In collaboration with the Israel Innovation Authority, C4IR Israel and the Good Food Institute (GFI) Israel

WORLD ECONOMIC FORUM

Creating a Vibrant Food Innovation Ecosystem: How Israel Is Advancing Alternative Proteins Across Sectors

WHITE PAPER

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Images: Getty Images

Contents

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Foreword

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The launch of this white paper comes at a critical moment for the climate agenda. With less than six years to go until 2030 to meet the commitments of the 2015 Paris Climate Agreement, leaders are at a crossroads, with finite choices before them that will determine the fate of future generations and life on this planet.

Among those choices is how best to transform food systems worldwide in a hot-and-getting-hotter world that looks set to be home to nearly 10 billion people by 2050.[1] Increasingly, for some countries, the focus is on ensuring sustainable protein diversification pathways. The science is clear: it will be impossible for governments and others, including farmers, the private sector and consumers, to meet their obligations under the Paris Agreement[2] and decarbonize the global economy without investing in sustainable protein diversification pathways and the overall food system. With global meat consumption projected to increase by at least 50%[3] from 2012 levels by 2050, alternative proteins – including plant-based and cultivated meat – offer an additional globally scalable solution. These technologies serve as value-added agriculture compared to conventional production, have the potential to reduce emissions dramatically, feed more people with fewer resources, reduce public health risks and free up lands and waters worldwide for restoration and recovery.

To underscore the critical role of country-led approaches in accelerating more efficient, secure and sustainable ways of producing protein, this paper, *Creating a Vibrant Food Innovation Ecosystem: How Israel Is Advancing Alternative Proteins across Sectors*, has been developed by C4IR Israel (an independent member of the World Economic Forum Centre for the Fourth Industrial Revolution network), the Israel Innovation Authority and the Good Food Institute Israel.

The paper highlights Israel as a case study for country-led approaches in which government leadership is creating the conditions for a robust, highly collaborative food-tech innovation environment focused on shared value – a space that can produce scientific breakthroughs, launch and support public-private sector partnerships and create a thriving bioeconomy.

Country-led approaches have long been catalysts for transformative new technologies and innovation ecosystems that address our biggest challenges, improve our quality of life and benefit future generations. Here again, by exploring and investing in alternative proteins, governments can play a leading role in ushering in a far brighter food future for all.

Preface

50%

projected increase in global meat consumption by 2050 (from 2012 levels).

The role of emerging technologies and innovation as key enablers of food systems transformation cannot be understated. Coupled with the right investment and multistakeholder collaboration models, emerging technologies can support agrifood systems to become one of the world's most hopeful responses to safeguard nature, achieve climate action, improve food and nutrition security and reduce inequity.

Recognizing that there is no silver bullet solution, the World Economic Forum's Food Innovation Hubs Global Initiative and the Centre for the Fourth Industrial Revolution are working to build insights and develop frontier thinking and new models of collaboration, in-country and globally, that can strengthen innovation ecosystems to capture the pace of technology for the benefit of the world's food systems.

Achieving universally accessible protein will require multiple transition pathways:[4] **1) accelerating protein diversification; 2) advancing sustainable production systems**; and **3) driving consumer behaviour change**.[5] With the demand for protein expected to rise, a robust innovation ecosystem for protein pathways will play an enabling role in driving positive impact across intertwined agendas, including food, the environment and nature, health and nutrition, livelihoods and economic growth.

The vast breadth and reach of the protein sector calls for a complex system of solutions. A successful transition will rely on an appreciation of the trade-offs particular solutions will bring, recognizing both the losses and the gains and allowing for more challenging decision-making. It will also require actors to come together with a commonality of purpose, to accelerate action in support of achieving the necessary protein transitions.

The future offers tremendous innovation potential for transition in the protein sector, and technological advances present significant tools to make these protein transition pathways a reality. Written by the independent C4IR Israel, the Israel Innovation Authority and the Good Food Institute Israel, this paper highlights one such solution pathway for alternate protein technologies and offers insights into the building blocks for country-led innovation ecosystems.

Executive summary

Alternative proteins are game-changing agricultural innovations that, with proper levels of support, can help aid planetary and public health.

> There is a growing acknowledgement that alternative proteins have transformative potential, particularly for farmers.

Nations around the world are becoming aware of the benefits of prioritizing alternative proteins to meet their climate, biodiversity, food security and public health goals. This paper demonstrates the Israeli example of how government initiatives tailored to the ecosystem's needs and challenges, and the country's fundamental assets, form a resilient, cross-sector alternative protein ecosystem. By examining Israel as a case study, broader takeaways can be identified for other countries to follow, using local resources and highlighting the importance of international collaboration in this sector to shape the future of food.

In recent years, there has been an unprecedented surge in public investment and commitment to alternative protein research and development. Countries such as Australia, Brazil, Canada, China, Germany, India, Israel, Japan, the Netherlands, Singapore, the United Kingdom and the United States are recognizing the essential role that alternative proteins can play in future food technology, innovation and progress, complementing traditional production methods while bolstering the bioeconomy and highlighting the potential benefits for the environment and public health.

There is a growing acknowledgement that, despite the industry being in its infancy, alternative proteins – meat made from plants, cultivated from animal cells or fermentation-derived meat – have transformative potential, particularly for farmers, who can benefit from and lead the transition towards a thriving alt-protein economy. Looking ahead to 2030, using agricultural side streams for alternative protein production presents a significant opportunity to enhance sustainability and circularity within the food supply chain. In light of the escalating challenges posed by climate change and the need to ensure food security, nations are called on to undertake a collective effort to elevate alternative proteins as a solution. Crafting a vision for this ecosystem requires a nuanced understanding of each country's distinct attributes – bilateral and multinational collaborations can play a crucial role in pooling strengths and overcoming shared challenges.

Alternative proteins, due to their deep-tech nature, high capital expenditures (CAPEX) requirement and longer return on investment timelines, may pose investment challenges for some parts of the private sector. Governments – which already allot billions of dollars each year to renewable energy and global health research and are also beginning to invest in better, safer, more efficient ways of producing meat – can help alleviate this burden. They can do so by providing financial support, grants or incentives to facilitate scale-up efforts and attract institutional investors comfortable with long-term returns. In addition, proactive engagement in formulating clear regulations to ensure product safety while encouraging innovation, drawing from the experiences of other nations, is essential. These interventions are effective in stimulating the sustainable growth of alternative proteins, positioning them as integral components of the future food landscape. External forecasts of the alternative protein market size by 2030 vary widely in their estimates – from $58 billion[6] to $570 billion[7] – but they all project robust growth from today's market size. Such market growth would demand unprecedented collaboration, investment and innovation in the sector.

While there is a growing consensus that the public sector must necessarily play a pivotal role[8] in shaping this sector's trajectory, the specifics – actions, funding and anticipated outcomes – often remain undefined. Innovation at the scale needed cannot thrive in isolation; it requires the removal of barriers and the formation of a robust multisector, collaborative business environment. Paving the way for this sector to become a core industry needs a stronger and more coordinated effort than any entrepreneur or company can achieve independently.

This white paper makes clear the essential role that governments play in propelling progress and takes a detailed look at how one country is creating a collaborative and dynamic food-tech innovation ecosystem. It sheds light on how the Israeli government's Innovation Authority identifies strategic intervention points as it considers its own unique national resources, the inherent challenges, its predominant status as an importer and the dynamics of the alternative protein value chain. By fostering a mutually beneficial partnership between the public sector and the rapidly evolving alternative protein business, the Israel Innovation Authority is paving the way for a smoother, quicker journey towards innovation and sustainability – a replicable approach other countries could adopt to boost the entire field and hasten global food systems transformation.

1 The role of governments in advancing alternative proteins

Government leadership is needed to develop and promote alternative proteins and address one of the biggest global challenges of this era.

> **Israel's proactive approach to fostering innovation in alternative proteins reflects our commitment to shaping a sustainable future for generations to come. By investing in academic research, as well as innovative start-ups at every stage and facilitating collaboration across industries, we are accelerating the growth of Israel's alternative protein ecosystem. Positioned to drive sustainable and efficient solutions, Israel is poised to redefine the global landscape of alternative proteins technology and make an impactful change for a more resilient food future.**
>
> Dror Bin, Chief Executive Officer, Israel Innovation Authority

Several motivating factors are at play in the field of alternative proteins, reflecting a broad recognition of the potential benefits and challenges associated with this transformative industry.

1. Economic growth and innovation

Governments generally view the alternative protein sector as a source of future-resilient economic growth and job creation. They aim to promote a thriving environment of start-ups, businesses and research institutions by supporting research and development (R&D) and providing financial incentives. This enhances a country's global competitiveness while stimulating new livelihoods, academia–industry connections and economic vibrancy. According to 2023 analysis conducted by McKinsey economists for ClimateWorks Foundation and the Global Methane Hub, alternative proteins are expected to support 83 million jobs[9] globally, contributing to a sector projected to be worth nearly $700 billion by 2050.

2. Food security

The alternative protein sector is a strategic response to the increasing global demand for protein sources. In the face of population growth, climate change and resource scarcity, transitioning to alternative proteins reduces supply-chain risks, and diversifies and increases the efficiency of global food production. Investing in alternative proteins will also help make meat production more resilient[10] to extreme weather, disease outbreaks and the emergence of crop diseases and pests (see Box 1). Countries that strategically adapt to evolving global food systems and diversify their food value chains stand to benefit from the positive impacts of integrating alternative proteins into their national policies.

BOX 1 | Alternative proteins

Plant-based meat

Plant-based meat is produced directly from plants. Instead of relying on an animal to convert plants into meat or other animal-sourced foods, plant ingredients are turned directly into alternatives to meat and other protein-rich foods. Like animal-based foods, plant-based foods are composed of protein, fat, vitamins, minerals and water. The new generation of plant-based foods looks, cooks and tastes like meat, eggs, dairy products and seafood.

Cultivated meat

Cultivated meat is grown directly from animal cells instead of farm animals. Cultivating meat is similar to growing plants from cuttings in a greenhouse, which provides warmth, fertile soil, water and nutrients. This new method of meat production enables the natural process of cell growth but in a more efficient environment. Cellular agriculture involves taking a small sample of cells from an animal and growing them in a cultivator. The cultivator facilitates the same biological process that happens inside an animal by providing the cells with the warmth and basic nutrients needed to transform them into meat: water, proteins, carbohydrates, fats, vitamins and minerals. The resulting cultivated meat – beef, pork, chicken and seafood – is identical to conventionally produced meat at the cellular level, but made in a more sustainable way.

Fermentation

Alternative protein companies are using fermentation in innovative ways to produce foods that deliver the distinctive flavours and textures of animal products without farming animals. Fermentation can be used to produce alternative proteins that look, cook and taste like meat through a process similar to the way in which foods such as tempeh are made. Precision fermentation uses yeast to produce real egg or dairy proteins (such as whey and casein), delivering familiar flavours and textures of foods like cheese and milk without using animals.

Source: GFI Israel, "Reimagining Meat": gfi.org.il

> Plant-based and cultivated meat require a small fraction of the land and cause far fewer emissions than industrial animal farming. Freed-up land can be repurposed for biodiversity preservation, reforestation and more ecologically friendly and regenerative methods of animal farming. With such profound benefits for our environment, for food security and for global health, alternative proteins are one critical strategy in our work towards a food system that we can all be proud of.
>
> Bruce Friedrich, President and Founder, The Good Food Institute

3. Environment and climate

Food and agriculture account for one-third of global greenhouse gas (GHG) emissions. Animal agriculture alone – including the crops and pastures to feed the animals – accounts for between 11% and 20% of all GHG emissions.[11, 12] Conventional animal agriculture also faces significant limitations. Humanity is running out of room for food production, leading to the clearing of forests and the destruction of other ecosystems worldwide. A global shift towards alternative proteins is one solution, addressing the twin crises affecting climate and biodiversity by slashing agricultural GHG emissions, reversing deforestation and restoring critical ecosystems. According to the Boston Consulting Group, at 11% market penetration, alternative proteins would have the climate mitigation impact of almost totally decarbonizing air travel[13] – and this does not include the sequestration potential of land freed up by decreased grazing and feed crop production.

> Animal agriculture alone – including the crops and pastures to feed the animals – accounts for between 11% and 20% of all GHG emissions.

4. Technology leadership

Governments worldwide have long been sponsors of research to strengthen innovative agricultural technologies. Being at the forefront of alternative protein innovation positions a country as a leader in emerging technologies. Governments recognize the potential for global influence that comes with being a recognized hub for groundbreaking advances in food and agricultural progress and innovation.

5. Regulatory frameworks

Within current frameworks, governments can create clear, supportive, agile and efficient regulatory processes to ensure safe and transparent pathways that instil confidence in consumers and industry players alike, fostering a robust alternative protein market in a shift towards food systems that are more sustainable, secure and just.

Less than $3 billion in capital has been invested in cultivated meat – not even the cost of one battery factory for electric vehicles.

6. Early adoption of innovation

Governments can drive society to become first movers in building a solid innovation ecosystem. They can encourage investment in holistic solutions that provide the right conditions for innovation to occur, while also tackling the challenges of improving production systems and increasing customer acceptance, highlighting the importance of building on the full value chain and gaining insights at every step of the way when adopting new food-tech solutions.

7. Leveraging and enabling private investments

When combined with private-sector investment, public investment has stimulated new markets, jobs and solutions. Privately funded research is valuable, but not sufficient; while private funding typically emphasizes applied science and commercialization to yield swift returns for a small group of shareholders, public investments support long-term basic research, often resulting in unforeseen breakthroughs over extended time frames.[14] Throughout history, from radar and information technology to clean energy and vaccines, the collaborative endeavours of public and private R&D have consistently demonstrated synergistic effects on scientific advancement, societal progress and economic growth. In addition, governments can actively de-risk[15] new food-tech innovation, including in alternative proteins, for private investments. By making crucial resources and infrastructure accessible, governments provide the necessary foundation for businesses to thrive in this emerging sector. This involvement not only encourages greater private investments but also contributes to the sustainability and scalability of alternative protein ventures.

8. Fostering academia–industry collaborations

Implementing science, technology and innovation policies becomes integral to a government's overall strategy. Such policies contribute to a more inclusive, comprehensive and cohesive approach to R&D, ensuring that companies, consumers and the government can access the latest technologies at the lowest possible cost. This, in turn, accelerates the development and adoption of alternative protein technologies, positioning nations at the forefront of food systems transformation.

Driven by the motivations above, governments around the world are beginning to pay heed. But if the world is to reach its global climate, biodiversity, food security and public health goals, much higher levels of investment are needed to accelerate protein transitions at the scale and pace required.

According to the Good Food Institute's 2022 *State of Global Policy* report,[16] public support for the alternative protein ecosystem has likely surpassed $1 billion. Governments are increasing their financial, policy and regulatory support for alternative proteins but have yet to approach the annual support required to realize alternative proteins' benefits to the economy, climate and global food systems. To unlock the full potential of alternative proteins, it is estimated that $10 billion per year is needed in global public spending[17] on R&D and commercialization.

As an investment, alternative proteins have already attracted billions in private funding (for cultivated, plant-based and fermentation-based meat). But this is not nearly enough. For cultivated meat specifically, less than $3 billion in capital has been invested, spread across just over 100 companies. That is not even the cost of one battery factory for electric vehicles and is a tiny fraction of the $1.7 trillion invested in clean energy in 2023.[18] Currently, cultivated meat technologies are at a nascent stage of development but have the potential to scale and attract investment similar to other clean-tech investments.

The investment needed to advance food tech is substantial, posing a challenge for many countries with limited financial resources. Recognizing the varying capacities of nations and the different roles each country can have in the alternative protein value chain, strategic partnerships become imperative to ensure shared investments, expertise and technological advances. Collaborative efforts can bridge financial gaps and support inclusive growth, promoting a global landscape in which all nations can actively participate in shaping a sustainable and resilient future through alternative proteins. Global forums such as the Food Innovation Hub[19] could significantly address common anticipated challenges, such as ensuring consumer acceptance and creating a level playing field alongside the traditional meat industry.

Governments need to consider investing in open-access research and creating private-sector incentives to realize the full economic and societal benefits of plant-based and cultivated meat and make these options accessible to all. Specifically, governments should consider funding science, creating scientific innovation centres and incentivizing private-sector R&D, manufacturing and infrastructure expansion focused on alternative meat production. Investment tax credits, loan guarantees and other forms of financial support, as well as demonstration projects, have stimulated explosive growth in the renewable energy and electric vehicle (EV) sectors and can stimulate similar progress for alternative protein infrastructure.

Federally supported innovation, in the form of increased investment in alternative protein R&D, can have a multiplier effect, leading to a more resilient food supply, more choices for consumers, climate-forward and agricultural job creation, nature-positive protein production and a stronger global bioeconomy.

2 Understanding the present challenges in the field

Through thoughtful, targeted and strategic interventions, governments can effectively address the diversity of challenges faced by the alternative protein sector.

Governments are well positioned to address the current challenges within the global alternative protein sector. Such support will help the entire industry grow and ensure successful integration into the mainstream food market.

> **Governments play a pivotal role in supporting and advancing deep-tech sectors such as alternative proteins. Through strategic public investments in research, infrastructure and regulatory frameworks, governments can lay the foundation for private-sector involvement and drive transformative change in the global food systems while benefiting from new economic opportunities.**
>
> Adi Ben Tov, Associate Director of Policy, The Good Food Institute Israel

1. Cost competitiveness

The alternative protein sector's capital expenditures (CAPEX) pose a challenge for the continued research and development needed to optimize production processes. Given the deep-tech nature of alternative protein innovation, substantial investment is essential to expand production capabilities and meet the increasing demand.[20] Scale-up efforts will require investment in long-operation infrastructure, necessitating institutional investors comfortable with long-term returns.[21] Governments can contribute by providing financial support, grants or incentives to alleviate the financial burden on companies to scale up their operations.

2. Regulatory uncertainty

The alternative protein sector operates within a dynamic and evolving technological landscape. Yet lessons from countries such as Israel, Singapore and the US indicate that existing regulatory frameworks can effectively accommodate the unique characteristics of these innovations. While proactive engagement from governments is essential in formulating clear regulations to ensure product safety and encourage innovation, there is also a need to learn from the experiences of other nations in this domain.

3. Collaboration with local industries

Collaboration is crucial among food-tech start-ups, farmers, food industries and pharmaceuticals as these sectors often possess the requisite expertise in scaling up and large-scale production. Governments can facilitate strategic partnerships, providing a platform for knowledge exchange, technology transfer and collaborative initiatives that use existing know-how within these industries. By encouraging and supporting collaboration, governments contribute to accelerating alternative protein production capabilities, ultimately fortifying the sector's position in the global market.[22]

Through adopting a comprehensive approach encompassing financial support, regulatory clarity and industry collaboration, governments can drive the sustainable growth of alternative proteins, positioning them as vital components of the future food landscape.

3 Global acceleration of public support for alternative proteins

In many countries, government support for research into alternative proteins is taking off, but more funds are needed to enable the sector to grow at the necessary pace.

When it comes to alternative proteins, the importance of global collaborations cannot be overstated. Genuine progress necessitates a unified global effort. By combining resources, knowledge and innovation globally, we can expedite the adoption of sustainable protein sources and effectively address pressing issues such as food security and environmental sustainability.

Shani Dayan, Project and Partnership Manager, Israeli Center for the Fourth Industrial Revolution (C4IR), Israel Innovation Authority

In addition to making notable investments in alternative protein R&D and commercialization, governments around the world are incorporating sustainable proteins into their bioeconomy, biomanufacturing, food security, global health and sustainability strategies. However, to accelerate protein transitions at the scale and pace required, much greater levels of investment are needed. The following section outlines examples of three countries engaging with this challenge.

Denmark

Denmark has spearheaded a groundbreaking strategy for a plant-powered future by investing more than €100 million in the Fund for Plant-Based Foods. This comprehensive action plan has many components, including bonuses to Danish farmers who grow plant-based protein crops for human consumption, professional education and initiatives relating to export activities, production and processing and robust research and development. Denmark's strategic approach[23] reflects a commitment to promoting sustainability and innovation across the alternative protein landscape.

Singapore

The Singaporean government has targeted investments in alternative proteins,[24] anticipating the future demand for sustainable protein sources. The Food Tech Innovation Centre (FTIC), a partnership between Nurasa and the Agency for Science, Technology and Research (A*STAR) Singapore, offers R&D and advisory services, lab- to pilot-scale facilities and potential investment support. Singapore was also the first country to approve the sale of cultivated meat, setting a precedent.

The Netherlands

In 2020, the Dutch Ministry of Agriculture, Nature and Food Quality introduced the Dutch National Protein Strategy,[25] outlining ambitious goals to enhance self-sufficiency in plant-based and innovative proteins over the next five to ten years. The Netherlands, facing an 80% dependency on vegetable protein imports and holding the title of the largest soybean importer in the European Union, is actively translating this policy into action and in doing so is reshaping the nation's protein landscape.

4 Case study: How Israel is advancing alternative proteins across sectors

In Israel, entrepreneurs, academics and the public sector are combining to drive the emergence of the alternative protein industry.

4.1 The Israeli alternative protein ecosystem today

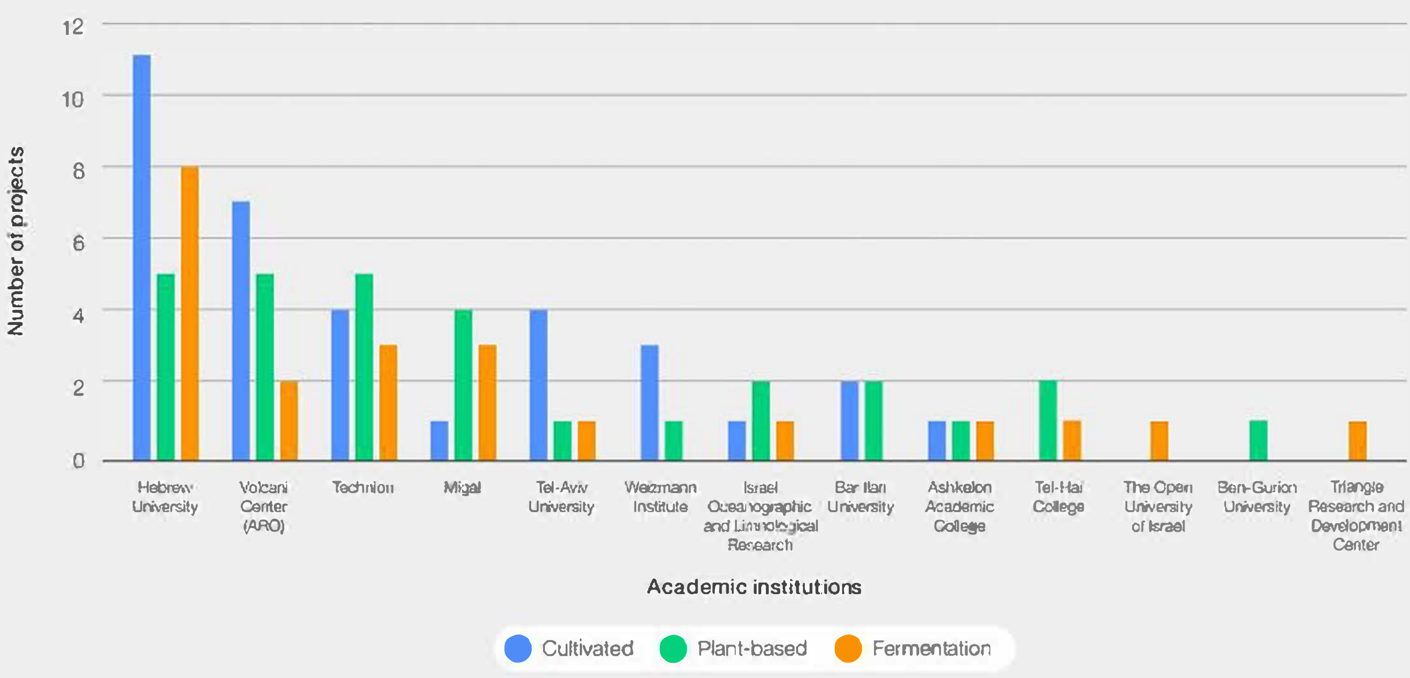
"Israel's leadership in alternative proteins is a testament to the Innovation Authority's commitment to innovation and disruption in the food industry. Over 75% of the Authority's investments in food technologies are directed towards high-risk deep technologies. We enable the development of growth verticals like food incubators and collaborative consortiums such as the Cultivated Meat Consortium, as well as direct funding of companies, from early-stage start-ups all the way to mature companies with production lines. Leveraging multidisciplinary research, an entrepreneurial ecosystem and a proven track record in agriculture, biotechnology and engineering, Israel stands at the forefront of disruptive innovation in the food industry.

Ronit Eshel, Senior Director, Head of Climate-Tech and Food-Tech Sector, Israel Innovation Authority

The Israeli alternative protein landscape has experienced a significant transformation of leadership over the past five years, driven by an effective blend of multidisciplinary academic knowledge, a dynamic and risk-taking entrepreneurial environment and active involvement from the public sector. These have laid the groundwork for the sector's further growth and development in the country.

Fostering a collaborative academic landscape: The actively collaborative ecosystem of entrepreneurs, researchers, food companies and the public sector in Israel creates an environment that is conducive to the development and advance of alternative protein technologies. More than 70 researchers are working on alternative protein research, 10 of whom embarked on their research journey in 2023, contributing to the developing landscape of this nascent and evolving sector in 2023. Moreover, there are almost 300 researchers working in adjacent areas, such as biotechnology, microbiology and pharmaceuticals, with the know-how and expertise that could contribute to the growing alternative protein industry. The Hebrew University and the Technion (Israel Institute of Technology) both declared in 2023 that they will establish research centres dedicated to food systems and alternative proteins. This move is expected to boost the local research and business environment significantly.

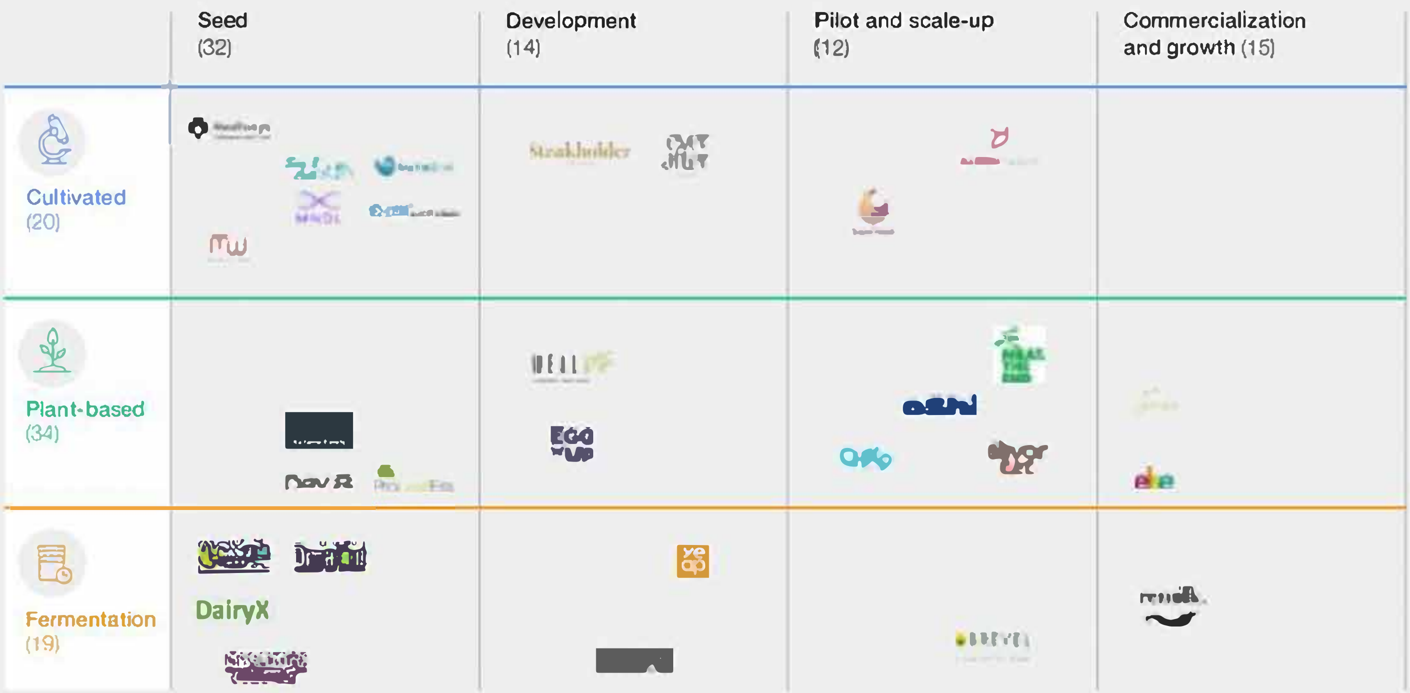
FIGURE 1 Alternative protein research in Israel's major academic institutions



Source: GFI Israel, 2024

Ensuring progressive and evolving venture creation: There was a record high of 15 new start-ups in Israel's alternative protein sector in 2023. These diverse ventures include start-ups in all three technologies (cultivated, plant-based and fermentation-based meats), along with companies focusing on final products, ingredients and supporting technologies. This diversity allows for synergies and further development of the field. As of January 2024, Israel has 73 active start-ups in this sector alone and more than 200 start-ups in food technologies as a whole.

FIGURE 2 Start-ups in Israel's alternative protein sector



Source: GFI Israel, 2024