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Shift to Healthy and Sustainable Consumption Patterns

- a paper on Action Track 2 -

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ACTION TRACK 2 - SHIFT TO HEALTHY AND SUSTAINABLE CONSUMPTION PATTERNS

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Section 1. Framing of the paper.

1. **What do we want to achieve?**

Food has become the number one driver of premature mortality. Globally, poor-quality diets are linked to 11 million deaths per year (Global Panel on Agriculture and Food Systems for Nutrition, 2020). While 690 million people are chronically malnourished and two billion individuals suffer micronutrient deficiencies, over consumption, notably of unhealthy foods is rising rapidly. Two billion people are overweight or obese, with many suffering chronic diseases driven by poor dietary health (Development Initiatives, 2020; Global Panel on Agriculture and Food Systems for Nutrition, 2020). Food, our more proximate relationships to our physical health, is failing us.

The food system is also failing the planet and is the single largest driver of multiple environmental pressures. Food accounts for 80% of land conversion and biodiversity loss including the collapse of major marine fisheries and freshwater ecosystems, 80% of contamination of freshwater and coastal ecosystems by excess nutrient run-off and chemical pesticides; accounts of 80% of freshwater consumption, with major river systems such as the Colorado river no longer reaching their deltas; and contributes 20-30% of global greenhouse gas emissions.

Food thus has become the biggest driver of environmental degradation; food is also the biggest victim of that degradation driving soils loss, increased droughts floods and other major weather events, but we are convinced that food is also our best bet at restoration, and regeneration (Rockström et al., 2020). What foods we consume, how much we consume, and how much we lose and waste have become critical considerations for people and planet.

This Action Track recognises that current food consumption patterns, often characterised by higher levels of food waste and a transition in diets towards higher energy, more resource-intensive foods, need to be transformed to protect both the people and planet. Awareness-raising, regulatory and behaviour change interventions in food environments, food education, strengthened urban-rural linkages, reformulation, improved product design, packaging and portion sizing, investments in food system innovations, public private partnerships, public procurement, and separate collection enabling reutilization of food waste can all contribute to this transition. Local and national policymakers and private sector actors of all sizes have a key role in both responding to and shaping the market opportunities created by changing consumer demands.

Section 2. Building the evidence on healthy diets (500 words)

A healthy diet is a dietary pattern that meets a person's nutritional needs (macronutrients and micronutrients), ensures optimal growth and development and promotes health across the lifespan specific to their gender, age, physical activity level and physiological state. It must supply adequate calories for energy balance, and include a wide variety of high quality and safe foods across a diversity of food groups to provide the various macronutrients, micronutrients and other food components needed to lead an active and healthy and enjoyable life. Healthy diets should include (FAO et al., 2004; WHO, 2020):

- At least 400g of fruit and vegetables per day (excluding starchy roots)
- Legumes, nuts and whole grains
- Energy intake balanced with expenditure (on average 2000-2500 kcal per person).
- < 10% of total energy intake from free sugars

- < 30% of total energy intake from fats; intake of saturated fats < 10% of total energy intake and *trans*-fats < 1% of total energy intake
- < 5g of iodized salt per day

There is great diversity in the foods and culinary combinations of these foods that together can form healthy diets which vary widely across countries and cultures according to traditions, preferences and local food supplies. Food based dietary guidelines (FBDGs) are intended to translate these common principles into nationally or regionally relevant recommendations that consider these differences, as well as context-specific diet-related health challenges. Most FBDGs recommend consuming a wide variety of foods, plentiful fruits and vegetables, inclusion of starchy staples, animal-source foods and legumes, and to limit excessive fat, salt and sugars (Herforth et al., 2019; Springmann et al., 2020). However, there can be wide variation in inclusion of and recommendations for other foods. Only 17% of FBDGs make specific recommendations about quantities of meat/egg/poultry/animal source food to consume (20% make specific recommendations about fish), and only three countries (Finland, Sweden and Greece) make specific quantitative recommendations to limit red meat (Herforth et al., 2019). Only around a quarter of FBDGs recommend limiting consumption of ultra-processed foods, yet this is emerging as one of the most significant dietary challenges around the world.

Adherence with national FBDGs and recommendations around the world is shockingly low. The average diet[1] in 28% of countries with national FBDGs did not meet a single dietary recommendation, and the vast majority of countries (88%) met no more than 2 out of 12 dietary recommendations (Springmann et al., 2020). Consumption surveys show vast regional and national differences in consumption of the major food groups (Afshin et al., 2019). No regions globally have an average intake of fruits, whole grains, or nuts and seeds in line with recommendations and only central Asia meets the recommendations for vegetables. In contrast, the global (and several regional) average intake of red meat, processed meat and sugar-sweetened beverages exceeds recommended limits. Australasia and Latin America had the highest levels of red meat consumption, with High-income North America, high- income Asia Pacific and western Europe consuming the highest amount of processed meat (Afshin et al., 2019). In general, consumption of healthy foods has been increasing over time; however, so too has consumption of unhealthy foods; a trend particularly evident as country incomes rise (Imamura et al., 2015). Of particular concern is the growing importance of ultra-processed foods and sugar sweetened beverages in diets across the world. Absolute intakes[2] are about 10-fold higher in high-income compared to lower middle-income countries. However, sales growth is evident across all regions, the fastest occurring in middle-income countries (Baker et al., 2020).

Availability, affordability and accessibility remain important drivers of dietary patterns and whilst income growth will improve some of these aspects in some regions in the future, this will be inadequate by far to achieve healthy diets for all (Imamura et al., 2015; Mason-D'Croz et al., 2019; Miller et al., 2016).

Many people living in extreme poverty are the two billion whom continue to struggle to access sufficient foods and are faced with acute caloric and nutrient deficiencies. Even the cheapest healthy diet costs 60 percent more than diets that only meet the requirements for essential nutrients (Hirvonen et al., 2020) and almost double the cost of the nutrient adequate diet, and 5 times as much as diets that meet only the dietary energy needs through a starchy staple (FAO et al., 2020). This is of concern as the high cost and unaffordability of healthy diets is associated with increasing

[1] based on adjusted food availability as a proxy for consumption

[2] Based on global sales data from 2019

food insecurity and different forms of malnutrition, including child stunting and adult obesity. The unaffordability of healthy diets is due to their high cost relative to people's incomes. Healthy diets are unaffordable for more than 3 billion poor people in low-, middle- and high-income countries, and more than 1.5 billion people cannot even afford a diet that only meets required levels of essential nutrients (FAO et al., 2020; Global Panel on Agriculture and Food Systems for Nutrition, 2020). The cost of a healthy diet is much higher than the international poverty line, established at USD 1.90 purchasing power parity (PPP) per day. At a global level, on average a healthy diet is not affordable, with the cost representing 119 percent of mean food expenditures per capita per day. Where hunger and food insecurity are greater, the cost of a healthy diet even exceeds average national food expenditures. The cost of a healthy diet exceeds average food expenditures in most countries in the Global South. More than 57 percent or more of the population throughout sub-Saharan Africa and Southern Asia cannot afford a healthy diet (FAO et al., 2020).

Section 3. Building the evidence on sustainable healthy diets.

Sustainable Healthy diets are dietary patterns that promote all dimensions of individuals' health and wellbeing; *have low levels of environmental pressure and impact*; are accessible, safe and equitable; and are culturally acceptable (FAO & WHO, 2019). In light of current environmental challenges, some would argue that sustainability is no longer sufficient, and that food needs to be come nature positive.

The conceptual transition from healthy diets to healthy diets that include sustainability considerations was mediated by recent studies linking consumption patterns, and their projections, to their health consequences in terms of non-communicable diseases, and the environmental impacts of food production (Springmann et al., 2018; Tilman & Clark, 2014; Willett et al., 2019). A broad range of diets have been tested as alternatives to current consumption, including Mediterranean, vegetarian, vegan, pescetarian, low animal products and many other variants (Aleksandrowicz et al., 2016; Arneth et al., 2019). The most recent set of studies is embodied in the work of the EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems (Willett et al., 2019). Healthy diets, based on food groups, were designed from a large body of evidence from nutrition observational studies. This helped establish ranges of inclusion of different types of foods. The authors then used six environmental dimensions of importance to planetary health and Earth System processes (greenhouse gas emissions, cropland use, water use, Nitrogen and Phosphorus use and biodiversity), using the planetary boundaries concept (Rockström et al., 2009), as boundary conditions for achieving a healthy diet. The environmental limits of food described by the EAT-Lancet Commission define a safe environmental space for food to help guide sustainable food consumption patterns.

Earth System Process	Articulated Boundary	Food System Implication
Climate Change (Carbon)	5 Gt Gt CO_2 *e* yr^{-1} ($4.7 – 5.4$ Gt CO_2 *e* yr^{-1})	0 new emission from food
Land System Change	13 M km^3 (11-15 M km^3)	0 net land expansion
Freshwater Consumption	2,500 km^3 yr^{-1} (1000-4000 km^3 $yr^{-1)}$	>30% environmental flows retained in river basins
Freshwater Quality (N)	90 Tg N yr^{-1} (65-130 Tg N yr^{-1})	N pollution <1-2.5 mg N L^{-1}
Freshwater Quality (P)	8 Tg P yr^{-1} (6-16 Tg P yr^{-1})	P Pollution <50-100 mg P m^{-3}

Biodiversity Loss	10 E/MSY (1-80 E/MSY)	Spare at least 50% of all ecoregion areas as intact, share space for biodiversity in agricultural lands (>10% km^{-2})
Air Pollution		No food system limit articulated yet.
Chemical Pollution (biocides)	Currently undefined	
Solid Pollution (e.g. plastics)	Currently undefined	

Willett et al. (2019) found that flexitarian diets that allow for diversity of consumption options, including moderate meat consumption, would significantly reduce environmental impacts compared to baseline scenarios. Flexitarian diets include the following characteristics:

a. high in diverse plant-based foods.
b. high in whole-grain, legumes, nuts, vegetable and fruits consumption.
c. low in the consumption of animal sourced foods (but requiring increases in fish consumption).
d. low in fats, sugars and discretionary/ultra-processed foods.

From a health perspective, these diets can avert 10.8-11.6 million deaths per year, a reduction of 19-23.6% from the baseline (consistent with the Global Burden of Disease studies). From an environmental perspective, transitions towards flexetarian diets contributed to reduce greenhouse gas emissions primarily, as a reduction in animal sourced foods reduced land use and the numbers of animals, and their associated emissions. However, the increases in fruits, nuts and vegetables needed more land, water and fertilisers, and therefore increases in productivity of cereals and legumes to bridge yield gaps by close to 75%, and reductions in waste of 50% would needed for achieving the diets within all sustainability constraints. These dynamics are consistent across many studies exploring dietary variants (Aleksandrowicz et al., 2016). The environmental footprint of foods however is strongly dependent on whether those foods are produced and how they are produced leaving significant room for innovation and improvement. Moreover, the adoption of any of the four alternative healthy diet patterns (flexitarian, pescatarian, vegetarian and the vegan diet) could potentially contribute to significant reductions of the social cost of greenhouse gas emissions, ranging from USD 0.8 to 1.3 trillion (50–74 percent) (FAO et al., 2020).

A growing number of studies have now shown that food and nutritional security are not incompatible goals, and rather that transitions towards healthy consumption, let alone sustainable consumption are critical contributors to achieving climate stability, and halting the rampant loss of biodiversity. Indeed combined actions on securing habitat for biodiversity, improving production practices, and better consumption would allow for halting biodiversity loss and bending the curve towards restoration by 2030 (Leclere et al., 2020).

There is also a financial case for shifting to sustainable healthy diets. There are hidden costs of our dietary patterns and of the food systems supporting them and two of the most important are the health- and climate-related costs that the world incurs (FAO et al., 2020). If current food consumption trends continue, diet-related health costs linked to non-communicable diseases and their mortality are projected to exceed USD 1.3 trillion per year by 2030. On the other hand, shifting to healthy diets that include sustainability considerations would lead to an estimated reduction of up to 97 percent in direct and indirect health costs. Currently our food systems are successful at producing low-cost calories feeding a demand of unhealthy diets, but are a major driver of climate change, generating up to one-third of greenhouse gas emissions (FOLU, 2019). The diet-related social

cost of greenhouse gas emissions associated with current dietary patterns is projected to exceed USD 1.7 trillion per year by 2030. The adoption of healthy diets that include sustainability considerations would reduce the social cost of greenhouse gas emissions by an estimated 41–74 percent in 2030 (FAO et al., 2020).

The EAT-Lancet study demonstrated that rebalancing consumption will require different consumer behaviours shifts in different locations and contexts. For example, in low-income countries achieving the healthy diet from sustainable food systems would require increasing the consumption of most nutrient-rich food groups, including animal sourced foods, vegetables, pulses and fruits, while reducing some starches, oils and discretionary foods (Willet et al. 2019). In contrast, in many-high income countries achieving the same balance would require reducing the consumption of animal-sourced foods, sugars and discretionary/processed foods, while still increasing the consumption of healthy plant-based ingredients (Figure 1). Many countries experiencing the double-burden of malnutrition, would require these actions to play simultaneously to achieve the desired benefits (Development Initiatives, 2020; HLPE, 2020; Willett et al., 2019), while a smaller number of countries (e.g. Japan) have smaller adjustments to make.

A global shift towards sustainable and healthy diets will require significant transformations in food systems, and there is no one-size-fits-all solution for countries. Assessing context-specific barriers, managing short-term and long-term trade-offs and exploiting synergies will be critical. In countries where the food system also drives the rural economy, care must be taken to mitigate the potential negative impacts on incomes and livelihoods as food systems transform to deliver affordable healthy diets (FAO et al., 2020). Low- and lower-middle-income countries, where populations still suffer undernutrition and nutrient deficiencies, may need to increase the consumption of nutritious foods even when they might result in higher national carbon footprints in order to meet recommended dietary needs and nutrition goals, particularly to prevent undernutrition. Other countries, especially upper-middle-income and high-income countries, where diet patterns exceed optimal energy requirements and people consume more animal source foods than required, require major changes in dietary practices and system-wide changes in food production, food environments and trade.

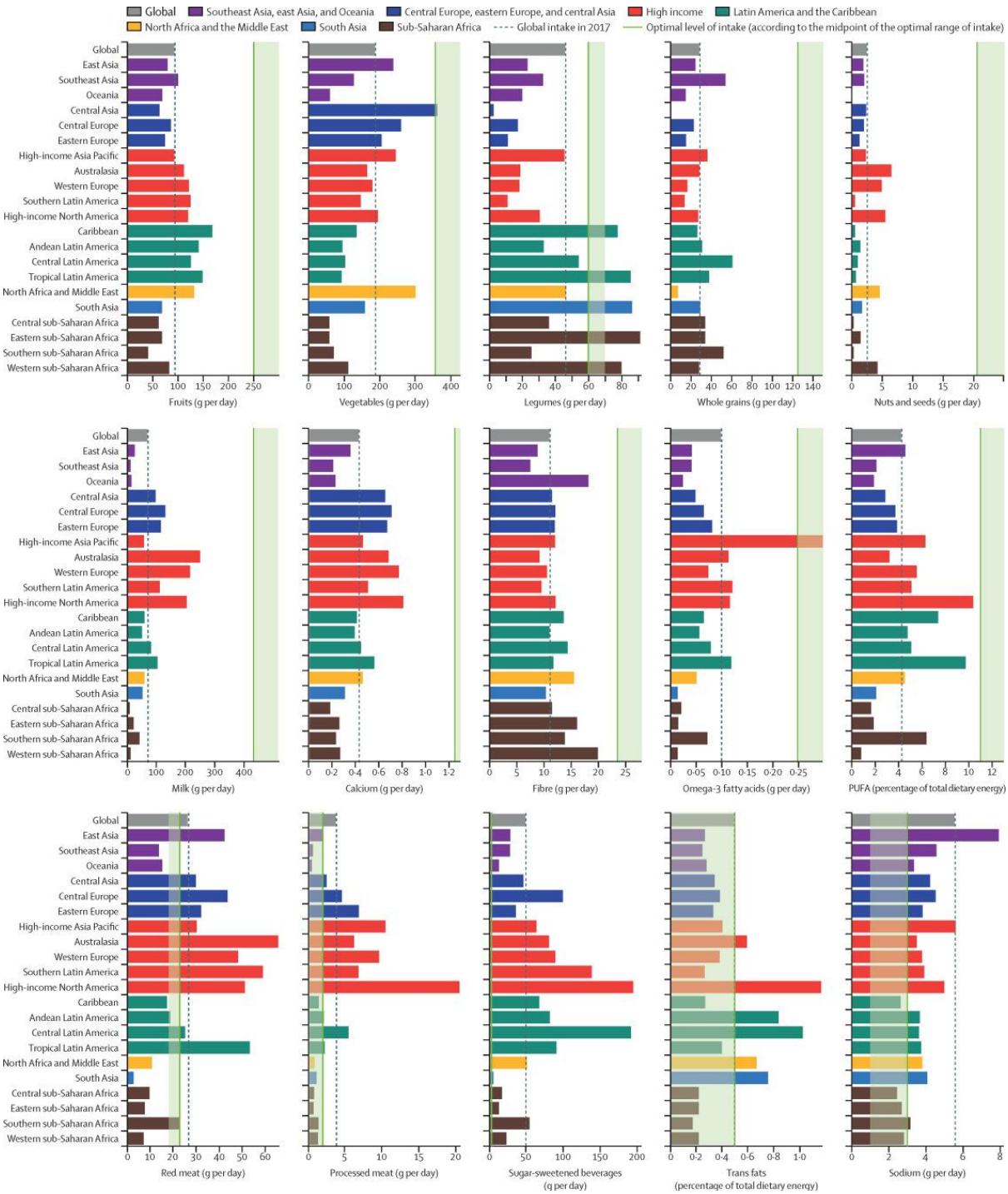

Figure 1: Age-standardised intake of dietary factors among adults aged 25 years or older at the global and regional level in 2017. Source: (Afshin et al., 2019).

4. Transitioning to Sustainable and Healthy Diets

The evidence is abundantly clear, without shifts in consumption patterns towards health and sustainability we will fail to achieve multiple SDGs, we will fail to achieve the Paris Climate Agreement, the post 2020 biodiversity goals and we will lose the opportunity to reposition food as our best bet for improving health and regenerating the environment.
Achieving these transitions and managing the trade-offs and synergies will require additional attention to many facets of food systems, including:

Food environments: the consumption of healthy food from sustainable food sources is dependent on sustainably produced healthy foods being available, affordable and accessible in different outlets. Whether they are in open markets in low- and middle-income countries, in supermarkets or in corner shops across the globe, the provisioning of nutritious food at affordable prices is a critical element for achieving transitions towards sustainable consumption (Downs et al., 2009; Swinburn et al., 2019, FAO, et. al., 2020). To increase the affordability of healthy diets, the cost of nutritious foods must be affordable for all, but farmers must receive the real cost of growing food. The cost drivers of these diets are throughout the food supply chain, within the food environment, and in the political economy that shapes trade, public expenditure and investment policies (FAO et al., 2020; Swinburn et al., 2019).

Tackling these cost drivers will require large transformations in food systems at the producer, consumer, political economy and food environments levels. Countries will need a rebalancing of agricultural policies to recognize their impacts on health and sustainability and to repurpose subsidies to recreate value (e.g. greater support to producing healthy foods, and rewards for environmental regeneration) all along the food supply chain to reduce food losses and enhance efficiencies at all stages (FAO et al., 2020). Trade policies, mainly protectionary trade measures and input subsidy programmes, tend to protect and incentivise the domestic production of staple foods, such as rice and maize, often at the detriment of nutritious foods, like fruits and vegetables. Non-tariff trade measures can help improve food safety, quality standards and the nutritional value of food, but they can also drive up the costs of trade and hence food prices, negatively affecting affordability of healthy diets (FAO et al., 2020). Nutrition-sensitive social protection policies will also be central to increase the purchasing power and affordability of healthy diets of the most vulnerable populations. Policies that more generally foster behavioural change towards healthy diets will also be needed. A critical challenge is the tremendous perishability of fruits and vegetables, particularly in the tropics (Mason-D'Croz et al., 2019) where refrigeration, food processing and sustainable packaging may be critical contributions in creating environmental, and public health value. In both urban and rural areas, the lack of physical access to food markets, especially to fresh fruit and vegetable markets, represents a formidable barrier to accessing a healthy diet, especially for the poor. Finally, empowering all people and especially the poor and vulnerable with sufficient physical and human capital resources, assets and incomes is the necessary precondition in order to improve the access to healthy diets. This will enable making choices, produce and consume, leaving no one hungry or malnourished, while consuming healthy and nutritious food and preserve ecosystems, biodiversity and natural resources. However, making progress and achieving this objective entails dealing with all trade-offs, negative externalities and also benefits emerging from policies and combination of policies presented previously.

Addressing food safety issues across value chains:
Food safety across the value chains is to be ensured along all stages until consumption. Responsibilities lie with all actors from producers to processors, retailers and consumers. Consumer behaviour at households in storing (temperature) and handling foods (cross contamination) impacts strongly on the onset of food borne intoxications. In the European Union, surveillance data, indicate that most of the strong-evidence outbreaks in 2018 took place in a domestic setting (EFSA and ECDC, 2019). Food safety will need to become a much more active player in guiding transitions to circular food systems, notably on the reuse and reutilization of food stuffs within sustainable supply chains. The safety of food is a matter of growing concern specially after the global estimation of the global burden of food borne disease comparable to that of HIV/AIDS, malaria and tuberculosis together, with low- and middle-income countries bearing 98% of the global burden. Most of the known health burden comes from biological hazards (virus, bacteria, protozoa and worms), biological hazards cause acute intoxication which are easier to detect and control. Chronic effects due to chemicals (natural or processed contaminants, pesticide residues etc.) are more difficult to be traced and to quantify their

actual impact on the disease burden. Currently there is ongoing work trying to estimate their burden of disease.

The riskiest foods for biological hazards are livestock products followed by fish, fresh vegetables and fruit (Grace et al, 2018). In addition to the disease burden, foodborne diseases in low- and middle-income countries have also a great impact on economic costs and market access (Unnevehr and Ronchi, 2014). Lately, the possible impact of microplastics and nanoplastics on health via food has raised a lot of attention with multiple studies pointing out the occurrence of micro and nanoplastic particles found in food commodities such as water, filtering molluscs and fish. Currently there're many ongoing research projects trying to standardize the methods of analysis and identifying the health impact from dietary exposure.

Food safety is positioned at the intersection of agri-food systems and health, thereby there're very strong interconncetions of bi-directional links between food safety, livelihoods, gender equity and nutrition disciplines (Grace et al, 2018).

There are many promising approaches to managing food safety in LMIC's but few have demonstrated a sustainable impact at scale. Food safety management systems (FSMS) are designed to prevent, reduce or eliminate hazards along the food chain, which includes primary production (farms), processors, retail distribution centres, supermarkets, restaurant, pub and other catering as well as food donation distribution centres (Ricci et al., 2017). Food safety control at primary production is achieved using general hygiene requirements including Good Agricultural Practices, Good Farming Practices, biosecurity and Good Hygiene Practices, and Good Veterinarian Practices. Food business operators should implement and maintain a permanent procedure or procedures based on the Hazard Analysis and Critical Control Points (HACCP) principles (WHO & FAO, 2006). They are effective in controlling most of the hazards during food production. Small-scale producers at retail might have difficulties in HACCP due to complexity of some systems and lack of resources to implement and lack of access to information and proper education. Transitions to circular food systems, local food systems, or short circuit systems are often slowed or hampered by current food safety regulations. Ensuring food safety while enabling small-holder farmers, or craft food companies to operate in local contexts will be critical unlock in the transition to more sustainable food systems, and greater availability of healthy food stuffs while supporting local economies.

Microbiological contaminations have always been a substantial issue in developing countries especially due to poor handling, lack of sanitation and hygiene conditions. According to Soepranianondo and Koesoemo Wardhana (2019) sanitary indicator bacteria were still found in city slaughterhouses and were due to illiteracy and lack of hygiene protocols in city slaughterhouses. In addition to this, the presence of toxins in crop production is also compromising health of farm. Labourers and consumers. Mycotoxins contaminate nearly 25% of the world's agricultural commodities (Thanushree et al., 2019). Aflatoxins (AFs) and ochratoxins, especially type A (OTA) are the major mycotoxins that contaminate spices. The fungal infection of Indonesian dried chili occurred both in the field and during storage with the levels of AFs B1, B2, and OTA in the contaminated dried chilies were in the range of 39.3–139.5 μg/kg, 2.6–33.3 μg/kg, and 23.7–84.6 μg/kg, respectively (Wikandari et al., 2020). It is known that poor adoption of scientific practices across the spice supply chain could cause mycotoxin contamination. With heavy implications on human and animal health, mycotoxin contamination is a threat, in particular combined with climatic changes conditions. Nevertheless, with proper preventive and control measures, mycotoxins contamination in spices can be effectively addressed. In addition, there is also a need for aggressive public awareness and farmers' education on the prevalence, and danger caused by mycotoxins, as well as detoxification strategies.

Metrics

Estimating the burden of food borne disease is very difficult and costly. In general food borne diseases are under reported across the globe and even more in LMIC's.
Risk-based approaches are the most useful for managing most food safety hazards and to assess links between hazards in food and actual risks to human health. As a result, risk analysis has been officially adopted by most LMICs but their ability to implement it is very limited. Conventional risk analysis is often expensive, time consuming and requires considerable amounts of data and quantitative analysis. In most LMICs, risk analysis is not used in setting standards or regulations for food sold in domestic markets, and government and private sector efforts to build capacity have focused on the export sector or formal private sector (Grace et al, 2018).

To avoid confusion caused by multiple different national standards, The Food and Agriculture Organization of the United Nations (FAO) and WHO established the Codex Alimentarius Commission (CAC) to address safety and nutritional quality of foods and develop international standards to promote trade among countries. The CAC establishes standards for maximum levels of food additives, maximum limits for contaminants and toxins, maximum residue limits for pesticides and veterinary drugs and gives indication for limits of microbiological hazards in a given food commodity. At national level, government food safety systems monitor compliance with official standards through food inspections.

The Risk Analysis framework described by Codex Alimentarius (CAC, 2007a) provides a structured approach to the management of the safety of food with three elements: risk assessment, risks management and risk communication. The establishment of a Food Safety Objective (FSO) is described as a tool to meet a public health goal such as an Appropriate Level of Protection (ALOP). The original definition for ALOP that was part of the Sanitary and Phytosanitary (SPS) Measures Agreement (WTO, 1994), is the "expression of the level of protection in relation to food safety that is currently achieved. An FSO specifies the maximum permissible level of a hazard in a food at the moment of consumption. Maximum hazard levels at other points along the food chain are called Performance Objectives (POs). The current definitions for FSO and PO (CAC, 2007b) are that an FSO is: "the maximum frequency and / or concentration of a hazard in a food at the time of consumption that provides or contributes to the appropriate level of (health) protection (ALOP)" while a PO is: "the maximum frequency and / or concentration of a hazard in a food at a specified step in the food chain before consumption that provides or contributes to an FSO or ALOP, as applicable".

Establishment of FSOs and POs provides the industry with quantitative targets to be met. When necessary, industry may have to validate that their food safety system is capable of controlling the hazard of concern, i.e., to provide evidence that control measures can meet the targets. In addition, industry must periodically verify that their measures are functioning as intended. To assess compliance with FSOs and POs, control authorities rely on inspection procedures (e.g., physical examination of manufacturing facilities, review of HACCP monitoring and verification records, analysis of samples) to verify the adequacy of control measures adopted by industry. In the context of the SPS Agreement (WTO, 1994), national governments may also need to quantitatively demonstrate the equivalence of their inspection procedures to ensure that food safety concerns do not result in an inappropriate barrier to trade. Similarly, a control authority may require individual manufacturers to provide evidence of equivalence of control measures, particularly when non-traditional technologies are being used to control a hazard. New doc provides guidelines for implementation in LMIC.

While metrics are considered key to monitoring and improving performance, they can also have unintended consequences, including focusing efforts on the thing to be measured rather than the ultimate goal of improving the thing being measured; stifling innovation through standardization; costs that increase in disproportion to benefits attained; incentivizing perverse behaviour to game

metrics and decreased attention to things that are not measured (Bardach and Cabana 2009). Balance and potential of large multinationals vs. SMEs; short vs. long value chains and LMIC's

Even in HICs, small and medium firms find it difficult to comply with complex and technocratic rules, measures and metrics that are characteristic of best practice food safety management systems and risk-based approaches: these methods are hardly applicable in LMICs. The same applies for traceability, which appears only attainable in niche, high-value markets in LMICs (Grace et al, 2018).

Local producers and value chains, income and land inequality: for many consumers, especially in low- and middle-income countries, local production is the main supplier of nutritious food (fruits, vegetables, pulses) and the primary provider of economic activity. Small and medium sized farms produce critical nutrient diversity in rural areas (Herrero et al., 2017) and hence the transition to sustainable consumption requires support and value chain creation for linking food systems actors (HLPE, 2020). Many cities are playing much more active roles in the development of city region food systems; notably recognizing that environmental damage in regions procimate to cities impacts a large number of peoples, and that greater collaborations between cities and pei-urban spaces offers important opportunities to tackle environmental challenges while increasing the availability of healthy foods, and supporting stronger rural economies (e.g. the Paris Food System Strategy)

The role of trade in open and closed economies: Trade is an essential instrument in the food systems, but it is not always geared towards sustainable consumption. While trade can act as an insurance policy to local disruptions, it can also increase exposure to disruptions in external markets. This is evident in many low- and middle-income countries where trade in cheaper, ultra-processed food with long shelf lives competes with healthy food. In many locations around the world (i.e. The Pacific, South America) this is a likely contributing factor to high prevalence of obesity and increases in non-communicable diseases (Swinburn et al., 2019). However, trade also allows for leveraging of comparative advantages, which can allow production to be located where it is more efficient (Arneth et al. 2019, Frank et al. 2018). This has been a key feature of scenarios for achieving greenhouse gas mitigation targets (Arneth et al 2018). However, when facing varied levels of regulation and power dynamics, trade can facilitate the outsourcing of environmental impacts of the food system to more vulnerable countries and individuals. Export-oriented value chains often are dominated by larger producers, who can concentrate market and political power as dominant producers and suppliers of food as well as sources of employment and revenue to governments (Swinburn et al. 2019). These aspects are intertwined with the political economy of food. .

It is also important to consider the impacts of the rising number of barriers to international trade on the affordability of nutritious foods (including non-tariff measures put in place to ensure food safety), as restrictive trade policies tend to raise the cost of food, which can be particularly harmful to net food-importing countries (FAO, et. al., 2020). Protectionary trade measures such as import tariffs and subsidy programmes make it more profitable for farmers to produce rice or corn than fruits and vegetables. According to data from Tufts University, removing trade protection across Central America would reduce the cost of nutritious diets by as much as 9% on average (FAO, et.al. 2020). The efficiency of internal trade and marketing mechanisms is also important as these are key to reducing the cost of food to consumers and avoiding disincentives to the local production of nutritious foods, are important to improve the affordability of healthy diets for both urban and rural consumers.

The political economy of food: Swinburn et al. (2019) demonstrated that the food system is riddled with power imbalances and conflicts of interest when large commercial interests in food manufacturing and trade exist. While large companies are interested in new metrics for sustainability, financial interests often prevail over sustainability concerns. According to Swinburn et al. (2019), changes in the regulatory environment and new incentives, combined with global efforts

on sustainable trade, will be required to create the necessary accountability and shifts towards healthy food.

Modifying behavioural changes: Most studies on transitions towards healthy diets from sustainable food systems have focused on exploring the technical feasibility of the diets and their production elements. Transition pathways and the levers for eliciting the required behavioural changes in consumption have received less attention (Garnett, 2016; HLPE, 2020). Nevertheless, there is unequivocal evidence that focusing on education at all levels is a key component for modifying behavioural changes (Alderman & Headey, 2017). Many regulatory instruments such as fat, meat and sugar taxes have been implemented without much success, while there is evidence that price incentives to make fruits and vegetables more affordable have worked in many instances (Garnett, 2016; Swinburn et al., 2019) . Regulation in marketing campaigns, certification and product placement have also played important roles in some instances (Swinburn et al., 2019).

Section 5. The key trade-offs and synergies

Food systems in both developed and developing countries are changing rapidly. Increasingly characterized by a high degree of vertical integration, high concentration, transitions in food systems are being driven by new technologies that are changing production processes, distribution systems, marketing strategies, and the food products that people eat (Stordalen & Fan, 2018). The arguments for aligned action on healthy diets from sustainable food systems are attractive from multiple standpoints. The possibility of engaging in triple-win actions linking health, consumption and the environment presents a real opportunity to achieve numerous global commitments simultaneously, which could be desirable from a policy perspective. These include planned emissions reductions (Arneth et al., 2019; Leclere et al., 2020; United Nations, 2015), reductions in malnutrition in all its forms and non-communicable diseases and achievement of SDG goals and targets (SDGs 1, 2, 3, 6, 8, 12-16)). These multi-sectoral opportunities will require increased concerted action and alignment at global and national level. While potentially these synergies could lead to human and planetary wellbeing, their achievement could also yield significant trade-offs that will require resolution. Some of these are related to the following dimensions:

Affordability: Hirvonen et al., (2020) recently demonstrated that the flexetarian reference diets proposed by Willett et al. (2019) are too expensive for 1.6 billion people, notably the world's poorest who live on less than $3.20 per day. For these people access to food, let alone healthy food remains a daily challenge. Increases in consumption of fruits and vegetables, pulses and animal source foods are often considered luxuries for these individuals, many of whom make up the 2 billion whom lack access to key micronutrient such iron and vitamin A. Healthy diets would represent between 52-89% of the daily household income in low and low- and middle-income countries

Availability: Part of the reason why many of the components of healthy diets are expensive follow the basic economics of supply and demand. In many cases, production of key dietary components does not meet the required demand, even at global level, and therefore their prices are high. Mason-D'Croz et al. (2019) recently demonstrated this for fruits and vegetables, a key component of healthy diets. They concluded that even under optimistic socioeconomic scenarios, future supply will be insufficient to achieve recommended levels in many countries. Even where supply exists (i.e India), internal barriers like poorly developed markets, increased incomes do not necessarily result in increased consumption of healthy diets (Fraval et al., 2019).

Economics and equity concerns: The evidence on equity trade-offs is significant and encompasses many aspects of consumption and the wider economy. Hirvonen et al. (2020) and Mason-D'Croz et al. (2019) estimated that up to 1.6 billion people will not be able to consume enough fruits and

vegetables, primarily low income consumers due to lack of availability; nor afford a shift towards healthy and sustainable diets as modelled by the EAT-Lancet study. These consumers would be the poor sectors of society.

Food Safety, Local and/or circular food systems:
Pandemics and zoonosis: Transitioning to plant-rich diets and reducing consumption of food of animal origin will contribute to preserving ecological systems and wildlife avoiding the spill over of zoonotic agents (mainly viruses) outside their original environment (Gale & Breed, 2013; Wood et al., 2012). In recent years we have seen several examples of such spill overs (Ebola, SARS, MERS and COVID19) with dramatic economic and public health consequences and the potential to cause global pandemics. Another consequence of COVID 19 pandemic is the disruption of global, or concentrated value-chain production in terms of affordability and food availability; inversely, many of local value chains have seen increases in production and market shares.

The global burden of disease from food consumption is very different across the globe as shown by the Global Burden of Foodborne diseases report (WHO, 2015) and it is in a large part produced by zoonotic infections. Today, the largest food source attributions in food borne intoxications is from food of animal origin in the western world. Antimicrobial Resistance contributes significantly to the burden of disease across the globe and constitutes a threat to public health.

Political feasibility:
Broad awareness of the positive or negative consequence of food systems changes from a nutritional, health, environmental and livelihood perspectives among key policymakers is key to policy changes. Increased biodiverse agricultural production can result in increased employment and income leading to growing demand for (healthy) food , provided there is strong consumer awareness regarding diets and their consequences, and provided there are few competing demands on the incomes of the poor e.g. health care, school fees, uniforms, mobile phones, transport charges —all increasingly important for poor households, and each with more immediate visible benefits than impacts of dietary changes. To understand this phenomena, we need to break down agricultural growth patterns and accompanying environmental and social changes and the trade-offs involved in those changes, for example, whereas there is abundance of production through growth it has led to adverse environmental impacts and insufficient income and employment generation to achieve positive dietary changes. But how broad is this knowledge? We just do not know. because of complex location specific trade offs among these processes and objectives. For example, increased oil palm production in Malaysia and Indonesia to meet rapidly rising global demand has come at the cost of loss of carbon dence and biodiverse tropical forests. But payments for environmental services is not an easy option given arresting oil palm production if it entails substantial loss of employment, income and involves fiscal costs. Many other such examples can be cited.

Political commitment is needed at all levels, but the evidence of transition strategies is few and far between and only in a few high middle income and developed countries (i.e. Chile, Canada, The Netherlands).

Section 6. Solutions and Actions

Solutions to enable the shift towards more sustainable consumption need to be defined around cross cutting levers of joined-up policy reform, coordinated investment, accessible financing, innovation, traditional knowledge, governance, data and evidence, and empowerment. Using the typology described by (Béné et al., 2020), these actions may include:

Economic and structural costs: Off-set the economic and structural costs associated with the transition to more healthy and sustainable diets.

- Policies and investments across food supply chains (food storage, road infrastructure, food preservation capacity, etc) are critical to cut losses and enhance efficiencies to lower the cost of nutritious food (FAO, et. al. 2020)
- The provision of financial incentives to make healthy diets more affordable has been shown to increase consumption on fruits and vegetables (Olsho et al., 2016)
- Provide support and transition options for potential losers impacted by the required changes to land use, food production practices, storage and processing technologies, food environment, distribution and food waste.
- Direct funding towards a healthy and sustainable food system e.g. repurpose funding from monoculture crops, or foods which when overproduced are detrimental to health and environment (e.g. sugar and its derivatives)
- Facilitate easier access to loans from financial institutions, or lands from municipalities notably for young farmers, both men and women.
- Piloting and scaling behaviour change interventions that are effective in reducing consumer food waste and increasing adoption of healthy and sustainable diets
- Investing in innovative food related infrastructure and logistical systems that will improve the efficiency of food supply chains, particularly to urban consumers

Challenge the current political economy

- Encourage large food system actors to transition to the provision of healthy foods through incentives matched with penalization or taxes for overproduction of unhealthy foods, or the use of degradative production practices.
- Trade policies and input subsidy programs need to change incentives towards nutritious foods like fruits and vegetables. This also imply improvement of food safety to reduce non-tariff trade measures to increase the availability of healthy diets.
- Business-driven mechanisms to re-orient markets and corporations (Swinburn et al 2019):
    - promote social and environmental aspects of corporate performance to be equal to financial performance
    - refrain from investing huge effort and resources into opposing public good regulations (that might harm product sales))
- Government-driven mechanisms to re-orient markets and corporations (Swinburn et al 2019):
    - Although the magnitude of effect ranges, there is evidence that fiscal measures such as taxes on unhealthy food improve diets (Andreyeva et al., 2010; Brambila-Macias et al., 2011; Eyles et al., 2012; Niebylski et al., 2015).
    - Regulatory measures to limit the sale and production of unhealthy products
    - Change the global regulatory environment, including international trade and investment agreements to favour healthy and sustainable foods over unhealthy foods.
- Investor-driven mechanisms to re-orient markets and corporations (Swinburn et al 2019):
    - divestment to avoid harm. This includes exclusion of certain companies from investment portfolios.
    - social impact investing. This aims to generate positive social impact from investment decisions alongside financial return.
- Civil society-driven mechanisms to re-orient markets and corporations (Swinburn et al 2019):

    - encourage consumers to demand for healthy, sustainable products and reject unhealthy products.
    - encourage consumers to demand increased accountability for large food system actors.
- Institutions, for example schools, health care facilities as well as government offices can transition to healthier diets through improved nutrition standards which flow on to improve the nutritional quality of meals served in those institutions (Gearan & Fox, 2020)
- Gear public policies towards creating a healthy and sustainable food system. In some instances there is evidence of effectiveness, for example regulation has been found to reduce the volume of children's exposure to marketing for foods high in fat, sugar and salt (Chambers et al., 2015).

Education and cultural norms: Facilitate a cultural shift in consumer perceptions and behaviour.

- Educate consumers to make healthy choices can be effective in some circumstances. For example, social marketing when employed to its full extent has been found to positively change healthy eating behaviour (Carins & Rundle-Thiele, 2014). However, measures to support informed choice such as public information campaigns have been found to be successful in raising awareness of unhealthy eating, but have failed change eating habits (Brambila-Macias et al., 2011).
- Investing in women's, minorities and youth leadership and technical and managerial skills is key to promoting more equitable and sustainable participation of women in food supply chains, as producers, processors, business leaders and consumers, example of women's self-help groups.
- Education and clarity for consumers about what constitutes a healthy and sustainable diet
- Altering food availability options can enhance consumer choice of healthy food. A review of studies found strategic placement of fruit and vegetables was found to have a moderately significant effect on fruit and/or vegetable choice/sales/servings increase (Broers et al., 2017). Individual studies show mixed results.
- Taxes and front-of-pack information labels have been used with success to moderate the purchase of unhealthy food, as well as influence reformulation of unhealthy products (Colchero et al., 2017; Roache & Gostin, 2017; Taillie et al., 2020).
- Investing in large-scale awareness-raising that connects food consumption patterns with health, environment and specifically climate change outcomes.

Equity and social justice: Manage equity and social justice to provide the greatest benefit to all:

- Encourage regions to transition to more healthy and sustainable diets in a culturally appropriate manner.
- The systematic use of full supply chain traceability has been shown to promote internal transparency (Bush et al., 2015). This could potentially be a way to promote social justice in the industry and protect people employed in low- and middle-income countries.

Governance and decision support tools

- Invest in addition to knowledge, skills and data and tools needed to identify, prioritize and manage trade-offs and competing priorities.
- Standardisation and clear labelling.

- Tools for measuring consumer and retail food waste at national level, to understand the scale of the problem, identify hotspots for targeted action, and track progress towards SDG 12.3.
- *Increased adherence to principles of circular economy recycling and repurposing food waste becomes the norm.*
- *Rationalizing food related sustainability standards*. Such initiatives, which set standards for sustainable production and often include certification programmes to verify compliance, can be used as tools to drive consumer choice on the one hand and to channel and enhance the nascent demand for more sustainable food systems into market related investments on the other. However, some regulatory approaches and private sector-led schemes create barriers primarily because of the costs of compliance and the potential exclusion of actors.

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