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CANADA, GERMANY, AND THE SUSTAINABILITY OF THE GLOBAL FOOD SYSTEM – DETERMINANTS, CHALLENGES, AND RECOMMENDATIONS

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EXECUTIVE SUMMARY

The global food system refers to the interconnected network of production, distribution, and consumption of food on a worldwide scale. Its objective is to ensure food security. Over the last 50 years, continuous improvements in farming methods, new technologies, and infrastructure capacity in international supply chains have allowed for a more affordable and safer food supply for an increasing global population. This has fostered domestic and foreign political stability. Fueled by the liberalization of exchanges and the rise of agri-food giants, and under the influence of cheap fossil fuels and mineral fertilizers, agricultural systems worldwide have converged towards industrial agriculture to feed a growing population that is also adopting similar food habits. Globalization and large-scale public policies have enabled billions of people to escape food insecurity, mostly in low- and middle-income countries. However, food security has come at a large environmental cost and has not always been successful in terms of equity. Particularly in Western countries, unhealthy and unsustainable diets are becoming the norm, while producers are caught in the crossfire between more stringent environmental policies and the economic push for competitiveness in international markets.

Furthermore, the fragility of food supply and the inelasticity of demand provide a perfect opportunity for foreign powers to exert pressure on food-insecure countries, using it as another tool of unconventional warfare. In their current state, it seems impossible within food systems to balance economy, environmental justice, and social justice. This calls for large-scale agri-food policies. There is a need to derisk investments in agriculture to promote the so-called agro-ecological transition, by incentivizing innovation and rewarding environmentally friendly practices. A shared governance of more territorial agri-food systems should be designed to ensure a fair distribution of monetary and non-monetary benefits across stakeholders. Mobilizing a "One Health" approach, policy programs should address the existing contradictions in the food systems, from a producer's perspective but also to better educate consumers. In particular, international trade agreements and standards for financial and extra-financial disclosure should be used as tools to correct market failures and inequities in the current food system

RÉSUMÉ

Le système alimentaire mondial consiste en un réseau interconnecté de producteurs, distributeurs et consommateurs, qui assure la sécurité alimentaire. Après la 2nde guerre mondiale, l'intensification de la production agricole et les progrès technologiques et logistiques ont permis à la fois d'avoir un accès à une alimentation moins chère et de meilleure qualité, mais également de stabiliser les gouvernements et les relations internationales. La libéralisation des échanges et l'émergence de géants de l'agro-alimentaire a certes élevé les niveaux de sécurité alimentaire, mais au prix d'impacts environnementaux importants, et sans résoudre les enjeux de justice sociale. A l'ouest, la consommation alimentaire est de plus en plus nocive pour la santé et pour la planète, quand en même temps les agriculteurs subissent un effet de ciseaux entre l'injonction de produire plus pour rester compétitifs sur les marchés mondiaux, et celle de produire mieux. De plus, la fragilité de l'offre alimentaire, ajoutée à l'inélasticité de la demande, crée des tensions géopolitiques habilement et malheureusement exploitées par certaines puissances, usant de l'arme alimentaire au sein de leur arsenal. Dans leurs états actuels, les systèmes alimentaires échouent à nourrir les hommes de manière équitable et sans abuser des ressources naturelles et de la capacité de la planète à les régénérer. Dé-risquer les investissements pour l'innovation et la mise en place de pratiques permettant de mettre en mouvement la transition agroécologique apparaît essentiel. La mise en place de modèles de gouvernance plus horizontaux, au sein de systèmes alimentaires territorialisés, pourra permettre une meilleure distribution des valeurs ajoutées monétaires et non monétaires entre les parties prenantes, tout en les capacitant. Une planification agricole et agroalimentaire ambitieuse devra dépasser les contradictions inhérentes au système actuel, supporter les producteurs dans la transition mais aussi éduquer les consommateurs ; elle devra se faire en suivant une approche « une seule santé ». Les accords d'échange internationaux, ainsi que les outils de comptabilité sont des leviers pouvant être mobilisés pour corriger les imperfections de marche et restaurer justice sociale et environnemental

Global food system: an addition of local food systems?

Food system: what and what for?

The notion of food system aims to capture the way in which people “organize themselves in space and time to obtain and consume their food”^{1,2}. It makes it possible to represent relationships among activities, flows (physical, economic, informational), institutions, and knowledge that contribute to feeding a population. A food system is defined by starting from a population of which we seek to understand how it feeds itself and its food source. Territorialized food systems promote products in local sectors, favour family farming and networks of agri-food companies and short marketing circuits to better share the value created, to invent new production models. Conversely, the global food system refers to the interconnected network of production, distribution, and consumption of food on a worldwide scale. Food systems are defined by several key features³:

1. **Biological:** Including cultivation, harvesting, processing, and consumption of living organisms, including plants, animals, and microorganisms, as essential components of the food supply chain. They are subject to a set of risks, with mitigation tools not always present.
2. **Complexity:** Food systems include agricultural production, processing, distribution, consumption, waste management, and governance structures.
3. **Multifunctionality:** Beyond food production, food systems contribute to economic development, employment generation, cultural identity, social cohesion, and environmental sustainability.
4. **Territoriality:** Food systems are more or less embedded within specific geographical territories, shaped by local ecosystems, cultural traditions, social dynamics, and economic conditions.

¹ Malassis Louis. Economie agricole, agro-alimentaire et rurale. In: *Économie rurale*. N°131, 1979. pp. 3-10. DOI : <https://doi.org/10.3406/ecoru.1979.2629>

² Roni A. Neff and Robert S. Lawrence, “Food Systems,” in Roni Neff, Introduction to the U.S. Food System (San Francisco [CA], Jossey-Bass, 2015), 4-22.

³ Rastoin Jean-Louis, Ghersil Gérard, *Le système alimentaire mondial. Concepts et méthodes, analyses et dynamiques*. Éditions Quæ, « Synthèses », 2010, ISBN : 9782759206100. DOI : 10.3917/quaer.rasto.2010.01. URL : <https://www.cairn.info/le-systeme-alimentaire-mondial--9782759206100.htm>

5. Dynamic Adaptation: Food systems are dynamic and constantly evolving in response to changing social, economic, environmental, and technological factors.
6. Governance and Policy: Food system governance involves a mix of public, private, and civil society actors at local, national, and global levels.
7. Objective driven: Food systems inherently involve normative goals and values related to societal aspirations and policy objectives, first and foremost food security (**see Box n. 1**), but also potentially sustainability and social justice.

Box n. 1: food security

Dimensions of food security

The definition of Food Security was set in 1996 at the World Food Security Summit 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” (FAO, 1996).

Four dimensions are used to evaluate the level of food insecurity a country is facing.

- 1. Food Availability:** The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid). This aspect focuses on the macro-level supply and its readiness to meet population needs.
- 2. Food Access:** Access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic, and social arrangements of the community in which they live (including traditional rights such as access to common resources). This aspect is more concerned with micro-level, individual capabilities to secure nutritional needs within their societal structure.
- 3. Utilization:** Utilization of food through adequate diet, clean water, sanitation, and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.
- 4. Stability:** To be food secure, a population, household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks.

Status of food security, in Canada Germany, and the world

In 2022, 1.3% of the Canadian population was considered some level of food insecure (Proof 2023), and 1.2% of the German population.

<https://data.worldbank.org/indicator/SN.ITK.SVFI.ZS?locations=DE-CA>

According to the 2023 edition of the State of Food Security and Nutrition in the World report, between 691 and 783 million people faced hunger in 2022, an increase of 122 million compared to 2019. Apart from hunger, 2.4 billion people experienced moderate or severe food insecurity, 900 million faced

severe food insecurity and over 3.1 billion could not afford a healthy diet.
<https://www.fao.org/3/CC3017EN/online/CC3017EN.html>

Global food system shapers

Food systems are dynamic and influenced by exogenous factors, such as climate change, technological change or global economy, plus endogenous factors such as agricultural labour market or consumers' preferences⁴. Below, we describe the major drivers of change, with an emphasis of their past and current status in both Canada and Germany.

Determinant n. 1: agricultural systems are embedded in food systems

The interdependence between the global food system and agricultural systems is a fundamental aspect of food security and sustainability. Agricultural systems, encompassing production, distribution, and management of food resources, are foundational components of the global food system; the latter relies on agricultural systems to meet demands of a growing population, provide nutritional sustenance, and ensure food access and distribution worldwide. Changes in agricultural practices, including technological innovations, land use patterns, or policy interventions, can have profound effects on the function and resilience of the global food system. Similarly, disruptions or challenges within the global food system, such as food price volatility, trade imbalances, or climate-related shocks, can reverberate through agricultural systems, impacting production, livelihoods, and food security⁵.

Agricultural systems vary widely across regions, climates and cultures. The main differentiators are: (i) the level of national and international commodities' trade - from subsistence agriculture to commercial agriculture; (ii) reliance on energy, and synthetic inputs such as fertilizers and pesticides; (iii) the uptake and application of technological advancements; (iv) synergy with rural and territorial development; (v) infrastructure to grow, harvest and move food; (vi) human capacity (R&D in private and public sectors, initial and continuous education of producers); and (vii) considerations for social-ecological outcomes. Overall, Western agricultural systems have largely been geared towards industrial agriculture i.e., producing crops and livestock for sale in markets involving larger-scale operations, mechanization, and relying on modern inputs and

⁴ Hueston W, McLeod A. Overview of the global food system: changes over time/space and lessons for future food safety. In: Institute of Medicine (US). Improving Food Safety Through a One Health Approach: Workshop Summary. Washington (DC): National Academies Press (US); 2012. A5. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK114491/>

⁵ Godfray, H. C. J., et al. (2010). Food Security: The Challenge of Feeding 9 Billion People. *Science*, 327(5967), 812–818.

technologies such as machinery, synthetic fertilizers, pesticides, and genetically modified organisms (GMOs) to maximize output. Industrial agriculture emphasizes efficiency, productivity, and economies of scale, modelled typically through large monoculture farms ⁶.

A few statistics highlight drastic transformations in agriculture. The number of German farms plummeted from 1 146 900 to 275 400 between 1970 and 2016, whereas the number of hectares per farm increased from 11.1 to 60.5. Canada had 189 874 farms in 2021, but 338 552 farms in 1976⁷. Alternative models exist, but are a minority, either in terms of practices or economic value. In 2019, Germany reported ~34 000 farms (13% of all farms) accounting for 9.7% of the agriculturally used land ⁸. In 2017, Canada was counting ~4 000 organic farms (2% of all farms), concentrated mainly in Quebec, British Columbia, and Saskatchewan⁹. Disappearance of small-scale, traditional agriculture, concentration of the production sector, and homogenization of production practices are all outcomes of large-scale agricultural policies launched in the 1950's.

⁶ See Parke Wilde, *Food Policy in the United States: An Introduction* (New York (NY), Routledge, 2013)56-76.

⁷ <https://news.uoguelph.ca/2022/08/canadas-disappearing-average-farmer-means-one-size-fits-all-policies-no-longer-work/>

⁸ https://www.bmel.de/SharedDocs/Downloads/EN/Publications/UnderstandingFarming.pdf?__blob=publicationFile

⁹ https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/202007E

Box n. 2: a quick review of Canadian and European agricultural policies

Agricultural policies to feed a growing population

Western agricultural systems were largely remodelled after the WWII to achieve food security by increasing agricultural productivity. Ambitious and structured public programs were implemented to ensure adequate food for a growing population.

In Europe, through subsidies, price supports, and investment in research and development, the Common Agricultural Policy (CAP) incentivized farmers to adopt modern farming techniques, significantly increasing yields and output. Initially aimed at ensuring food security, stabilizing agricultural markets, and increasing agricultural productivity, the CAP introduced price supports, production quotas, and market intervention mechanisms to regulate agricultural production and trade within European Economic Community (EEC) member states.

Canada implemented policies to modernize and expand its agricultural sector. The Agricultural Stabilization Act of 1958 aimed to support farm incomes by stabilizing prices and providing income support to producers. Government subsidies encouraged adoption of new technologies, mechanization, and increased productivity.

Government expenditures and policies, as well international trade agreements, have accelerated consolidation in every stage of the food system value chain and reinforced specialization of countries. The soybean example is striking: The Marshall Plan favoured soybean exports to European countries and in 1974, Europe represented of 43% seed sales and 54% of soybean meal exports, whereas the United States accounted for nearly 75% of world production and ensured a virtual monopoly on international trade. U.S. policies and European policies, encouraging competitiveness, left European countries highly dependent on American protein. After the 1973 U.S. embargo on soybean, EEC recognized the issue and there were negotiations and policies that largely rebalanced the powers.

Agricultural policies to stabilize volumes and prices, in a context a liberalization

Canada's farm policy approach has been equally if not more focused on income stabilization rather than food security. It's rarely had widespread domestic food security issues, but rather farm income challenges. Income support programs, enabled by Farm Income Protection Act of 1991 (but it had precursors that went back as far as the 1930s) are aimed at subsidizing incomes directly with program payments for income losses or indirectly through subsidies to crop insurance, a program aimed at helping farmers limit impacts of crop yield losses. These programs are shared in multilateral policy frameworks with the Provinces and Territories. These programs work alongside sectors that are supported through other marketing mechanisms, like dairy and poultry through the Supply Management system, a system of production quotas and price supports aimed at stabilizing incomes in those sectors. Canada implemented supply management systems for dairy, poultry, and egg production in the 1970s to stabilize prices, control production levels, and protect domestic producers from fluctuations in global markets. The Canadian Wheat Board (CWB), established in 1935 and dissolved in 2012, was an important feature of Canadian agricultural policy, with a monopoly on marketing wheat and barley for export.

Throughout the 1970s and 1980s, the European CAP expanded its interventionist approach to address market surpluses and price volatility, including buying, export subsidies, and production quotas aimed to stabilize prices, support farm incomes, and manage surpluses of grains, dairy, sugar, etc. In 1992, the Mac Sharry reform (named after the European Commissioner in charge at this time), marked a significant shift towards market-oriented policies and decoupling direct payments from production levels. This aimed to reduce overproduction, by linking subsidies to land and not yield and reducing intervention prices, streamline agricultural support mechanisms, and align EU agricultural policies with international trade rules under the Uruguay Round agreements.

European and Canadian agricultural policies shifted towards greater trade liberalization and international competitiveness in response to global

trade agreements, particularly the General Agreement on Tariffs and Trade (GATT) and World Trade Organization (WTO) agreements.

Agricultural policies to overcome negative consequences of over-production

Recognizing environmental impacts of intensive agricultural practices, EU agricultural policies increasingly integrated agri-environmental measures and rural development initiatives. Programs such as the Rural Development Policy and the Leader approach funded environmental conservation, sustainable land management, diversification of rural economies, and support for small-scale farmers. The CAP underwent further reforms in the early 2000s, introducing a two-pillar structure to support farmers' incomes and promote rural development. Pillar 1 consisted of direct payments, decoupled from production, aimed at income support and market stabilization, whereas Pillar 2 focused on rural development measures, including agri-environmental schemes, innovation, and infrastructure investments. The European Green Deal (2014-2020) promoted sustainable agriculture, biodiversity conservation, carbon sequestration, and resilience to climate-related risks.

In Canada, The Environmental Farm Plan (EFP) program was first implemented in Canada in the early 1990s. It is worth noting that agriculture is a shared jurisdiction in Canada: for example, animal welfare, climate emissions targets, and trade are federal responsibilities while irrigation is a provincial one. The exact timing of its implementation varied by province, as each province had its own schedule for introducing and administering the program. Since then, the EFP program has been adopted by all Canadian provinces and territories as a voluntary, whole-farm assessment tool to help farmers identify environmental risks, improve resource management, and implement best management practices on their operations. Growing Forward, a suite of agricultural policy initiatives introduced in 2008, was succeeded by Growing Forward 2 in 2013. These programs provided funding and support for a wide range of initiatives aimed at improving sustainability in agriculture. Key components included environmental stewardship programs, innovation and research, and on-farm food safety programs. These policy frameworks continue with the Canadian Agricultural Policy framework of

2018 and most recently, the Sustainable Canadian Agricultural Policy Framework of 2023. The frameworks cover a wide range of support programs including sustainability but also risk management (income support), science and innovation, and marketing and other related programs - cost shared with Provinces and Territories. The largest portion of these is in risk management programs (income support and crop insurance premium subsidies).

Determinant n. 2: geopolitics, energy and mineral (pathway) dependences

Farming machinery is mostly powered by fossil fuels, whereas electricity powers irrigation pumps, grain dryers, and storage facilities. Energy-intensive inputs such as fertilizers, pesticides, and agrochemicals are essential for maintaining crop yields and quality in intensive farming systems. The Agricultural Revolution marked a transition from traditional agrarian societies to more intensive and productive agricultural practices. Innovations such as crop rotation, selective breeding, mechanization, and enclosure systems led to increased food production, population growth, and urbanization. The Industrial Revolution facilitated expansion of agricultural markets, development of agricultural machinery, and mechanization of farm labour, increasing efficiency, productivity, and scale in food production. Despite agricultural policies that exhibit a close dynamic in Canada and Germany, the status of these two countries is very different when it comes to energy and mineral provision. Canada is one of the top oil and natural gas producers globally, and a major exporter of energy products, including crude oil, natural gas, and electricity. The U.S. continues to be the primary market for Canadian energy exports, absorbing the majority of Canada's crude oil and natural gas exports. The war between Russia and Ukraine did more than reveal the extreme dependence (and hence fragility) of Germany and its industry to other countries producing energy, questioning its economic alliances. Compared to other sectors, agriculture is not an important source of energy consumption (~ 3% in both countries); however, low margins in agriculture, and the relative inelastic demand for energy in the production process, emphasize the capital importance of energy availability and affordability¹⁰.

Canada is also the world's largest potash producer, accounting for 38% of the world's total in 2022, with Russia, China, and Belarus being the other major sources. More importantly, Canada has the largest reserve in the world: 1 100 million tonnes equivalent (one-third of the global stock), whereas Germany has 150 million tonnes equivalent¹¹. Potash, is a key

¹⁰ <https://energie.hec.ca/wp-content/uploads/2022/05/AB.EnergyTransGermCda.Pineau.Apr27.pdf>

¹¹ <https://natural-resources.canada.ca/our-natural-resources/minerals-mining/mining-data-statistics-and-analysis/minerals-metals-facts/potash-facts/20521#>

component of inorganic fertilizer. Furthermore, natural gas is needed to produce nitrogen.

Determinant n. 3: trade agreements

Trade agreements significantly influence the global food system by shaping market access, price stability, technology transfer, food security, and environmental and social impacts. As trade agreements reduce tariffs and quotas, they allow countries to specialize in their comparative advantage, increasing efficiency and diversity in the global food supply. They also contribute to price stability in the global food market, mitigating supply shocks and disruptions. Although trade can improve food security by providing access to affordable food, it may also pose risks of dependency and vulnerability to external market fluctuations. Trade agreements can negatively impact land use, biodiversity, and natural resources, as well as labour standards and livelihoods in the agricultural sector, raising concerns about sustainability and social equity. Overall, the empirical literature generally points to a broad association among trade liberalization, improved dietary quality and reduced undernutrition¹². Interestingly, the global trade system has been proposed to favour unhealthy, ultra-processed food trade, partly due to improved transportability, extended shelf life, significant profit margins, and ease of marketing.

Since 1995, the World Trade Organization (WTO) governs multilateral trade, including agriculture (Agreement on Agriculture – AOA). The number of regional trade agreements have risen to > 350 since 2021 and notified at WTO, with some worth highlighting (**box n. 3**).

¹² Zimmermann, A., Rapsomanikis, G. (2023). Trade and Sustainable Food Systems. In: von Braun, J., Afsana, K., Fresco, L.O., Hassan, M.H.A. (eds) Science and Innovations for Food Systems Transformation. Springer, Cham. https://doi.org/10.1007/978-3-031-15703-5_36

Box n. 3: trade agreements

The North American Free Trade Agreement (NAFTA), implemented in 1994 among Canada, the United States, and Mexico, eliminated most tariffs on agricultural products traded among member countries. NAFTA significantly influenced agricultural trade patterns and market integration in North America. NAFTA was renegotiated to the Canada United States Mexico Trade Agreement (CUSMA) in 2018-19.

The Mercosur-European Union (EU) Agreement is a trade deal among the Mercosur bloc (comprising Argentina, Brazil, Paraguay, and Uruguay, with Venezuela and Bolivia as suspended members) and the European Union. The agreement aims to establish a comprehensive trade framework covering various sectors, including agriculture, industry, services, and investment. It is supposed to be one of the most important trade agreements in the world, with nearly 780 million people affected and trade volumes of between 40 and 45 billion euros in imports and exports.

<https://www.vie-publique.fr/questions-reponses/289981-laccord-dassociation-ue-mercosur-en-huit-questions>

The agreement, concluded in 2019, was swiftly criticized by several European governments (France, Germany, Austria, The Netherlands, and Ireland). As of March 2024, the entirety of the agreement must be signed by a unanimous vote of the state members, the European Parliament, and the national chambers. As commercial agreements remain the exclusive competency of the European Commission, it may choose to exclude trade from the overall agreement.

The **Canada-European Union Comprehensive Economic and Trade Agreement (CETA)** entered into effect in 2017. <https://agriculture.canada.ca/en/international-trade/market-intelligence/reports/canadas-export-performance-european-union>

The EU, Canada's second largest trading partner, has had substantial growth due to eliminated trade barriers and introduction of CETA. Canada had a 35.7% increase in agriculture trade and a 53% growth in agricultural exports to the EU between 2016 and 2020.

As of December 2022, 17 State members (including Germany) have ratified the agreement. Regarding the Mercosur-UE agreement, CETA has to be signed unanimously. As for any agreements, there are apparent identify winners and losers after its provisional implementation. With regards to agriculture, CETA enabled a sharp rise of Canadian fertilizers exports (from 339 to 895 thousand tonnes between 2016 and 2022), plus EU wine and liquor exports. It also recognizes the existence of protected geographical indication (PGI) and ensures no counterfeits. https://www.veblen-institute.org/IMG/pdf/rapport_ceta_6_ans_inst_veblen.pdf

Regardless, CETA has blind spots, such as recognition of the precaution principle, and a risk of regression when it comes to sanitary and environmental regulations. Furthermore, it does not currently include "mirror clauses"¹³, although Chapter 5 of CETAs statement of Implementation specifically deals with Sanitary and Phytosanitary (SPS) measures stating that the agreement maintains, "each Party's right to take the SPS measures necessary to protect against risks to human, animal or plant life or health, while requiring that those measures be science-based, transparent, and applied only to the extent necessary to protect human, animal or plant life, so as not to create unnecessary and unjustifiable SPS-related trade restrictions."

Determinant n. 4: market concentration and trade networks

Vertical and horizontal concentration are frequent in the agri-food supply chain. Vertical integration of sectors allows processing, retail, and distribution companies agri-food companies to contract with producers, and even integrating production. Horizontal concentration is based on technological and economies of scale, with oligopsony/oligopolies in many agri-food subsectors. For example corporations such Archer Daniels Midland (ADM), Bunge, Cargill and Louis-Dreyfus – known in the sector as the "ABCD" – control > 70 % of global grain trade.

Clearly, international trade requires adequate infrastructure for transportation and logistics to ensure reliability. The Covid 19 pandemic and

¹³ Mirror clauses are trade agreements that require imported agricultural products to meet the same standards as domestic products within an economic area They are regarded as a way to level the playing field in international trade by ensuring fairness and equality.

the war in Europe highlighted vulnerability for supply chains on a global scale. More locally, short supply chains usually commercialize products with higher nutritional and environmental attributes, meaning that such products are also more expensive. Depending on the area, access to a local and sustainable diet is virtually impossible. Here, Germany and Canada have obvious differences, with improved accessibility and local infrastructure in Germany.

Determinant n. 5: demand driven market and role of the food industry

Economically, the food industry shapes the structure and dynamics of the food system through market forces, supply chain relationships, and corporate consolidation. Large food corporations wield considerable market power, influencing prices, consumer choices, and access to resources for food production. Moreover, industrialization of food production and processing has concentrated control over key inputs, technologies, and distribution channels, shaping patterns of agricultural production and trade¹⁴. Socially, the food industry has a significant role in shaping dietary patterns, nutritional habits, and public health outcomes through advertising, product promotion, and labelling practices. Food marketing strategies often prioritize the promotion of highly processed, energy-dense foods that contribute to the prevalence of diet-related diseases such as obesity, diabetes, and cardiovascular disorders.

¹⁴ Heasman, M., & Lang, T. (2004). *Food Wars: The Global Battle for Mouths, Minds and Markets* (1st ed.). Routledge. <https://doi.org/10.4324/9781849776011>

The sustainability of global food system in question

Forecasts from the OECD and the Food and Agriculture Organization (FAO) of the United Nations predict that the relative importance of food, feed and biofuel use will not change significantly on a global basis over the coming decade¹⁵. The forecast assumes intensification of livestock production and aquaculture, combined with improvements in feed efficiency. Consequently, feed consumption will continue to increase due to ongoing expansion of food animal production in low- and middle-income countries.

Sustainable food systems are those that contribute to food security and nutrition for all in such a way that the economic, social, cultural and ecological bases that generate food security and nutrition for future generations are safeguarded. They ensure fair distribution of benefits along the food supply chain, are respectful of consumer health and integrate good management practices of losses and waste throughout the food value chain¹⁶. Overall, the current global food system has major vulnerabilities that are reflected in domestic, international, and intergenerational challenges.

First challenge: global food system provides unsustainable diets

The Western diet emphasizes processed foods, red meat, sugary snacks and beverages, refined grains, with limited intake of fruits, vegetables, whole grains, and lean proteins. This dietary pattern has become prevalent in Western countries and is increasingly adopted globally, contributing to a range of health and environmental challenges¹⁷. The convenience and affordability of these foods have contributed to their popularity, leading to overreliance on highly processed and nutritionally poor options. Excessive consumption has been linked to increased risks of cardiovascular disease, cancer, and other chronic conditions. In March 2024, a study published in the *Lancet* concluded that one out of eight people in the world were considered obese. In Canada, almost two in three

¹⁵ <https://www.oecd.org/publications/oecd-fao-agricultural-outlook-19991142.htm>

¹⁶ von Braun, J., Afsana, K., Fresco, L.O. *et al.* Food system concepts and definitions for science and political action. *Nat Food* 2, 748–750 (2021). <https://doi.org/10.1038/s43016-021-00361-2>

¹⁷ Clemente-Suárez VJ, Beltrán-Velasco AI, Redondo-Flórez L, Martín-Rodríguez A, Tornero-Aguilera JF. Global Impacts of Western Diet and Its Effects on Metabolism and Health: A Narrative Review. *Nutrients*. 2023 Jun 14;15(12):2749. doi: 10.3390/nu15122749. PMID: 37375654; PMCID: PMC10302286.

adults and one in three children and youth are overweight or obese. For obesity only, in a 2010 U.S. study, health expenditures were \$9,000 to \$17,000 higher compared to normal-weight adults¹⁸.

Second challenge: industrial agriculture has major environmental impacts

Beyond its implications for human health, the Western diet also has significant environmental consequences. Intensive food production requires large amounts of land, water, and feed, promoting deforestation, habitat loss, and greenhouse gas emissions. Moreover, production and transportation of processed foods contribute to pollution, resource depletion, and climate change, further exacerbating environmental degradation. The magnitude of the impact is very dependent of the type of agricultural system, and commodity produced. However, agriculture accounts for ~10% of Green House Gases (GHG) emissions in Canada or Germany, and for 8 and 3% of water use in Canada and Germany, respectively¹⁹ ²⁰. It is worth to note that some agricultural systems are provisioning positive externalities, such as carbon sequestration, biodiversity conservation, and stabilize rural development.

Globalization of food systems, homogenizing practices, and use of synthetic inputs, as well our food habits, promote unsustainable production and consumption. The rationale of specialization of production and competitive advantage falls short when it comes to environmental pressures. Worldwide, hidden costs of unsustainable diets are estimated at \$2 per \$1 of food expenditure in 2018 (U.S.\$ 14 trillion of externalities, U.S.\$ 8.3 trillion for health and U.S.\$ 5.7 trillion for environment)²¹. The case of pesticides (**box n. 4**) is particularly demonstrative of the challenge, and complexity of the policy responses.

¹⁸ Thompson D, Edelsberg J, Colditz GA, Bird AP, Oster G. Lifetime health and economic consequences of obesity. *Arch Intern Med.* 1999; 159:2177-83

¹⁹ <https://www.oecd.org/agriculture/topics/water-and-agriculture/documents/oecd-water-policies-country-note-germany.pdf>

²⁰ <https://www.oecd.org/agriculture/topics/water-and-agriculture/documents/oecd-water-policies-country-note-canada.pdf>

²¹ Lucas, E., Guo, M. & Guillén-Gosálbez, G. Low-carbon diets can reduce global ecological and health costs. *Nat Food* 4, 394–406 (2023). <https://doi.org/10.1038/s43016-023-00749-2>

Box n. 4: a spotlight on pesticides

Pesticides are chemical or biological substances designed to control, repel, mitigate, or kill pests; the latter can include insects, weeds, fungi, rodents, nematodes, or other organisms that threaten crops, livestock, and/or human health. Development, commercialization and use of pesticides is regulated by the European Medicine Agency, European Food Safety Agency, and national agencies in Europe, and in Canada, Health Canada, Environment and Climate Change Canada, and the Canadian Food Inspection Agency. This ensures safety for producers and consumers. More recently, environmental considerations have been added to market authorization dossiers. High scrutiny regarding pesticide residues in food and water does not ensure food is “free from” these types of inputs. A 2024 report from Pesticide Action Network Europe per- and polyfluoroalkyl substances (PFAS) concluded that the proportion of fruit and vegetables containing residues of PFAS pesticides in the EU has nearly tripled in a decade. It concerns imported but also EU-grown products, with the highest levels of contamination (~25%) in Belgium, The Netherlands, and Austria. https://www.pan-europe.info/sites/pan-europe.info/files/public/resources/reports/Report_Toxic%20Harvest%20The%20rise%20of%20forever%20PFAS%20pesticides%20in%20fruit%20and%20vegetables%20in%20Europe%2027022024%20%281%29.pdf

Pesticide is a longstanding target of environmentalists. Some production systems further restrict their use, up to a strict prohibition by organic agriculture. The case of glyphosate, a herbicide is arguably the most famous and controversial, having been reapproved for use in the EU in September 2023. <https://www.politico.eu/article/glyphosate-is-safe-to-use-in-agriculture-says-eu-food-safety-watchdog/>

Reapproval of glyphosate enables member states to decide how it can be used in their country. Although impacts of glyphosate on biodiversity, and particularly soil health and pollinators, are well documented, effective and affordable alternatives are lacking in commercial agriculture, thereby putting pressure on producers, who will transfer pressure to authorities. <https://content.ces.ncsu.edu/are-there-alternatives-to-glyphosate-for-weed-control-in-landscapes>

Beyond the scientific controversy, it has also become a political controversy. Berlin forecasted to remove glyphosate from the market by the end of 2023, with misalignment across coalition stakeholders on the topic. By coincidence, in December 2022 at the COP15 in Montreal the world community emphasized the importance to protect nature and ecosystems. Meanwhile, the European Farm to Fork strategy, nudging a transition towards more sustainable farming systems, was torn apart by, among other factors, the war in Ukraine, on the basis of a threat for food security. Farmers' lobbies were vehemently opposed to the Farm to Fork strategy, which forecasted benefits for GHG emissions and species conservation, but also reduced yields.

<https://corporateeurope.org/en/2022/12/not-so-soft-killing-eus-farm-fork-strategy>

Third challenge: the race to economies of scale

The race towards competitiveness, a legacy of Ricardo's theory of comparative advantage, prompted farmers to make large investments that increased production but decreased prices of raw commodities. Consequently, farmers have become more competitive, productivity wise, without any subsequent economic benefit.

This race towards competitiveness extends to all the levels of food supply chains. Global food markets are increasingly integrated and concentrated, with most of the value captured by a handful of "Agri-food giants." Food markets have an oligopolistic structure, with significant market power over farmers, enabling them to dictate prices, volumes, and production standards. Interestingly, international trade agreements, now challenged by producers, have been favourable for industry, as they have opened new export markets.

Fourth challenge: farmers face major policy contradictions

Although the challenge of food security has largely been solved, the framework around food production in the West, as well as the narrative, have not. On one side, producers are encouraged to remain competitive (produce more with less) to feed the world and trade on export markets. In contrast, sustainability goals, such as those initially described in the Farm to Fork strategy, inevitably decrease production. The race to competitiveness, described above for increased productivity, holds true for

environmental conservation; producers must produce more sustainably, but barely capture the benefits of more virtuous practices. Simultaneously, international agreements are creating options for imports of commodities that do not adhere to the same standards of production, creating unfair competitive advantage. In addition, the power imbalance between increasingly fewer farmers, and large corporations, hampers producers' capacity to negotiate modifications in trading and production systems. Finally, growing gaps between urban and rural communities, and between social classes, do not promote communication.

Fifth challenge: wheat (and other commodities) as weapons

Wheat has increasingly had a role in geopolitical contexts due to its importance as a staple food crop and its impact on global food security. Major wheat-exporting countries like the United States, Russia, Canada, and Australia have significant geopolitical influence due to their ability to control wheat supplies. Disruptions in wheat production or exports from these countries have far-reaching consequences, affecting global food prices and availability.

Dependency of countries heavily relying on wheat imports, particularly the Middle East and North Africa, creates major vulnerabilities, not only in terms of food insecurity, but of international relations. Wheat has been used by Russia as a tool for diplomacy and geopolitical influence. In addition, in regions affected by conflict or humanitarian crises, food commodities often become tools of political leverage and aid. Humanitarian organizations and donor countries provide food as part of emergency assistance, which can influence political dynamics and public perception both domestically and internationally. Overall, the role of food in geopolitical contexts highlights interconnectedness of food systems, trade relations, and political dynamics on a global scale.

With climate change, some countries in the world will also likely see an increase in their capacity to produce, whereas in the global south as a whole, it will become increasingly difficult to sustain agricultural production²². This will lead to derisking strategies, spanning from national reserves to food alliances, to mitigate increasing risks. In a so called "agricultural rearmament," might even put food production and access at the centre of

²² <https://www.ipcc.ch/report/ar5/wg2/food-security-and-food-production-systems/>

a war around resources, on par with energy, critical minerals or water. This will, in turn emphasize issues of equity and social justice.

Opportunities for Canada and Germany

As powerful economies, Canada and Germany should influence the future of food systems. Several public policies have the power to shape the food system and dietary habits; however, they will not be straightforward to execute, as they can profoundly affect our relationship with food production and consumption. One way to address their acceptability is to understand how much policy resistance they may create, which is relative to the level of disruption they represent. The second dimension one can use to qualify such policy is the spatial scope, related to the jurisdictional level. However, in this paper, we will not focus on the policy and law instruments required to implement them.

What can be done to derisk investments and practices nudging agroecological transition?

1. Incentives for innovation

Incentive models have been studied in various sectors, such as health²³. Push and Pull incentives can bring technologies to farming operations and the supply chain. Push incentives are designed to support research and early-stage developments of new technologies. They consist of grant fundings, which are currently largely undermentioned in Europe and Canada compared to other jurisdictions. It can also be fiscal incentives for start-ups and their funders. Push incentive consists of strategies lowering production costs of technologies, whereas pull incentives focus on rewarding innovations where profitability is not certain, despite societal needs, e.g., a market entry reward for an herbicide that does not affect biodiversity. For example, a market entry reward for an herbicide not impacting biodiversity could be envisioned. Another consideration that is worth noting is the regulatory systems of each country and how it enables innovation. Innovation is underpinned and can be limited by the regulatory system where that innovation is being developed. Advanced countries with robust regulatory frameworks and an history of innovation like Canada and Germany could find common ground on regulatory processes and modernization to enable innovation.

²³ <https://epha.org/wp-content/uploads/2021/01/wp9-financing-pull-mechanisms-for-antibiotic-related-innovation.pdf>

2. Rewarding for ecosystem services

Despite a significant fraction of the CAP budget dedicated to “greening” agricultural practices, it has not largely led to environmental benefits. The new CAP framework (2023-2027) reinforced the conditionality of subsidies on adoption of sustainable practices. Unfortunately, the initial ambition of the Farm to Fork strategy was largely downsized, mostly under pressure from farmers’ movements^{24 25 26}.

In Canada, some mechanisms such as the Resilient agriculture landscapes program under Sustainable Canadian agriculture partnership or the On-Farm Climate Action Fund reward more sustainable practices, but not at the level required to offset production losses. Ambitious programmes to support a greener agriculture are needed. Access to subsidies can be practice-based (e.g., share of land with no-till) or outcome based (e.g., amount of carbon sequestered per year); in both cases, this will require disclosure of farming practices. In the future, it may be possible to condition access to insurance programmes on farmers’ adhesion to agro-ecological principles, enabling them to choose the framework most profitable for them.

What can be done to ensure a fair repartition of added value along the supply chains?

3. Shared governance of food system

Alternative agricultural models coexist and enable a higher resilience of a spatialized food system. However, dominance of the agro-industrial system threatens emergence of other systems involving more consumers, and questions social justice across high- as well as low- and middle-income countries, with the latter being challenged in food sovereignty. Policies must address compensation of farmers (prioritizing pricing over subsidies, in line with farmer demands). Additionally, by ensuring that governments have authority over market powers, we can effectively tackle the evident market

²⁴ <https://www.euronews.com/my-europe/2024/02/19/over-half-of-von-der-levens-food-policy-promises-werent-met-analysis-shows>

²⁵ <https://capeve.fr/2024/04/la-pac-en-revision-express-les-evolutions-prevues/>

²⁶ <https://www.euractiv.com/section/agriculture-food/news/agrifood-brief-farm-to-fork-is-dead-long-live-the-strategic-dialogue/>

failures. Provinces or Länder may be the smallest appropriate sizes to approach questions of food system governance in its vision, strategic planning, and execution. However, enforcement of national policies, especially supervision of commodity prices, will ensure viability for producers.

4. Creating conditions for meaningful dialogues among stakeholders

Building such agreements should be seen as a co-construct, not a one-time debate. It will unfold in multiple stages, gradually incorporating additional dimensions and issues. Strengths and weaknesses of compromises will emerge, with successive versions subject to critical examination, including socio-economic, environmental, and health considerations, enabling improvements. The process should also be guided by successful stakeholder dialogue.

Reaching consensus among stakeholders also entails simultaneous support for agri-food industries and dietary practices, while safeguarding producers from competition due to non-sustainable imports. Therefore, agroecological transition policy must encompass industrial, commercial, social, and health dimensions.

What can be done to foster a simultaneous transition in food production and food consumption?

5. Aligning our production and processing with sustainable diet: territorialized food systems

Public policies need to be developed to ensure that all food chain actors are engaged in food citizenship. Food choices are affected by the food environment, namely “physical, economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food”²⁷.

Retailers and the public sector widely shape those systems. Territorial food systems are coordinated by local governance, and usually emphasize greater local food production and consumption. Municipalities, provincial and national institutions can strategize and execute supply chains that

²⁷ HLPE. *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.* <https://www.fao.org/3/i7846e/i7846e.pdf> (2017).

respect animal and environment integrity, while ensuring local and rural development. For example, requirements for public procurement, based on sustainability indicators, would be a step towards more sustainable production²⁸. The originality of this approach also lies in their configuration and participatory governance. A second layer is ensuring access to sustainable food to a large fraction of the population; for that, local models inspired by universal access to healthcare could be implemented.

6. Ensuring consistency in policy development

Agriculture has unique features to produce simultaneously and alternatively food, feed, fuel and fibre (“the four f’s”). For example, energy policies encouraging production of biofuels will have direct effects on agricultural systems, including land use and daily practices. Conditions for dialogue between policy-makers will be first ensured by clarity in expected outcomes of food policy, i.e., a programme for the sector. It also encompasses identification of indirect consequences of sectorial policies for agriculture and food.

7. Empowering consumers as food citizens

Consumers have more active roles in the modern food system, but often lack understanding of its operations, types of foods produced, and environmental impacts. Furthermore, there is inadequate awareness of a healthy diet. Socioeconomic disparities persist, with many consumers facing financial constraints that limit access to nutritious diets. Consequently, they may buy cheaper, processed foods high in sugar and fat, but lacking essential nutrients.

There is a need for increased consumer awareness about sustainable diets, proactive debunking of misinformation related to food choices, and stricter policies aimed at regulating the marketing and commercialization of ultra-processed foods.

What can be done to turn sustainable production into a competitive advantage?

²⁸ Björkbom, C. The EU sustainable food systems framework - potential for climate action. *npj Clim. Action* **2**, 4 (2023). <https://doi.org/10.1038/s44168-023-00034-9>

8. Developing and implementing at large scale an alternative accounting framework for business

True cost accounting (TCA) (socio-environmental accounting) considers various components holistically; it includes value from hidden costs such as environmental, social, and health factors. In contrast, market-based decisions lead to prices that do not necessarily include these hidden (or external) costs. TCA is grounded in the concept of double materiality, which means that companies should report their materiality if impacted (how their operations affect the environment and society) and their financial materiality (how their operations are affected by ESG challenges). In the EU, the CSRD, or Corporate Sustainability Reporting Directive, is a new directive aimed at enhancing financial flows towards sustainable activities within the EU. Notably, it also affects non-EU companies that generate more than €150 million of turnover in the EU²⁹. It will unfold over the next years, but only applies to companies with > 500 employees. Canada is lagging behind³⁰. Extra financial reporting only includes climate-related risks for investors. Implementing such a model is key to ensure investors will support virtuous practices. However, it requires hands-on support for implementation by farmers, who are already reporting administrative burdens, prompting protests. In addition, there is defiance towards governments and challenges around data sharing and data use.

9. A bold approach on trade agreements and mirror clauses

Current trade agreements create large market distortions that do not widely benefit Canadian and European producers, and also threaten the environment.

WTO rules prohibit food stocks, encourage subsidies linked to acreage, and cap options to reward ecosystem services and greening of practices. Collectively, this is at odds with sustainable food systems, as it jeopardizes governments' ability to take strategic orientation for agriculture, including

²⁹ https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en

³⁰ <https://www.theglobeandmail.com/business/rob-magazine/article-net-zero-tipping-point/>

“geosecurization” of food systems³¹. Trade should be a tool in multilateralism for more geopolitical stability, and not an objective per se.

Revisiting international rules is becoming increasingly urgent, with major food-producing countries already adapting their national frameworks. Europe, in particular, should protect its agriculture much better.

Competitiveness at all costs is not appropriate for either Canada or Germany. As agriculture is already much more sustainable in these two countries than in many others, alliances should be made to advocate for agreements on international markets, including production standards. Whereas there are massive programmes for energy transition, something similar should be designed for an agroecological transition.

³¹ Sollogoub, T. (2024). Vers la géosécurisation des systèmes alimentaires ?. Dans : Sébastien Abis éd., *Le Déméter 2024: Mondes agricoles : cultiver la paix en temps de guerre* (pp. 27-46). IRIS éditions.

CONCLUSION

In 2015, the United Nations Member States collectively ratified the Sustainable Development Goals as integral components of the 2030 Agenda for Sustainable Development. There is an urgent imperative in formulation and execution of agricultural policies designed to facilitate realization of SDGs and account for local parameters. The 2020 report evaluates advancements to achieve these goals, delineating nuanced and moderate progress. However, increasing food insecurity, environmental degradation, and food waste are major tolls borne by the global food system. An agroecological transition will need to include industrial, commercial, social, and health dimensions. This will involve strategic planning and budgets dedicated to farmers, the agrifood industry, and consumers. Food prices will likely rise, and new financial flows will be needed to ensure a smooth transition. This is challenging in the context of increasing defence budgets.

As for the energy transition, the food transition is also intergenerational. One unknown is the capacity of younger generations, overall described as more individualists, to take the necessary actions, as shared governance appears to be key. It is also an opportunity for governments and municipalities to mobilize resources while engaging the public.

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