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Plant proteins:

a key lever to accelerate food system transformation

Contents

About FReSH

Food Reform for Sustainability and Health (FReSH) is a project of the Food & Nature Program of the World Business Council for Sustainable Development (WBCSD).

We take a 'fork to farm' approach, starting with what people consume and focusing on the dietary and production shifts that are required, to develop, implement and scale transformative business solutions that are aligned with science-based targets. FReSH emerged from the WBCSD and EAT Partnership.

FReSH facilitates the pre-competitive collaboration of over 30 member companies to accelerate transformational change in the food system in order to reach healthy, enjoyable diets for all, produced responsibly within planetary boundaries. We focus on areas where business can have the most impact, along **four transformational goals**:

- Healthy and sustainable, from fork to farm;
- Food loss and waste;
- True value of food;
- Policy and advocacy.

The healthy and sustainable from fork to farm workstream accelerates the development of business-led solutions with the biggest positive health and environmental impacts – as outlined in FReSH's sustainable and healthy diets report published in 2018, as well as international publications issued the following year. We do this by focusing on the following topics:

- Accelerating the delivery of positive nutrition by the food industry;
- Scaling-up healthy and sustainable protein production and consumption;
- Stimulating the healthy and sustainable production and consumption of a diversity of nutrient-rich plants.

This report is a call for action for the business community and beyond to understand that business as usual is no longer an option and to find ways to scale up plant proteins to deliver healthy, enjoyable diets for all.

We will complement these documents with a FReSH roadmap to be launched at the Global Nutrition Summit in Tokyo containing a concrete action plan for positive nutrition, protein and plants.

Defining key terms:

- A **plant-based diet** is a diet comprised of foods mainly sourced from plants.
- A **plant-based food** is a food coming from any part of a plant; an **animal-based food** is a food sourced from animals, including meat, fish and dairy products.
- A **plant-based product** is a processed product derived from plant ingredients.
- A **plant protein** is a protein found within a plant-based food or product.
- A **plant-based protein** is a protein derived from plants that can be isolated and added to another product.

1 Introduction

① Introduction

A KEY LEVER TO REDUCE ENVIRONMENTAL IMPACTS IS A DIETARY SHIFT TO MORE PLANT-BASED FOODS

The global food system provides billions of people with energy, protein and other nutrients to support daily life. Yet it is also a major source of greenhouse gas emissions, it is depleting natural resources and fails to secure healthy diets for all communities around the world.[1,2,3,4] We have an urgent need to transform our food system to achieve the Sustainable Development Goals (SDGs).

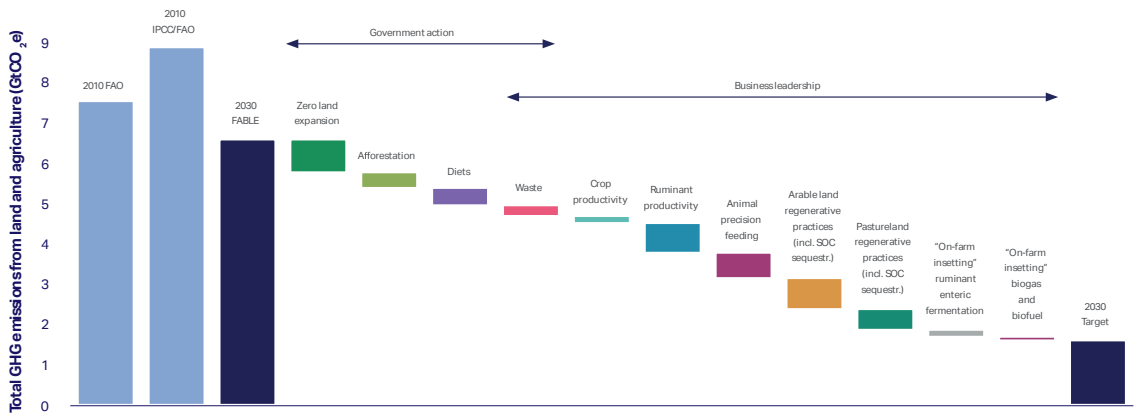
Consensus is increasing on the best pathways to transform the global food system to ensure a sustainable and healthy future. Thought leaders from the scientific community and civil society highlight the opportunity to improve health and promote global sustainability by shifting to plant-based diets.[5,6,7,8,9]

Figure 1 presents in graphic format the respective impacts of potential of business solutions to mitigate greenhouse gas (GHG) emissions from land-use and agriculture (see figure captions for more details).

Animal-based foods tend to have higher environmental impacts than plant-based foods.[12,13,14] Regardless of the production system, livestock are major emitters of greenhouse gases. They represent about 14.5% of all human-induced GHG emissions (which would be roughly equivalent to 7.8 gigatons carbon dioxide equivalent (CO2e) in 2018) and about 50% of emissions from agriculture.[15,16] As discussed in the FReSH "People, Planet, Protein – What's the Plan?" Science to Solutions Dialogue,[17] these high GHG emissions are attributable to the fact that it is necessary to feed animals throughout their life and ruminants such as cows release large quantities of enteric methane, a potent greenhouse gas.[18]

Thus, rebalancing diets with more plant-based foods – especially in countries dominated by Western diets where animal proteins are overconsumed – provides an opportunity to reduce greenhouse GHG emissions, the amount of land required for agriculture, natural resource consumption, chemical input use and biodiversity loss.[19, 20] To ensure the realization of this opportunity and a balanced and diverse market of plant-based foods will require both farm-level (e.g., to improve nitrogen conversion efficiency from fertilizer to plant protein) and system-level interventions.

Figure 1: Mitigation potential of business solutions on land and agriculture GHG emissions in $GtCO_2$[10]



WHY FOCUS ON PLANT PROTEINS?

Central to the discussion on transforming the global food system is protein. Proteins are essential for the human body; therefore, consuming adequate protein is vital to ensuring basic human health. Moreover, foods containing proteins are an important part of what makes food appealing in terms of aroma, taste and texture. The amount of protein an individual person requires depends on many factors (e.g., gender, weight, physical activity) but generally falls in the range of 40-70 grams per day for adults across the globe.[21] In Europe, North America and an increasing number of developing regions, many people today consume more protein than biologically necessary. This overconsumption of proteins parallels a greater consumption of animal proteins instead of plant proteins.

In Europe, the share of protein from animal sources (meat, eggs, dairy) compared to total protein increased from 48% in 1960 to over 60% in recent years.[22] Rising levels are also occurring in China, with an enormous global impact.[23] Generally, the dietary share of animal protein – and specifically meat protein – grows in step with increasing GDP; the various socioeconomic explanations for this are related to higher per person income, urbanization and accessibility.[24] With this increase in protein consumption, and specifically proteins from red meats, come higher environmental impacts – on climate, land and biodiversity – and can have a detrimental impact on health.[11,25]

In developed countries, there is a clear need – and a tremendous opportunity – to reach the right protein intake levels and rebalance the protein mix by promoting the production and consumption of plant proteins. Increased plant protein offerings can help balance and diversify diets, thereby fostering good health and nutrition, decreasing environmental damage and improving social factors such as food security and farmer livelihoods.

Pathways to achieving optimal protein intake and balance differ according to the development level and sociocultural habits of different regions. In many developed regions, like the Europe and United States, balancing protein intake requires a reduction in animal protein consumption. In other regions, such as Africa and India, which have a high plant protein intake,[26] the challenge is to ensure the population can maintain or improve access to an optimal mix of protein sources along with socioeconomic growth.

From an agricultural perspective, data shows sufficient global protein production to satisfy the basic needs of the world's growing population; however, important issues remain, including diversity of available foods, food waste across supply chains, maintaining farmer livelihoods in rural areas, as well as equity and access to high-quality protein in low-income populations.[27,28,29]

As such, any strategy to achieve a transformational shift in the food system provides an opportunity to address social issues such as access to healthy foods and securing farmer income and livelihoods. In the transition to a more diverse plant protein offering, it is essential to include farmers to ensure there is no risk of income instability.

A sustainable global food system will require work to ensure the accessibility and availability of a variety of high-quality and nutritious plant proteins for people across different cultures and incomes.

In the plant protein workstream, we identify and support the best solutions to scale-up a variety of plant proteins globally, promoting a sustainable and healthy balance of plant and animal proteins. Together with our members, we focus on driving the specific solutions where we can achieve the highest potential impact through collaboration.

WHAT IS A PROTEIN?

A protein is a molecular structure built out of amino acids that is fundamental to life. Protein provides nitrogen, energy and amino acids that are essential to building and maintaining the functioning of cells, tissues and organs. There are 20 amino acids that are the building blocks for all proteins. There are nine essential amino acids that the human body cannot make and thus that we need to obtain from food. Both animal and plant proteins provide all 20 amino acids, including the nine essential ones.

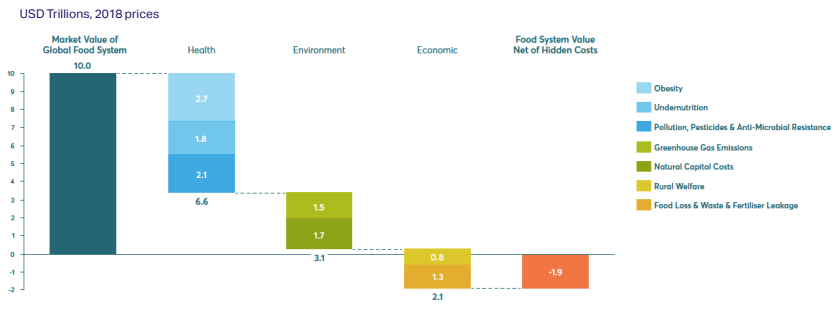
A "complete protein" refers to a source of protein that contains all essential amino acids that the human body can adequately digest and absorb to meet its needs. Plant products have different amino acid profiles and different digestibility and absorption by the body. Plant products can be complete proteins on their own (e.g., quinoa or soy) or act as complementary protein sources. This is important for diets high in plant proteins because different types of plants have different amino acid profiles and digestibility. Thus, consuming diverse plant foods can help to obtain complete amino acid profiles, for example by combining legumes with cereals, such as lentils with rice.[30] Whole plants (e.g., whole grains, nuts and seeds, fruits, vegetables and legumes) can also offer beneficial fibers, phytonutrients, antioxidants and other micronutrients; diets high in these whole plant-based foods are associated with decreased risks of non-communicable diseases.[31,32]

Another way to consume proteins from plants is as plant-based protein isolates. Food companies extract and purify isolated plant-based proteins and then use them as an ingredient in a plant-based product. Extracting proteins from plants can help facilitate digestibility and absorption by the body.

A trade-off to protein isolation is that, depending on the food that receives the protein, it may not provide other nutrients contained in whole plant-based food, such as fibers, antioxidants and micronutrients.

In the recently published Food and Land Use Coalition report (FOLU),[33] health aspects related to food consumption and food production dominate externalities (see Figure 2). However, environmental aspects related to biochemical flows of phosphorous and nitrogen exceeding planet boundaries surpass the externalities associated with GHG emissions.

Figure 2: Hidden costs of global food and land use systems[34]



The importance of nitrogen for the future of sustainable crops

To produce proteins, plants need nitrogen. Nitrogen availability is a main limiting factor for crop growth, which is why fertilizers are key to increasing crop yield. Some plants (like most legumes) can also obtain nitrogen from the air through a process called nitrogen fixation, where microbes near the roots are able to convert nitrogen gas to a form usable to make proteins.[35] There are a wide range of ways to make nitrogen available to crops, including: organic or synthetic fertilizers, plant engineering, and rotation with nitrogen-fixing plants. Diverse socioeconomic and environmental externalities can determine the methods used. Thus, to make plant proteins widely available and accessible, and to ensure environmental protection, careful consideration of nitrogen cycling and improving nitrogen efficiency is essential.[36]

2 State of the world and outlook for plant protein production and consumption

② State of the world and outlook for plant protein production and consumption

To understand the current global state of plant protein production and consumption, it is important to pay attention to the types of plant protein foods and products, as well as their regions of production and consumption.

Plant products, such as legumes, cereals, roots, nuts and seeds, contain plant proteins, as do plant-based products made with protein isolates or concentrates. Developed regions such as Europe and North America tend to consume more processed plant-based products made from soy, wheat and corn, while less industrialized areas often consume a more diverse protein mix, with a higher consumption of plant products.

To achieve more sustainable food systems, there is a need to scale-up healthy plant-based products as alternatives to products sourced from animals in more developed regions. At the same time, it is important to ensure that developing regions maintain or achieve a healthy and sustainable balance of nutritious plant-based and animal-based foods.

Globally, maize, rice, soy, and wheat make up nearly two-thirds of crops and human calorie consumption.[37,38] Producers have scaled up soy, wheat, maize and rice production for technological efficiency and to deliver processed foods with relatively long shelf-lives, resulting in generally high availability and accessibility, along with high awareness and economic value across various markets. Moving beyond these primary global crops, there is an opportunity to diversify plant production to widen the range of ingredients, promoting nutrition, health and the environment. Other relevant sources of plant proteins include nuts, pulses, roots, seeds and cereals. To scale up a more diverse array of plant proteins globally – especially in developed regions – there is a need to promote demand, availability and accessibility within the market. Today many of these plant proteins still have relatively limited global production and consumption, as well as a lack of markets, distribution networks and, in some cases, manufacturing facilities able to process them for large-scale consumption.

There are signs of growth of the plant protein market in many developed countries. Market research predicts that plant protein sales, as alternatives to animal proteins, in the United States and Europe will achieve 10% growth between 2019 and 2025, reaching a nearly USD $10 billion market size.[39,40] In Europe, plant protein intake is on the rise in many regions, especially in western and northern regions. Particularly promising is the market for plant-based products positioned as meat and dairy alternatives, with annual growth rates of 14% and 11% respectively between 2013 and 2017.[41] There has been a dramatic improvement in the quality, nutritional profile and appeal of these plant-based products in the last five years due to increased investment.[42] This growth in the plant-based product market represents new business opportunities for food companies as well as for farmers, agri-food industry players, food service providers and retailers.

Still, plant protein growth projections show that they will not be sufficient to meet the demands of a growing global population and socioeconomic development, which will place greater pressure on the environment, human health and society. Therefore, it is necessary to promote a sustainable balance in the production and consumption of a wide variety of plant proteins.

3 Hurdles and levers to scaling up plant proteins globally

3 Hurdles and levers to scaling up plant proteins globally

Adjusting protein intake and balancing its consumption present tremendous social, environmental and business opportunities. Nevertheless, there are a range of hurdles to overcome in order to achieve success, ranging from social and regulatory to technological and financial. They impact the availability and accessibility of diverse plant proteins globally.

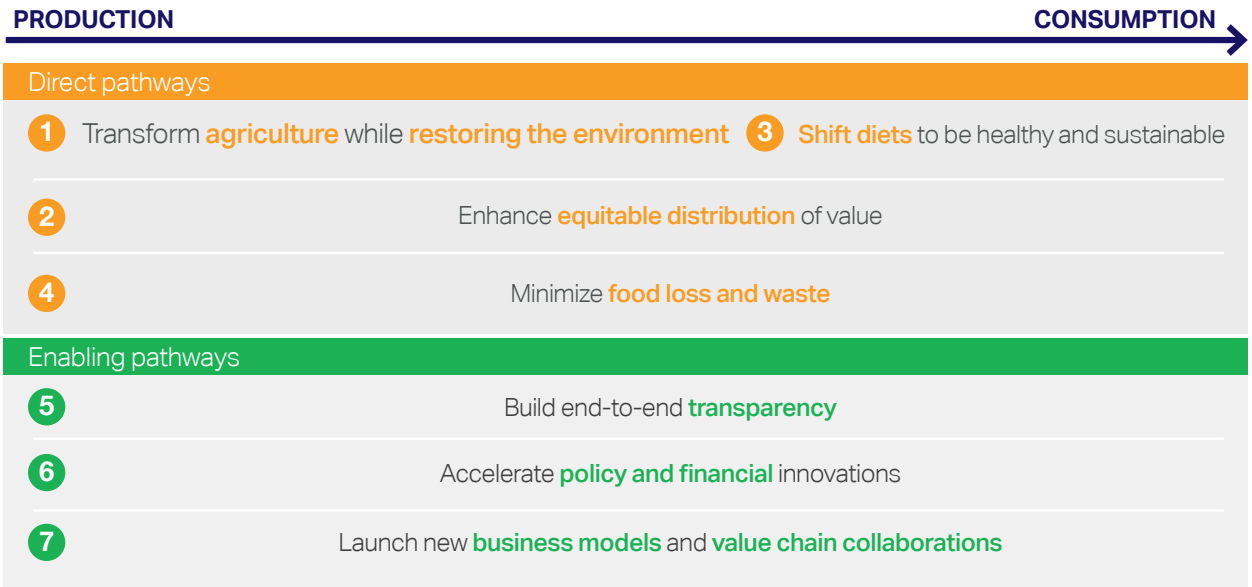
Over the past months, we have been working alongside our members and others stakeholders, to identify four main hurdles related to plant protein development where joint action could unlock the food system:[43]

1. Supporting a healthy and sustainable transition to plant protein production
2. Increasing global demand for diverse plant proteins;
3. Reorienting policies and regulations;
4. Reflecting the true value of food with a long-term perspective.

These correspond to five of the seven pathways identified in our CEO Guide to Food System Transformation:[43]

- Transform agriculture while restoring the environment;
- Equitable value distribution;
- Shift diets to be healthy and sustainable;
- Accelerate policy and financial innovations;
- Launch new business models and value chain collaborations.

Figure 3: Seven pathways to Food System Transformation[44]



1. SUPPORTING A HEALTHY AND SUSTAINABLE TRANSITION TO PLANT PROTEIN PRODUCTION

Transform agriculture while restoring the environment, equitable value distribution and new business models

The hurdle: There is a need to produce a wide variety of plant protein crops, ingredients and products that are sustainable and nutritious, as well as available and enjoyable to eat. Although businesses, manufacturers and retailers are investing in research and innovation in alternative protein product development, from novel recipes and marketing to advances in food processing and biotechnology, much work is still necessary throughout the plant protein value chain. Training, pilot projects and resources are emerging[45] but many growers and manufacturers still have limited knowledge and experience in developing and producing a variety of sustainable plant protein crops and products. Production cost variability and access to investments are also major barriers to consider when dealing with growers. Moreover, there is a lack of processing knowledge and capacity among technological, nutrition and marketing teams for a wider variety of plant protein foods and products.

The lever: Technology, innovation and training can help support a food system that provides an optimized, healthy and sustainable protein mix. Precision agriculture, censors, plant protein isolates, processing technologies and product fortification are all examples of technologies that can help promote plant protein production and consumption at scale – if properly introduced to farmers and food value chain employees. Innovative business models, focusing for example on regenerative crop rotations that favor agrobiodiversity, can help promote low-tech solutions to scaling up plant protein production and consumption. But farmers require access to information and training, as well as to microloans and credits, to be able to adapt farming practices to achieve sustainable plant protein production.[46] Finally, better supply chain organization can contribute to improving competitiveness and the development of plant-based food innovations that overcome texture and taste hurdles. Internally aligned strategies to build up capabilities, awareness and education throughout the whole value chain, from farmers to retailers, are crucial to achieving this. Shifting businesses' training priorities, as well as pre-competitive action to meet the skills gap, will be key.[47]

2. INCREASING GLOBAL DEMAND FOR DIVERSE PLANT PROTEINS

Shift diets to be healthy and sustainable

The hurdle: While in developed countries awareness of the benefits of plant proteins is growing, the overall demand and appeal of diverse plant proteins in foods, ingredients and products remain limited compared to those made with animal proteins – particularly meat, eggs and dairy. Notwithstanding the critical cultural role that animal-based foods play in many countries, the still too slow shift to more plant-based food consumption is partially attributable to the fact that today's food environment and regulations currently do not favor plant protein options; for example, isolated retail placement and labeling restrictions often lead mainstream consumers to believe plant protein foods and products are "niche foods" only for particular consumer groups.

The lever: To increase demand for plant protein foods, ingredients and products, stakeholders should encourage the development of and transition to a food environment that promotes plant proteins. This must encompass social, physical and socioeconomic factors that influence the availability and accessibility of foods, as well as people's perceptions of which foods are acceptable and appealing. There is a need for regulators to develop clear, accessible guidelines, such

as revised dietary guidelines on the benefits of eating more plant proteins. Furthermore governments, retailers and foodservice companies have an important role to play in order to drive a shift in perception and behavior. Finally, food companies should be driving social change through product innovation, marketing campaigns, appearance and taste improvements, labelling and sales placement.[48] For example, studies show consumers are more likely to buy a "vegetarian meal" if it is not labelled as "vegetarian" and is positioned as another tasty option – in a restaurant or retail shop.[49]

3. REORIENTING POLICIES AND REGULATIONS

Accelerate policy and financial innovations

The hurdle: Regulatory and economic policies do not always support healthy and sustainable proteins. Some organizations have introduced sustainable protein public procurement policies, but progress is still slow overall and clear guidance is not yet available. Subsidies and investments to expand sustainable protein innovation still do not sufficiently support mechanisms to encourage all farmers to deliver a diversity of nutritious food and environmental benefits.[50] Moreover, plant-based product definitions and labelling regulations are inconsistent across markets and often hinder the visibility and placement of these products, such as meat or dairy alternatives. The need to fortify many plant protein-based products can also put these products at a disadvantage when considering labelling regulations (e.g., fortification of organic plant-protein product).

The lever: It is necessary to refocus policies to support the transition to healthy and sustainable plant proteins that are sensitive to regional economies (e.g., impact on livelihoods), health needs and environmental considerations (e.g., water scarcity and greenhouse gas emissions). Governments can revisit and realign policies specifically related to fortification, food labelling, taxes and subsidies, with a shift to diets rich in a diverse array of plant proteins. Policies can also help change the direction of investments in education, business and social programs to promote plant proteins. Finally, governments should redirect funding and subsidies to the production and distribution of more sustainable and healthy plant protein foods and products, enabling them to compete more fairly with animal-based products on the market.

4. REFLECTING THE TRUE VALUE OF FOOD WITH A LONG-TERM PERSPECTIVE

Accelerate policy and financial innovations; launch new business models and value chain collaborations

The hurdle: Today's economic system focuses on short-term returns on investment and commodity markets. Processing crops for use in plant protein-based products requires significant capital investments and focus from both manufacturers and governments.

The lever: There is a need to invest in the future of food and to harness both ancient and cutting-edge knowledge to improve the sustainability of agricultural production. Thus, it is necessary to consider the true value and true cost of food with respect to both positive and negative externalities of the food system.[51] Investment may partly come from improving willingness to pay for foods produced more sustainably in countries where consumers are willing and able to do so. Nevertheless, in order to reach the necessary global scaling up of plant proteins, it is crucial that the financial sector directs investments to supply chains, technologies, foods and products made with plant proteins while concurrently realizing the benefits of reduced risk and more stable long-term returns. Wherever the investments come from, when transitioning to new production systems, supporting farmers is crititcal. Farmers should not risk losing their livelihoods if they change practices or shift away from commodity crops – otherwise this replaces one problem (environmental degradation) with another (unemployment or poverty). This is especially true when transitioning to regenerative practices that may reduce short-term yields but improve yields over the long term.[52]

4 Mapping of existing initiatives

④ Mapping of existing initiatives

INITIATIVES			
Title	Author	Partners	Considerations Social/health
RESEARCH INSTITUTES			
Breaking habits for the better: Behavioral change towards more sustainable foods	Wageningen University	Unilever; Wageningen University Research, Noldus Information Technology, Kikkoman Europe	Research to support the change of existing food habits or generate new food habits (e.g. from a meat to a plant-based diet)
Sharp	Wageningen University	Unilever, DSM, Friesland Campina	Development of a data platform to build models for dietary shifts and collect case study on the role and impact of plant and dairy based meat replacers
Plant Meat Matters	Wageningen University	Meyn, Avril, Givaudan, saturn petcare, Nutrition&Nature, DVS, Unilever, Ingredion	Develop new technologies for the production of plant-based products with a texture and taste that would reach the next generation consumer expectations
Alternative Meat Lab	The Sutardja Center for Entrepreneurship & Technology (Berkeley University)		Research on "better" plant-based meat alternative products, providing consumers similar taste and texture and high nutritional products
Menus of Change	The Culinary Institute of America (CIA) and Harvard T.H. Chan School of Public Health		Bring attention to protein, both animal- and plant-based and make plant-forward dining a mainstream concept in the culinary profession and foodservice industry
Better Buying Lab	World Research Institute (WRI)	Google, Panera, Standford University, Trinit, Quorn, Hilton, Sodexo, Sainsbury's, Wrap, Unilever, Pulse Canada, USA Dry Pea & Lentil Council	Develop strategies and a communication narrative to enable consumers to purchasing more plant-based foods
The Cool Food Pledge	World Research Institute (WRI)	UNEP, Carbon Neutral Cities Alliance, Health Care Without Harm, Practice Greenhealth, Climate Focus	Support signatories to provide plant-based foods
Meat: the Future dialogues	World Economic Forum (WEF)		Accelerate the agenda for alternative proteins with healthier and sustainable solutions such ase plant-based proteins a mainstream food
Future Food Initative - A Swiss Research Initiative	Bühler, Givaudan, Nestlé, ETH Zürich, EPFL Lausanne, coordinated by the Worls Food System Center		Expand research and education in the area of food and nutrition sciences; the fellowship programme within the initiative aims at bringing together competences from academic and industrial research in this field. →

A wide range of research projects and public-private partnerships on developing plant protein solutions and driving demand for plant-based diets, menus and products among consumers are already available. We have benchmarked the following ones in order to identify gaps and areas where further collaboration could drive a food system transformation.

		Focus			Link
Environmental	Economical	Global	EU	National	
Develop new and reformulated (sustainably sourced and produced) food products		X			https://www.noldus.com/projects/breaking-habits-better
			X		https://www.wur.nl/en/project/Scientific-knowledge-base-and-data-platform-for-modelling-SHARP-Diets-.htm
Develop new techologies for the development of plant-based analogues with a lower environmental impact than animal-based products	Develop new techologies for the production of more cost-effectively plant-based proteins	X			https://www.wur.nl/en/Research-Results/kennisonline/AF16011-Plant-Meat-Matters.htm
	Provide the food industry new meat alternatives, including plants, insects, in-vitro meat	X			https://www.foodnavigator.com/Article/2017/08/22/Berkeley-researchers-seek-actionable-solutions-at-alternative-protein-lab
	Support foodservice industries and the culinary professions to develop long-term strategies on plant-based proteins, integrating optimal nutrition and public health, environmental stewardship and restoration, and social responsibility concerns	X			http://www.menusofchange.org/
Develop science-based metrics, targets and methods to help the food industry measuring and monitoring the environmental impact of the foods they source and sell to consumers	Develop strategies to support companies, restaurants, food retailers, bars to communicate about plant-based proteins; develop new techologies to formulate completely plant-based dishes	X			https://www.wri.org/our-work/project/better-buying-lab/
Support signatures to make responsible choices and to reduce their environmental impact through the integration of more plant-based foods	Develop a platform to help facilities to track the environmental impact of the food they serve	X			https://www.wri.org/our-work/project/cool-food-pledge
Highlight the environmental costs of animal-based proteins vs. plant-based proteins in order to provide sustainable and healthy proteins to a growing poulation	Encourage multistakeholders to collaborate, combining the public and private sector to co-create new alternative proteins and to set regulations on the definition of alternative proteins	X			http://www3.weforum.org/docs/White_Paper_Meat_the_Future_Time_Protein_Portfolio_Meet_Tomorrow_Demand_report_2018.pdf; http://www3.weforum.org/docs/WEF_White_Paper_Alternative_Proteins.pdf
The overarching goal is to develop solutions that address grand challenges, including sustainable packaging (for example the elimination of plastics) and affordable nutrition (for example combatting deficiencies and starvation globally).				Switzerland	https://www.futurefoodtalents.org

INITIATIVES			
Title	Author	Partners	Considerations Social/health
ALLIANCES			
Green Protein Alliance	Alliance between 25 retailers, the catering industry, food producers and 10 knowledge partners in the Netherlands, supported by the Dutch Government		Restore a sustainable and healthy balance in protein consumption focusing on the education and engagement of consumers in order to increase plant proteins' demand
The Protein Challenge 2040	Forum for the Future	GAIN, Ahold Delhaize, Danone, Unilever, Baxterstorey, Calysta, Firmenich, Hershey's, WWF, M&S, Evonik, Environment Agency, Impossible, Nestlé, University of West London, Volac, Waitrose, Tulip, Unilever	Develop with chefs affordable plant-based ingredients in menus, culinary training about plant-based and rebalanced meal, good in taste and texture. Support stakeholders to highlight the importance of plant proteins for health, nutrition and environmental sustainability: create positive messages, share stories and use the power of food brands to empower consumers to make positive choices
The Chef's Manifesto	The SDG2 Advocacy Hub		Engage in education, public relations, and media outreach to increase visibility for plant-based foods and boost consumer acceptance
The Protein Cluster	Global platform for ingredient suppliers, food manufacturers and other stakeholders		
EIT Food	Euopean initiatives collecting partners around Euope from the industry community, academia, retailers		Reduce plant-proteins "antinutritional factors" (ANFs), develop a novel technology platform to improve the texture and taste of plant-based foods based on extrusion technologies
Future 50 Foods	Initiative led WWF and Knorr with the support of Bioversity International, Crops For the Future, EAT Foundation, Edelman, Food and Land Use Coalition (FOLU), Food Reform for Sustainability and Health (FReSH), GAIN, Global Crop Diversity Trust, Gro Intelligence, Oxfam GB, SDG2 Advocacy Hub, Wageningen University and Yolélé Foods		Scale-up more vegetables, more plant-based sources of protein, more variety in grains, cereals and nutrient rich sources of carbohydrates; design of plant-based recipes for schools and canteens (e.g. Sodexo)
INSTITUTIONS			
QualiFabaBean	The German Federal Ministry of Food and Agriculture		Reduce the anti-nutritive substances and produce meal and concentrates based on field beans
The Eucleg	Multidisciplinary Research Unit for Grasslands and Forage Crops (URP3F)	European Union (Horizon 2020)	
Good Food Institute	Team of scientists, entrepreneurs, lawyers, and lobbyists		Mobilize millions of supportive consumers to encourage plant-based foods' sale in stores, restaurants, and foodservice outlets
UN (WHO,FAO, WFP, UNGC)			The UN leads researches on the healthy and sustainable intake of proteins, with also a focus on plant-proteins (e.g. Global Agreement on Sustainable Diets)
OTHER			
European Plant Based Protein Award	The Village by CA North of France and by CA Champagne-Bourgogne	Partners	

			Focus			Link
	Environmental	Economical	Global	EU	National	
	Scale up sustainable protein alternatives such as plant proteins	Engage businesses to make the transition happen			The Netherlands	http://greenproteinalliance.nl/homepage-2018-engels/
		Lead industries to take action on key areas to scale up a sustainable and healthy production and consumption of protein	X			https://www.forumforthefuture.org/protein-challenge; https://www.forumforthefuture.org/Handlers/Download.ashx?IDMF=026a4509-ecf6-400a-b176-7e33ad649813
		Promote and support the plant-based foods industry to a fair and competitive marketplace for alternatives to animal ingredients and products	X			http://www.sdg2advocacyhub.org/chefmanifesto
		Enable stakeholders to expand their business and meet changing consumer demands towards healthier and more sustainable plant-based products				https://www.theproteincluster.com/
		Develop projects and technologies to provide economically viable and environmentally sustainable products from fava bean as well as to increase the texture and taste of plant-based foods				https://www.eitfood.eu/eit-food-projects/
		Create products that will be sold through retail and food service channels with programmes to scale-up plant-based foods through inspiration, education and increased access	X			https://www.knorr.com/uk/future50report.html
	Scale up sustainable protein alternatives such as plant proteins	Provide food industry with high quality and nutrient faba beans			Germany	http://greenproteinalliance.nl/homepage-2018-engels/
				X	China	http://www.nouvelle-aquitaine-poitiers.inra.fr/en/All-the-news/Eucleg
	Promote sustainable plant-based foods with a lower environmental impact	Educate grant-making institutions, corporations, and governmental bodies about plant-based foods' R&D and support companies producing clean and plant-based products	X			
			X			
		meet tomorrow's challenges in the field of plant-based proteins and closely support start-ups offering innovative solutions in the field of plant-based products			France	http://plantbased-protein-awards.ca-norddefrance.fr/#awards

INITIATIVES			
Title	Author	Partners	Considerations Social/health
ASSOCIATIONS, FOUNDATIONS AND NGOs			
Alternative Protein Fund			
PBFA (Plant Based Foods Association)		147 company members	Take a public health approach to getting and educating people to eat more plant-based foods while ensuring that great-tasting plant-based foods are widely available, convenient, and affordable
EUVEPRO (European Vegetable Protein Association)		ADM Specialty Ingredients (Europe) B.V, Beneo GmbH, Cosucra Groupe Warcoing SA, Dupont, Ingredion Germany GmbH, Roquette	
ENSA (European Plant-Based Foods Association)		Association of plantbased foods manufacturers (Alpro, Sojasun, Liquats vegetals, Nutrition et Santé, Valsoia, Amidori, Gold&Green, Quorn)	Contribute to mainstreaming plant-based foods for healthier and more sustainable diets
Less is More	Greenpeace	Member cities	Education program for cities and universities around the world to promote plant-rich meals and meat reduction
Protein Highway		Industry, academia and government	
Starch Europe		Trade association of 27 EU starch producing companies	
GEPV (Groupe d'Etudes et de Promotion de Protéines Végétales)		Association of 10 members with a plant protein production, distribution or marketing activity in France	Inform the general publicon the development of plant proteins
Protéines France		Consortium of French enterprises, cooperatives, distribution, innovation and research centers active in the plant-based and alternative proteins sector	Support communication and information related to market introduction of innovative products
Sojaxa		Association of soyfoods manufacturers in France	Support the production and promotion of of healthy and sustainable soy based products
Pulse Canada		National association of growers, traders and processors of Canadian pulses	

			Focus			Link
	Environmental	Economical	Global	EU	National	
		Invest leading start-ups working to create plant-based meat alternatives	X			https://agfunder.com/invest/protein-fund/
		Outreach to retailers to expand shelf space for plant-based foods, as well as help food service directors offer more plant-based options. Change the debate on important public policy issues such as the dietary guidelines in order to elaborate practices that support plant-based products' scale up	X			https://plantbasedfoods.org
		Support manufacturers and distributors of vegetable proteins for human consumption in the European Union, increasing recognition in European, national and international legislation, of vegetable protein products		X		https://euvepro.eu
		Raise awareness about plant-based products amongst policymakers and advocate for fair treatment for the emerging plant-based sector		X		http://www.ensa-eu.org
		Engage cities, local governments, or public institutions (like universities, schools or hospitals) to include at least one vegetarian meal per week	X			https://lessismore.greenpeace.org/cities/
		Promote partnership in research, business development and innovation for the development of the alternative protein sector			Canada and USA	https://proteinhighway.wixsite.com/protein-hwy/about-us
		Promote and protect the reputation of starch products and the interests of EU starch producers to EU and international institutions and stakeholders, in order to assure a reliable and sustainable supply of safe starch based ingredients in a fair competitive environment		X		https://starch.eu
		Promote the development of plant proteins by participating actively in a better knowledge of these products; provide professionals of the food-processing industry of the informative, technical and educational tools			France	http://www.gepv.asso.fr/Default9e79.html?lid=7
		Federate, promote and represent the French plant-based and alternative proteins value chain; ease the development and public support of innovation projects; facilitate investment in industrial plants; encourage the creation and development of start-up			France	http://www.proteinesfrance.fr
						https://www.sojaxa.com
		Contribute to the profitability of the Canadian pulse industry through programs designed to deliver innovative solutions that improve efficiencies and increase value of plant proteins			Canada	http://www.pulsecanada.com

INITIATIVES			
Title	Author	Partners	Considerations
			Social/health
Protein Industry Canada			
Global Plant-Based Food Eco-System		Cooperation between the industry community and public partners	Raise the bar on sustainability, nutrition, taste, value chain, more eco-friendly production methods and regulation
BMGF (Bill & Melinda Gates Foundation)			Deliver nutritious, appealing, affordable, and accessible proteins ingredients to consumers underserved by markets, with a focus on affordable plant based protein
Terres Univia		Organisation representing French oilseed and oil fruit sector (oil seed rape, sunflower, soya, linseed, olive) and French legume seed sector (field pea, faba bean, lupin, lentil, chickpea, alfalfa) interests	
Barilla Foundation			Fosters change towards healthier and more sustainable diet, by promoting a higher consumption of plant-based food
Eat Plants. For a Change			
The Alpro Foundation	Platform for academics, health care professionals and key stakeholders		Support research and innovation on plant-based nutrition and its nutritional and environmental values
The Soy Nutrition institute	Collaborative organization of the United Soybean Board and soy industry leaders, including global corporations and national associations		Provide evidence-based information on the impact of soybeans and soy components on human health through a variety of education and outreach efforts

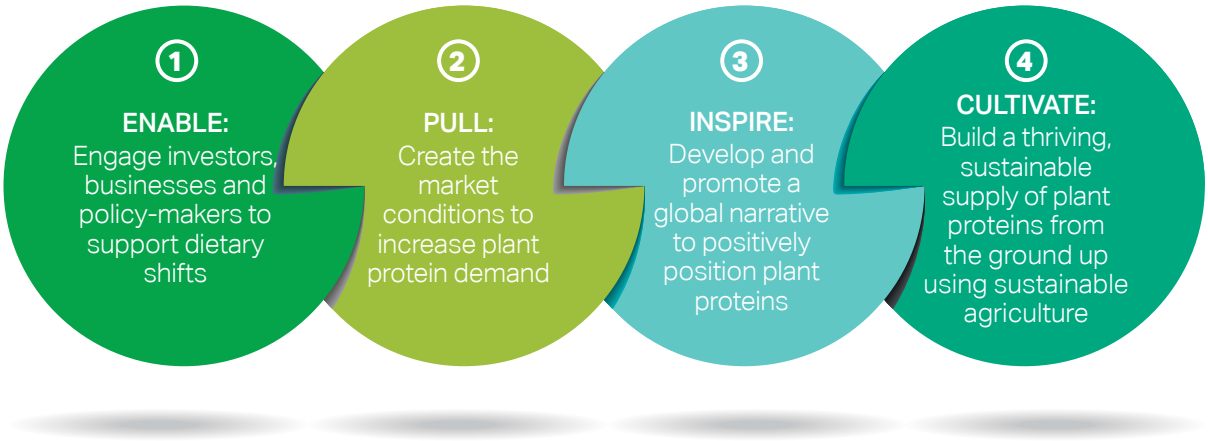
			Focus			Link
	Environmental	Economical	Global	EU	National	
	Work with private sector industry partners to create co-investment projects that have the potential to transform the agriculture and food production sector	Challenge Canadian businesses to collaborate with other businesses, and post-secondary and research institutions to create new projects on high-quality plant-proteins				
		Focus on R&D, innovation, production, quality with food brands, food ingredient brands, technology brands, and research background	X			
			X			https://www.gatesfoundation.org/what-we-do/global-development/nutrition
		Facilitate interactions between producers and processors to promote the development and the use of oilseeds and associate products and undertake activities of collective interest action			France	http://www.terresunivia.fr/terres-univia-en
		Provide recommendations to public decision makers and maintains an ongoing dialogue with its stakeholders by providing food related multidisciplinary studies and highlighting best practices	X			https://www.barillacfn.com/en/magazine/food-and-sustainability/do-healthy-diets-protect-the-planet/
			X			https://www.ciwf.com/your-food/plant-based-alternatives/
				X		https://www.alprofoundation.org
		Identify and determine soy and health research priorities and facilitate the development and funding of targeted research projects			USA	https://thesoynutritioninstitute.com/about/

The table lists a wide range of initiatives led by associations, alliances and institutions focused on the development of plant proteins in foods and products as well as on increasing consumer awareness and demand for a variety of protein sources. In addition, a number of activities focus on ways to improve the taste and texture of plant protein products and consumer appreciation of these products. Yet, there are only a limited number of initiatives addressing the following critical solution areas: promoting a supportive regulatory environment; stimulating the production of diverse plant crops through sustainable agriculture; and supporting farmers overall in the production of crops as a source of proteins.

This benchmark analysis is an important contribution to the identification of the most urgent and impactful business solutions that FReSH can support to accelerate the scaling up of plant proteins.

5 Solution spaces

In order to overcome the main hurdles related to plant protein scaling up and to fill in the gaps among existing initiatives, FReSH supports company transformation efforts to across the following four solution spaces:



ENABLE: Engage investors, businesses and policy-makers to support dietary shifts

Business should not and cannot act alone to promote more sustainable and diverse plant proteins. It is essential to reform today's policies to support more diverse and sustainable agricultural systems while promoting marketing of the next generation of nutritious and sustainable plant-based foods and products. In addition, investors will be instrumental in driving this shift to plant proteins, both through direct financial support of emerging plant-based products as well as by prioritizing more sustainable food system investments. For example, the introduction of carbon and water pricing could help identify investment opportunities that support a shift to plant proteins.

Food value chain companies, within FReSH and individually, should engage policy-makers, businesses and investors to support the development of a global plant protein production and consumption shift, in particular by:

- **Developing a set of supportive policy asks to advocate for in key events;**
- **Communicating to other businesses, suppliers or customers of individual companies about the need to scale up plant proteins; and**
- **Engaging investors through various individual and multistakeholder channels.**

PULL: Create the market conditions to increase plant protein demand

Creating the conditions for success goes beyond building awareness of the benefits of plant proteins. It is necessary to understand the drivers of consumer behavior and demand with respect to plant proteins in different markets. Nudging consumers towards healthy and sustainable food requires a whole set of changes in the food environment – or the context in which we produce, provision and consume food.

Food value chain companies, within FReSH and individually, should create the market conditions enabling plant protein consumption, in particular by:

- **Investing in innovative plant-based protein products with positive nutritional and sustainability profiles – creating product appeal and options;**
- **Sharing knowledge and case studies on consumer behavior change in relation to plant proteins, including communication and marketing tools; and**
- **Implementing changes throughout supply chains, from fork to farm – i.e., from retail and restaurants to farm, to facilitate consumer access to plant-based foods.**

INSPIRE: Develop and promote a global narrative to positively position plant proteins

To promote plant protein production, transformation and consumption, it is necessary to positively position them using a renewed collective narrative, both within and beyond industry. An internal business communication plan can help ensure managers and executives within relevant industries are aware of the need to promote diverse diets high in plant proteins. Among growers, food producers and food manufacturers, this global narrative will be instrumental in raising awareness of the benefits of plant proteins and will drive a sense of urgency to produce and promote plant protein foods, ingredients and products. Finally, to raise awareness among the population, the narrative should position plant proteins as an appealing and attractive option, part of a healthy, fun and social lifestyle. The role of policies is fundamental here to support public education campaigns and the integration of such a healthy and sustainable diet into the national school curricula.

Food value chain companies, within FReSH and individually, should develop a strong narrative on the positive role played by plant-based products and amplify its outreach, in particular by:

- **Building synergies with existing global initiatives[53] on various communication tools and events;**
- **Integrating that narrative into brand positioning and communication/marketing efforts.**

CULTIVATE: Build a thriving, sustainable supply of plant proteins from the ground up using sustainable agriculture

To transform the food system and shift to more sustainable and healthy outcomes, there must be on-the-ground efforts to transition and support farmers with a more equitable system that creates longer term solutions. A key lever of success for any sustainable dietary shift is to move away from agricultural systems that degrade land and ecosystems, overconsume resources, and offer a limited number of crops for global consumption. Promoting the growth of diverse plant crops through sustainable agriculture can be a way to readdress and adapt to consumer needs and to help create a more resilient food system that is less dependent on fossil resources and enhances the equitable distribution of value across the value chain. More specifically, regenerative agriculture can be a way to build, from the ground up, a revived food system able to provide a diverse array of plant proteins. For example, legumes can play a key role thanks to their capacity to naturally fix nitrogen from the air, increasing soil fertility and reducing fertilizer use.

Food value chain companies, within FReSH and individually, should support farmers in scaling up the sustainable production of diverse plant-based proteins, in particular by:

- **Sharing best evidence of sustainable plant protein production practices and impacts across members and relevant business units;**
- **Coordinating messages to existing influential groups (business, policy-makers, extension services structures) to orient research and extend and advance efforts to promote plant-based proteins;**
- **Adapting business strategies and decision-making to prioritize the production or sourcing of sustainable plant-based proteins.**

6 Conclusion

2019 has sounded the alarm for the need to urgently transform the food system to sustainably feed a growing population expected to reach over 10 billion by 2050. Consumers, stakeholders and even governments are increasingly expecting business to take action, yet none of the scientific or economic reports produced to date highlight why and where business should lead.

In WBCSD's CEO Guide to Food System Transformation launched in October 2019,[54] seven pathways were identified for business action on food system transformation, including: agricultural transformation while restoring the environment; enhancing the equitable distribution of value; dietary shifts to be healthy and sustainable; accelerating policy and financial innovations; and new business models and value chain collaborations.

In order to achieve a successful food system transformation, we must develop a comprehensive set of credible, high-impact solutions across these pathways in relation to proteins – with careful consideration of the different sociocultural and economic environments. On one side, we must deliver more nutritious foods from a healthy and sustainable mix of plant and animal sources to the 2 billion people living in moderate or severe food insecurity. On the other side, in most developed countries, we need to significantly reduce and partly replace the production and consumption of animal protein-based foods and products – particularly red meat – with plants and plant protein-based alternatives.

To that aim, society at large must accept and implement the shift to the wide-scale production and consumption of plant proteins. In particular, business must urgently take bold action along the following four axes: creating the market conditions to increase plant protein demand; developing and promoting a global plant protein narrative; engaging policy-makers, businesses and investors; and building a thriving, sustainable supply of plant proteins from the ground up using sustainable agriculture.

More generally, societies need to reinvent the food environment and food-related businesses in ways that deliver accessible, affordable and enjoyable, healthy and sustainable food to everyone, while contributing to thriving communities. We will provide concrete suggestions on how to achieve this in the FReSH Roadmap that we will publish at the end of 2020.

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