not to be underestimated in effecting technology justice, but the state is not the only relevant player. Technology justice relies on actors at all levels—including

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[13] Simon Trace, *Rethink, Retool, Reboot: Technology as if people and planet mattered* (Rugby, UK: Practical Action Publishing, 2016) at 28.

policymakers, the judiciary, and other members of the legal profession, as well as scientists and technologists, producers, and consumers—to define what kinds of technologies are appropriate for a given set of conditions, how those with the greatest need can meaningfully access those technologies (or at the very least, not be prohibited from accessing those technologies), and how those technologies can best be put to use in the public interest. Engaging a wide range of stakeholders through participatory processes that allow for deliberative, democratic, open-ended dialogue and engagement will be a crucial part of this process.

Existing justice movements have made and continue to make laudable contributions in terms of advancing equality agendas, and the concept of technology justice offered here is not intended to supplant them. Rather, it seeks to augment current and ongoing efforts by stressing specific dimensions of STI practice and policy that raise unique justice-related concerns, using the agri-food sector as an illustrative case in point. Though some may argue that this distinction amount to little more than splitting hairs over semantics, framing clearly matters for policymakers and their publics.

Framing a problem as a technical one plays an essential role in justifying a technocratic approach to solving it, which pre-emptively shuts down a fulsome consideration of the social and ethical dimensions. Dominant narratives have tended to present technologies as the best—and sometimes even the only—solutions to the problems that we face. As a result, not only are technological fixes prioritized, but the realization of alternatives is also suppressed. By focusing too narrowly or uncritically on technological “silver bullets”, we run the risk of diverting time, energy, attention, and resources from pathways that may be simpler or more viable in current conditions. In accepting a productionist position as a taken-for-granted or natural starting point, there is scant space left for serious discussion of different pathways for meeting demand (such as addressing existing leakage points, like food waste), or strategies for dismantling entrenched institutional barriers to change.

Technological improvements will not be sufficient if unaccompanied by concomitant shifts in human behaviour to ensure that the potential benefits of technologies are fully realized. We need to move beyond overly simplistic appeals to science or rationality to recognize that "[g]ood ideas and evidence do not necessarily result in change … there is a huge array of cognitive, institutional and political pressures … [that] often close down options towards narrow risk-based and stability-oriented perspectives, reinforcing the interests of the powerful."[14] Left unchecked, dominant paradigms and their adverse consequences will continue to be perpetuated; corrections need to be built into our systems. Thus, if we are to see a transformative shift for the better in our food systems, we need structural interventions that will address the root causes of unsustainability and injustice.

Beyond simply acknowledging the flaws in our existing frameworks, we need to be more proactive about taking concrete action toward building a different kind of future than the one towards which we are currently headed. This includes gathering more data to fill gaps in our knowledge, striving to decouple economic growth from environmental degradation, and experimenting with different kinds of regulatory tools and levers at multiple scales. Undoubtedly, some of these efforts will not be successful, in the sense that they will not connect directly with the hoped for outcomes. However, they will all contribute to the learning process required to make cumulative improvements. The continuance of environmental harms and systemic inequalities cannot be justified on account of the uncertainty associated with any

[14] Leach, Scoones & Stirling, *supra* note 7 at 125.

proposed solutions. Demanding that alternatives to the existing state of affairs meet unrealistic standards of perfection seriously thwarts any ability to move forward.

This struggle will not only be fought on discursive or legalistic battlegrounds. To put it starkly, incremental and individual changes will not be enough. Especially for those of us living in wealthy, industrialized countries, we need to confront the dark realities of capitalism, materialism, and overconsumption, and the far-reaching changes to our attitudes and our behaviours that such a sober reckoning demands. I am attentive to the difficulty associated with any program of radical social and ethical reform or reconstruction. I am under no illusion that what I am proposing will be straightforward, or linear, or will not create some other kinds of negative consequences of its own.

Nevertheless, it is imperative that we use this moment to try to move closer to establishing the conditions we need to sow the seeds of sustainability and justice in our hearts and minds, such that they will sprout into our laws and practices. Indeed, "[s]ocial change will come through seeds growing in well prepared soil – and it is we, like the earthworms, who prepare the soil. We also seed thoughts and knowledge and concern. We realize there are no guarantees as to what will come up … [but] without the seeds and the prepared soil nothing will grow at all."[15] Although the task is large, this is no time for defeatism. As much as we need pragmatic solutions for the problems we face in the present, we also need to draw on our wells of courage, ambition, and creativity to engage in more expansive visioning of a brighter future, along with our role in it. In so doing, we should make central our fundamental dependence on one another and on the Earth, and the corresponding responsibility to care more thoughtfully for all of our relations.

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[15] Ursula M Franklin, *The Real World of Technology*, Revised Edition (Toronto: House of Anansi Press Inc, 2004) at 121.

The current *modus operandi* has allowed short-term economic priorities, large-scale industrial undertakings, and exploitative capitalist models to continue to dominate the agri-food sector, often at the expense of environmental sustainability (both now and into the future) and social justice (for a multiplicity of marginalized groups). Furthermore, the rush to embrace technological fixes for complex problems may pre-empt a complete accounting of things like trickle-down effects, unimagined consequences, and cumulative considerations. Incorporating a broader range of concerns, including a diversity of voices, and taking a longer-term perspective are obvious ways to strengthen existing frameworks and shed light on different possibilities, and a technology justice framework is one way to think more critically about the principles, processes, and outcomes associated with any given pathway.

In this dissertation, I have endeavoured to bring together several different theoretical frameworks and bodies of literature in an effort to create a more robust analysis of the relationships between law, technology, the environment, society, and various forms of justice, particularly in the context of food and agriculture. Though there are many connections that can be drawn between these areas, there has hitherto been a lack of attention to the ways in which they all mutually inform and impinge on one another. This work seeks to fill that gap, to allow us to have a "deeper, more informed, and more honest public policy debate"[16] about not only effective, but also ethical ways to address the most challenging issues that we face today.

At the same time, a healthy foundation of knowledge on which to build already exists; it is not necessary to reinvent the wheel. The project that remains is to arrange our growing collection of new and reconfigured ideas on a different scaffolding. The hope is that synthesizing existing bodies of research, best practices for governance, and other kinds of epistemologies and

[16] Trace, *supra* note 13 at 224.

ethical frameworks can help lead us towards forms, methods, and outcomes of innovation that are both socially and environmentally beneficial, as opposed to principally being profitable. Together, we can better reflect on how to sustain that which sustains us—and formulate the kinds of laws and policies, technologies and tools, and values and relationships that can help us get there.

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