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EXECUTIVE SUMMARY

The Farm to fork (F2F) highlights priorities to be addressed by action plans and political interventions. In this report, existing policies are linked to sustainable priorities in a way to spot synergies and gaps along the food supply chain (FSC). In total, 15 food-related political strategies were found and detailed according to FSC stage, scope (climate change mitigation or adaptation, and governance) and their contribution to the decarbonization target. Despite visible synergies with F2F priorities, current policies do not cover all aspirations proposed in the F2F blueprint, a fact that calls for concise planning and political interventions in all working areas.

Deliverable D7.3

1 INTRODUCTION

Climate change is a pressing global challenge that threatens the biodiversity conservation, disrupts natural cycles' dynamics (Naumann et al., 2018), worsens social vulnerability (Otto et al., 2017), and jeopardizes food production to a growing world population (Del Borghi et al., 2022). In this context, food production is not only sensitive to climatic variations (Howden et al., 2007), it is also a major agent of greenhouse gas (GHG) emissions (Crippa et al., 2021). Land-use systems alone contribute to about 25% of global GHG emissions, of which 10-14% refer directly to food production and 12-17% from land-use change (LUC) and deforestation (Paustian et al., 2016). Notwithstanding the importance of emissions coming from activities before the farm gate, large amounts of GHG are also emitted in post farm FSC stages. Thus, strategic interventions to decarbonize all FSC stages are urgent to sustain ecosystems' ability and resilience to produce food. Moreover, if FSC missions remain untouched, the Paris Agreement target of keeping average temperature below the 1.5°C would not be achieved, even if fossil fuel emissions were reduced (Clark et al., 2020).

The European Green Deal (EGD) is a policy package to promote carbon neutrality in a wide range of productive sectors. More specifically to the food sector, strategies and political plans are proposed within the EGD'S blueprint to reduce environmental and climate footprints of the EU's FSC, to promote healthy diets, and to reduce food waste (e.g. *Farm to Fork Strategy (F2F)*, *Biodiversity Strategy*, *Circular Economy Action Plan*, *Zero-Pollution Ambition*, *Just Transition*). These strategies exemplify policy building blocks with specific guidelines and policy proposals to the broad scope of European productive sectors (Figure 1).

The F2F is the central policy workhorse related to the European food sector with a proposed legislative framework for sustainable food systems, expected to be approved by the end of 2023 (European Commission, 2023). Despite the urge for a comprehensive set of food-related political proposals in the EU, the scope of the legislative framework is still under elaboration and discussions. It is considered that a concise set of legislation might only be fruitful with social commitment and engagement, able to provide not only voluntary measures and monitoring, but also to directly promote change. Nevertheless, transiting to a sustainable food sector calls for clear commercial and political engagement fostering the affordability of sustainable food, GHG emissions monitoring, synergies between current and new policies, taking into consideration specificities and challenges in all stages of the FSC (Baldock & Hart, 2021). The new legislative framework has the important task to set a common definition and backdrop elements about "sustainable food", as well as to highlight priorities, objectives, key areas of action, how they are going to be tapped, and in which time frame.



Figure 1 EU Green Deal's main goals and central policy blocks proposed
Source: Author's elaboration based on the European Green Deal by [the European Commission](#).

Following from the political agreements and efforts to transform the European food sector, this report serves this process by supporting policy makers and multiple stakeholders involved in all FSC stages. The report builds upon a benchmark of policies and regulations and performs a policy content analysis. With that, synergies and gaps among existing policies and the F2F proposed priorities across all stages of the FSC are assessed. Next, the method, priorities, existing policies and policy gaps are outlined, to finish with some conclusions.

2 METHODS

The methodological approach consists of a policy content analysis of policies, regulations, and directives as means to assess policy gaps towards sustainability in the European food sector. Policy content analysis is a methodological tool which systematically assesses the informational content of political documents (e.g. Policies, regulations, speeches, reports) to identify specific patterns, progress, priorities, among other characteristics (Hall & Steiner, 2019; Hsieh & Shannon, 2005). To identify policy gaps, the analysis is drawn from a food-related self-collected set of policies and regulation to strive sustainability in the European food sector (Moreira-Dantas et al., 2022a; Moreira-Dantas et al., 2022b). This political benchmark is coded and categorized according to FSC stage as described by Moreira-Dantas et al. (2022b). Additional to the regulations, the analysis targets policy proposals related to food sustainability. The goals and targets proposed by the F2F are used as the

main blueprint to sustainable transition, so that current political efforts will be linked according to proposed F2F targets

Figure 2 sets out the systematic policy analysis that is performed in this report. Firstly, the benchmark of current policies and regulations related to sustainability in the food sector is analyzed according to FSC stage, the expected result and how a certain policy might contribute to the achievement of the net-zero emission target. Subsequently, laws and regulations are analyzed according to the targets and priorities proposed and agreed by the F2F. Technical documentation related to the F2F is used to spot priorities and political proposals.

POLICY CONTENT ANALYSIS

TARGET

Policies and Regulations

QUESTIONS

Food supply chain stage

Expected result

How it contributes to the net-zero target

SUSTAINABLE BLUEPRINT

Targets and priorities

FARM TO FORK STRATEGY

"Fair, healthy and environmentally-friendly food system"

Figure 2 Policy content analysis framework based on two stages: Specific policy target and content followed by their synergies with the farm to fork strategy.

3 FARM TO FORK PRIORITIES

The F2F acknowledges the importance of all actions involved in the FSC to support and enable the sustainable transition. According to the F2F action plan (European Commission, 2020), collective engagement is key to reduce input (e.g. fertilizer, pesticide, energy) use and to switch to a clean production process. Yet, it is only possible with human capital and financial investments. Policy design is at the forefront to guide and provide means for a progressive transformation while considering several levels of policy implementation (Parks, 2022). Policy design does not only imply stringent laws and regulations that mostly apply in the supply-side, but also the integration of several demands, policies, and priorities across economic and regional contexts (Parks, 2022). Hence, decarbonizing the European food sector depends on a well-designed political framework that considers stages, actors, and socio-economic, cultural and environmental conditions across FSC

stages. The F2F sets policy proposals (some of them still under elaboration and approval process), private initiatives, and action plans while considering issues about food production, food security, sustainable food processing, wholesale, retail, food services, food consumption, and reducing food loss and waste. Such categories represent overarching domains of change with specific challenges that should be tackled in order to achieve a net-zero sustainable FSC. The specific targets related to each stage of the FSC, namely, (i) Production; (ii) Processing, Packaging, Retailing and Distribution; (iii) Consumption; and (iv) Waste; are outlined below.

3.1 Production

In the production sphere, the F2F strives political action in the following issues: (i) *green business models* with focus on carbon sequestrations with public benefits from the common agriculture policy (CAP) and private gain from carbon market and certification schemes; (ii) *circular biobased economy* through the establishment of bio-fertilizers and chemicals, protein feed, bioenergy, and biogas based on organic waste and manure; (iii) *reduction of chemical pesticides* and their associated pollution and biodiversity loss risks. The EC targets to reduce these risks by 50% until 2030, which will be accompanied by the “Sustainable Use of Pesticides Directive” with integrated pest management strategies; (iv) *soil and water pollution through excessive nutrient use* due to inefficient nutrient management. The EC aims at a 50% reduction of nutrient loss and, consequently, a 20% fertilizer reduction by 2030; (v) *antimicrobial resistance* through the excessive sale of antimicrobial to animals and aquaculture production. The EC targets a 50% reduction of antimicrobial sales by 2030; (vi) *animal welfare* through the revision of the animal welfare legislation; (vii) *organic farming* shall be further promoted by additional CAP measures, investments, certification schemes, to reach the goal of at least 25% of EU land under organic production by 2030; (viii) *sustainable fish and seafood production* through sustainable production management.

3.2 Processing, packaging, retailing, distribution

Stages beyond the farm-gate are important GHG emitters (Crippa et al., 2021; Garnett et al., 2013) and deserve especial legislative attention when it comes to decarbonization strategies. So far, the F2F envisions transformative actions in the following fields: (i) *circular business models* for food processors and retailers to strive bioeconomy across SMEs; (ii) *food packaging* to support alternative re-usable and sustainable means of packaging; (iii) *marketing standards to strengthen the supply of food products* that follow sustainable standards. The EU is a major food importer and exporter, a fact that may also influence the carbon footprint of its trade partners. For this reason, it is also important to enact regulations that track the origin of the products.

3.3 Consumption

In the EU, food consumption patterns still have to go through profound modifications in order to follow the increase in demand of food products produced under sustainable premises. The F2F proposes actions to empower consumers to obtain information about sustainable consumption, as well as products origin, packaging, nutritional content, among other aspects of sustainable food. Besides revising voluntary schemes for sustainable initiatives, the EC aims to improve *price and food availability* to scale up demand for food products that accompany the changes envisaged across FSC.

3.4 Waste

Food loss and waste management are related to several economic and environmental impacts not only related to GHG emissions, but also *water and soil pollution*, and socioeconomic implications of excessive use of resources and costs for consumers and producers (European Commission, 2020; Lipinski et al., 2013). In this matter, the EC aims to *reduce food loss* by 2030 by including waste

prevention in the EU policy and by improving the measurements for food waste while integrating its member states¹.

4 POLICY

Figure 3 sets out the self-collected list of EU regulations and directives related to the FSC stages. A total of 15 policies are analyzed according to the FSC stage of influence, scope of action and final objective that each has. All policies have a direct relation to net zero emissions, either in terms of improving governance tools to design suitable policies; or supporting technology-oriented pathways to enable affordable clean energy sources or setting products energy standards. While some policies are directly related to specific FSC stages (e.g., net zero emissions in land use activities), most regulations and directives listed have a more general characteristic, being applicable not only across several SFC stages but also in other productive sectors. Furthermore, climate change mitigation is the main scope of action of most policies, a fact that supports efforts to implement clean energy sources in refrigeration equipment, transportation systems, public and private buildings, and even single equipment parts (contemplated within the eco design directive).

¹ Commission Delegated Decision (EU) 2019/1597 of 3 May 2019 supplementing Directive 2008/98/EC of the European Parliament and of the Council as regards a common methodology and minimum quality requirements for the uniform measurement of levels of food waste

POLICY	FSC STAGE	SCOPE	OBJECTIVE
R 2018/841/EU Reduce emissions	Production	Climate change mitigation	Ensure net zero emissions in land use activities
D 2006/40/EC Refrigerant use	Distribution	Climate change mitigation	Monitoring air conditioning systems and leakage
D 2019/633/EU Fair trade	Production Processing	Governance Climate change adaptation	Prevent unfair food trading practices
R 517/2014/EU Regulate F gas use	Processing Distribution Retailing	Climate change mitigation	Labelling, reporting and regulating F gases use
D 2018/2001/EU Renewable energy	General	Climate change mitigation	Energy consumption from renewable sources
D 2010/30/EU Product label	Packaging Consumption	Governance Climate change mitigation	Labelling and standard product information
D 2009/125/EC Eco design	Processing Distribution Retailing Packaging	Climate change mitigation	Ensure energy efficiency and environmental protection through eco design requirements
R 2018/842/EU Reduce emissions (general)	General	Climate change mitigation	Determine annual emission allocations
D 2018/844/EU Energy efficient building	General	Climate change mitigation	Cost-effective transformation of existing buildings
R 2018/1999/EU Strategies to reduce emissions	General	Governance Climate change mitigation	Mechanism design emission reduction strategies
R 517/2014/EU Reduce F gas emissions	Processing Distribution Retailing	Governance Climate change mitigation	Rules f-gas containment, use, recovery and destruction
D 2019/1937/EU Protect persons reporting breaches	General	Governance	Standards to report breachers in the food sector
D 2013/34/EU Financial liability	General	Governance	Consolidate annual financial statements and reports
D 2009/128/EC Sustainable pesticide use	Production	Climate change adaptation and mitigation	Regulate pesticide use
D 2008/98/EC Waste management	Waste	Climate change mitigation	Framework for waste management

Figure 3 Detailed policy characteristics according to food supply chain stage, scope and policy objective. Note: D=directive; R=regulation.

5 POLICY GAPS

In this section the policies identified in Figure 3 are linked to F2F priorities, by FSC stage. In this way, the overarching F2F priorities to secure sustainable FSC are used as the basis to identify current policy gaps. Considering that transformative targets proposed by the F2F and the EGD represent a new economic paradigm, some policies and regulations are still under elaboration and public consultation and debates in EU wide political spheres will serve to give a final shape. New policies shall be in synergy with existing ones so to act as efficient “push-factors” of sustainable transformation. Thus, the FSC stage-specific priorities proposed by the F2F, are our base for analyzing which political efforts already in place need to be synergically incremented, and which priorities are not yet accounted for by existing policies. Therefore, policy gaps are not missing policies, but rather those priorities that are not yet contemplated by existing policies, and should be targeted by upcoming political efforts.

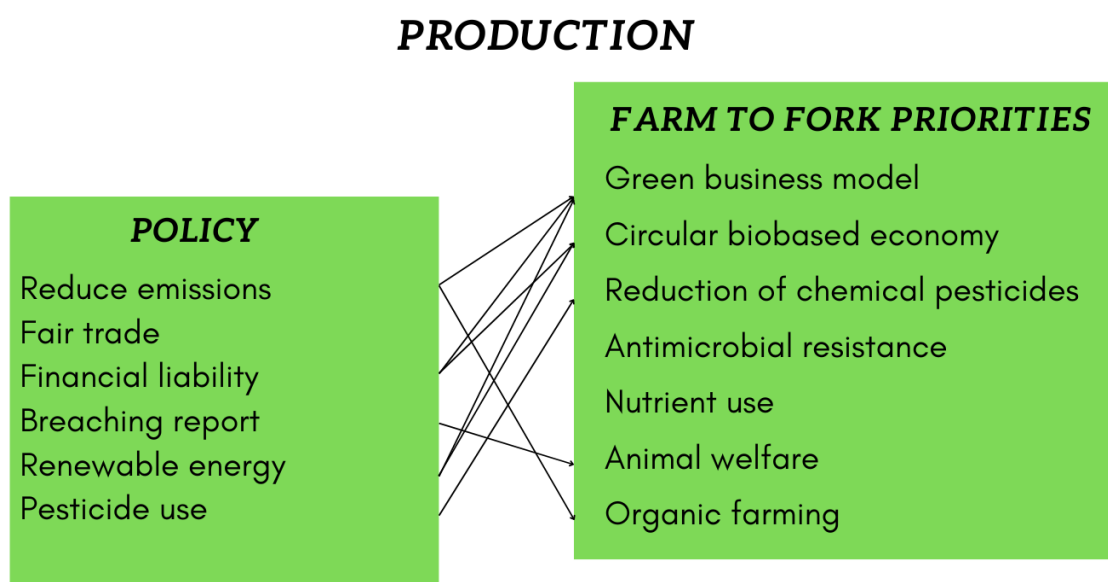


Figure 4 Linking existing policies to Farm to Fork priorities in production.

In the production stage, F2F priorities are in general supported by existing policies (Figure 4). Reducing emissions and avoiding unfair trade agreements relate to the overall F2F objectives. We found synergies in terms of net zero emission targets in land use activities and the goal to increase organic farming. Although the net zero emission policy is neither causal nor central to achieve higher organic farming practices, it may influence not only organic farming but also agricultural operations as a whole, while enforcing the need for more sustainable agricultural practices with high carbon removal potential. The policy regarding financial liability and investment transparency is in synergy with the premises for green business models and circular biobased economy. Considerable investments are foreseen to enable such priorities, which calls for financial transparency where capital is allocated to support SMEs with sustainable portfolio. Likewise, policies enforcing higher shares of renewable energy sources and the phase-out of fossil fuels are directly linked to green business and circular economy advancements. The law to protect persons that inform breaches in production activities is related to animal welfare when it comes to agricultural production, but also to food and feed safety. Lastly, a directive to regulate pesticide use is directly linked to the priority to reduce chemical pesticides in food production. Policy gaps are exemplified by the need of higher

policy guidelines to meet antimicrobial resistance, and excessive nutrient use. Existing policies do not seem to be in synergy with such priorities, pointing to the need of higher political enforcement to achieve such targets. Furthermore, action plans, guidelines, training, and investments shall be in combination to establish carbon removal practices and to support sustainable production.

PROCESSING, PACKAGING, RETAILING, DISTRIBUTION

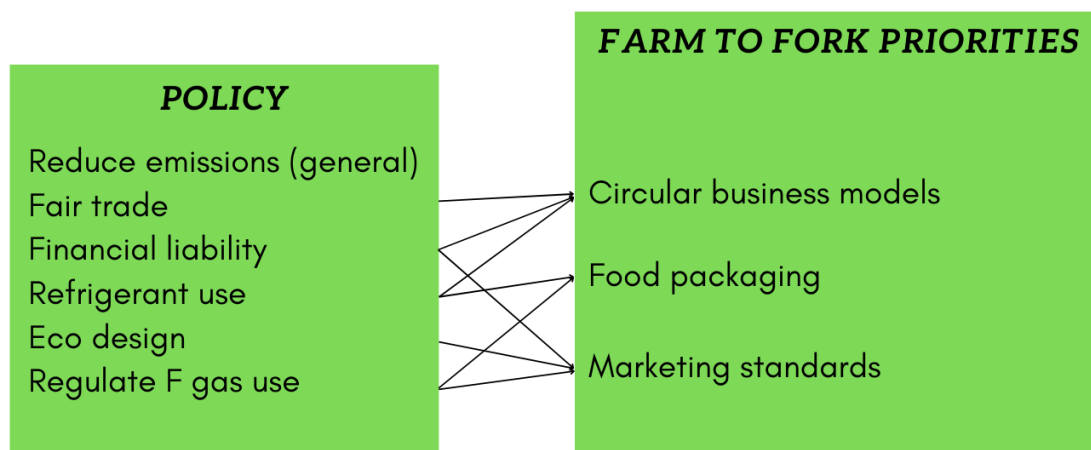


Figure 5 Linking existing policies to farm to fork priorities in processing, packaging, retailing, and distribution stages.

Moving to stages beyond the farm gate –processing, packaging, retailing and distribution–, these are very complex and involve high number of SMEs and large companies (Kühne et al., 2010). The F2F envisions three main priorities of action across such stages: circular business models, food packaging and market standards. Despite their overall synergies with existing policies (Figure 5), more emphasis should be placed on political and financial incentives to develop clean technology and the subsequent adoption.

Current F-gas regulations are aimed at improving enforcement and implementation and applying harsher penalties for non-compliance. Monitoring will have to be more comprehensive with enhanced reporting and verification procedures, preventing leakages, recovery, and labelling. Despite that, the stage in the food chain in which legislation related to refrigerants is lacking is that of transport refrigeration units (TRUs). For TRUs there are no product bans. Furthermore, more emphasis should be in place to enhance competitiveness of business that produce cold systems and products with alternative low global warming potential (GWP) natural refrigerants (e.g. carbon dioxide, hydrocarbons and ammonia). Thus, new businesses will be able to attract market demand for clean technologies and, in fact, consolidate a market where high GWP refrigerants are not crucial.

Next, food consumption, a central FSC stage, is not only relevant for food security issues, but also because high amounts of GHG emissions come from households (e.g. cooking, cooling) and carbon footprint product consumption (Munksgaard et al., 2000). It is estimated that animal-based diets emit twice as much GHG emissions than the amount emitted by plant-based food (Xu et al., 2021). Therefore, consumption patterns have the possibility to push demand for food produced under sustainable premises. Consequently, sustainable consumption may impact production processes and embodied emissions. Shifting consumption has high mitigation potential in several areas, including changes in household purchasing patterns, community behavior, and everyday choices around

consumption (Ivanova et al., 2020). Existing policies are synergically related with the F2F priorities proposed in the consumption sphere (Figure 6). Product labeling is certainly an important aspect when fostering conscious and sustainable consumption, a fact that is already envisioned by current laws but shall be incremented with future directive. Nevertheless, food affordability is not amply tackled with existing regulations. The F2F intends to reinforce minimum sustainability standards for public procurement (European Commission, 2020), however, this might not be a sufficient strategy to ensure affordable sustainable food.

FOOD CONSUMPTION

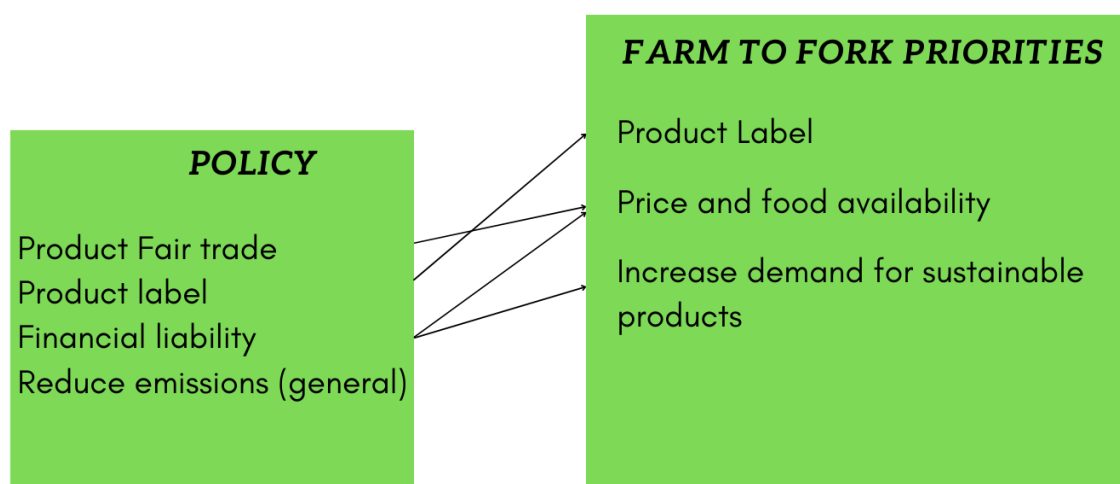


Figure 6 Linking existing policies to Farm to Fork priorities in consumption.

FOOD WASTE

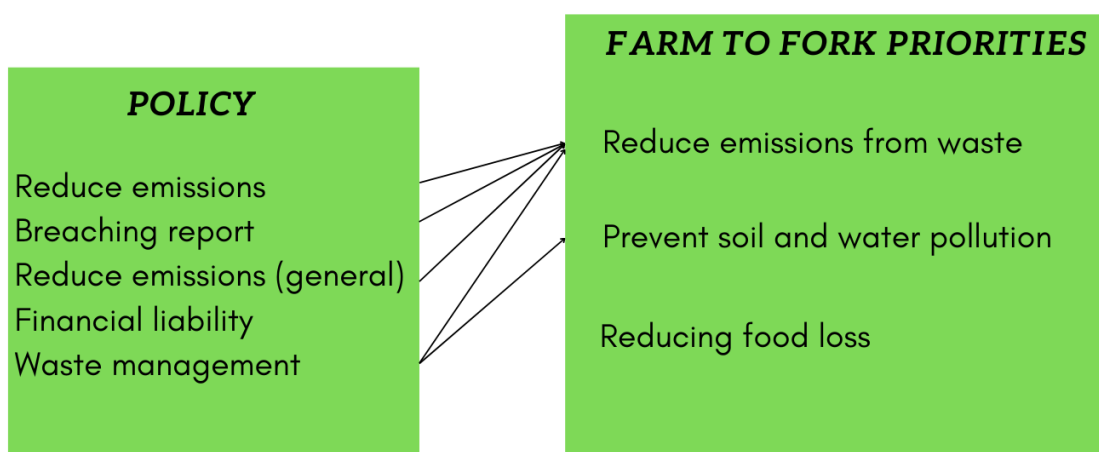


Figure 7 Linking existing policies to farm to fork priorities in waste

Finally, food waste and loss happen across all FSC stages and result in considerable environmental impacts in terms of emissions, water and soil pollution, as well as socioeconomic issues regarding food security (Wang et al., 2021). Thus, addressing food loss and waste shall take into consideration socio-economic and environmental pressures beyond GHG emissions. Priorities set for waste

management seem to present the least synergies with existing policies (Figure 7), with the emphasis mainly put on reducing emissions from waste. Nevertheless, policies have a more general character with only one directive for a legal framework of waste management, but rather in a broader scope of all activities in the food sector. Currently, the EC explores the integration of food loss and waste in future policies, as well as improving cross-country monitoring tools for food waste (European Commission, 2020). Ongoing political debates would profit from designing interventions to foster waste management and regulations for reducing food loss and protecting soil and water resources from waste contamination.

6 CONCLUSION

The F2F is the central political blueprint to advance the transition in the European FSC. Currently, the EC is committed to design political interventions to transform production and consumption patterns into a sustainable net-zero emission food sector. Despite synergic relationships among existing policies and F2F priorities, there is a need for additional political strategies in specific areas.

In the production stage, policy interventions are needed to meet reduction of antimicrobial resistance, and excessive nutrient use. Moreover, action plans and guidelines are central to establish carbon removal in production practices.

Furthermore, addressing GHG emissions in cold chain stages is mainly related to the F-gas regulation. Despite improvements brought by this regulation, political interventions are still needed to enhance competitiveness of business that use clean technologies. Concise action and investment plans are key so companies could shift production structures to clean energy sources.

Sustainable food consumption priorities are overall synergic with existing policies. Improving product labelling informs consumers about nutrient content, origin, production patterns, and other elements. Consequently, consumers can potentially make healthier and sustainable decisions. Nevertheless, how policy makers plan to make sustainable food affordable is still unclear, a fact that calls for a clear approach.

Finally, F2F priorities regarding reducing waste and food loss presented few synergies with existing policies. For instance, policies are general and encompass several FSC stages, not presenting concise strategies to address food waste *per se*. Therefore, political interventions and action plans are needed to address food loss reduction, to halve soil and water contamination, and to promote sustainable waste management.

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Appendices

APPENDIX

POLICY	FSC STAGE	CONTRIBUTION
Amending Regulation 2018/841/EU	Production	To ensure that emissions do not exceed removals, calculated as the sum of total emissions and total removals on its territory in all of the land accounting categories (forest, agriculture, etc.)
Directive 2006/40/EC	Distribution	To grant EC or national type-approval to emissions from air conditioning systems; ensure that manufacturers supply information on the type of refrigerant used, and that the leakage rate of such gases does not exceed the maximum permissible limits of 150 global warming potential
Directive 2019/633/EU	Production Processing	Prevent unfair trading practices among seller and buyers of agricultural and food products as a way to diminish economic and welfare risks of agricultural communities
Regulation No 517/2014/EU	Processing Distribution Retailing	Containment, use, recovery and destruction of the fluorinated greenhouse gases (covered by the Kyoto Protocol); labelling and disposal of products and equipment containing those gases; reporting of information on those gases; placing market prohibitions for products and equipment; training and certification of personnel and companies involved in activities provided for by this Regulation.
Directive 2018/2001/EU	General	EU target for overall share of energy from renewable sources in the Union's gross final consumption of energy in 2030. It lays down rules on financial support for electricity from renewable sources, on self-consumption of such electricity, on the use of energy from renewable sources in the heating and cooling sector and in the transport sector, on regional cooperation between Member States, and between Member States and third countries. It establishes sustainability and GHG emissions saving criteria for biofuels, bioliquids and biomass fuels.
Directive 2010/30/EU	Packaging Consumption	Framework for the harmonization of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products.
Directive 2009/125/EC	Processing Distribution Retailing Packaging	Framework for the setting of Community ecodesign requirements for energy-related products with the aim of ensuring the free movement of such products within the internal market. It sets requirements which the energy-related products must fulfil in order to be placed on the market and/or put into service. As a result, it increases energy efficiency, environmental protection and security of the energy supply.
Regulation 2018/842/EU	General	Obligations on Member States with respect to their minimum contributions for the period from 2021 to 2030 to fulfilling the Union's target of reducing its greenhouse gas emissions by 30 % below 2005 levels in 2030 in energy, industrial processes, product use, agriculture, and waste. It determines annual emission allocations and for the evaluation of Member States' progress towards meeting their minimum contributions.
Directive 2018/844/EU	General	Establishing a long-term strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonized building stock by 2050, facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings.
Regulation 2018/1999/EU	General	Establishing governance mechanism to implement strategies and measures designed to reduce emissions by 2030; stimulate cooperation between Member States; to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of reporting by the EU; to contribute to greater regulatory certainty and investor certainty.
Regulation No 517/2014/EU	Processing Distribution Retailing	Reducing emissions of fluorinated greenhouse gases. Establishes rules on containment, use, recovery and destruction of f-gases; imposes markets conditions for products and equipment.

Directive 2019/1937/EU	General	Enhance the enforcement of Union law and policies in areas (e.g. food and feed safety, animal health and welfare) by laying down common minimum standards providing for a high level of protection of persons reporting breaches.
Directive 2013/34/EU	General	Improve and consolidate annual financial statements and reports.
Directive 2009/128/EC	Production	Framework to achieve a sustainable use of pesticides by reducing the risks and impacts of pesticide use.
Directive 2008/98/EC	Waste	Legal framework for the treatment of waste within the EU.

Figure A 1 List of policies across food supply chain stage and their main contribution

Sources: [EUR-Lex - 32006L0040 - EN - EUR-Lex \(europa.eu\)](#)

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