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FOOD SYSTEMS

Research and Innovation Investment Gap Study

Policy Report

Research and
Innovation

Food Systems Research and Innovation Investment Gap Study: Policy Report

European Commission
Directorate-General for Research and Innovation
Directorate B – Healthy Planet
Unit B.2 – Bioeconomy & Food Systems

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GLOSSARY

Acronym/ Abbreviation	Definition
ZPO	Secondary Public Offering
CPC	Cooperative Patent Classification
DG RTD	Directorate General for Research and Innovation
EC	European Commission
EIF	European Investment Fund
EU	European Union
EUR	Euros
FNS	Food and Nutrition Security
Food 2030	The EU's research and innovation policy to transform food systems and ensure everyone has enough affordable, nutritious food to lead a healthy life
FP7	7th Framework Programme for Research and Technological Development
GDP	Gross domestic product
H2020	Horizon 2020 (8th EU Framework Programme for Research and Innovation)
IP	Intellectual property
IPO	Initial Public Offering
IPRs	Intellectual property rights
JRC	Joint Research Centre
MS	Member States
PIPE	Public Investment in Private Equity
R&D	Research and development (In this study R&D/R&I are used interchangeably to describe all activities in the research and innovation cycle, with R&I the preferred term).
R&I	Research and innovation
SQL	Structured Query Language
TRL	Technology readiness level
VC	Venture capital

EXECUTIVE SUMMARY

In December 2020, Ipsos and SPI were commissioned by the European Commission's Directorate General for Research and Innovation (DG RTD) to carry out a comparative study related to the Research and Innovation (R&I) investment level in food systems in Europe, intended to develop a detailed understanding of the current state of play, both at the national and EU level.

This study involves the identification and collation of several different national and EU datasets to provide a picture of the overall level of investment in food-systems R&I at different levels across the EU. In effect, it presents a collage made up of data of varying quality, completeness and granularity. The picture of R&I investment resulting from this study should therefore be understood as **representing the best data available to the project team, rather than providing a comprehensive view of all public and private R&I funding.**

1. BACKGROUND AND CONTEXT

Ensuring and creating a sustainable, climate-friendly Union is seen as a priority in order to future-proof the EU. Changes to food production, processing and consumption have been linked to significant biodiversity loss and a decrease in overall soil quality, leading to reduced agricultural productivity and a reduction in the nutritional quality of food. Combined with an ageing population, a transition away from agriculture in the workforce, increased pressure on natural resources (including both land and water) and the growing prevalence of nutrient-poor diets, current food systems represent a serious threat to food and nutrition security (FNS).

The European Commission's approach to food systems R&I is outlined in the Food 2030 policy framework, which is intended to create a coherent and comprehensive approach to EU-funded R&I on FNS.¹ It provides a roadmap for how R&I can be leveraged to ensure the long-term resilience and sustainability of the European food system, in order to ensure affordable, nutritious and safe food for all European citizens within healthy planetary boundaries. It also outlines an approach for EU-funded R&I for sustainable, healthy and inclusive food systems to be deployed via Horizon Europe's "Sustainable Food Systems for People, Planet & Climate" Partnership to be launched in 2023.

Food 2030 supports an interdisciplinary approach to food systems R&I, with the aim of strengthening policy coherence, leveraging funding and investment, supporting the development of a wide variety of innovations – from disruptive technologies to new

¹ FNS here refers to accessibility to a healthy and affordable diet that is also environmentally sustainable. A more detailed definition is available in: The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. <https://doi.org/10.4060/ca9692en>.

governance processes – and increasing inclusion of social dimensions and market take-up of food products leading to new tools, approaches and business models required to support the transition to a more sustainable and resilient EU food system.

2. RESEARCH METHODOLOGY

This study has taken a mixed methods approach to data collection and analysis, combining analysis of data on investment levels with qualitative literature review and in-depth interviews to provide a detailed understanding of investments in food systems R&I at EU and national level from 2007 to 2020. Private sector investments into food systems R&I were estimated through patent data and an analysis of equity investment. More detailed information on the methodology is included in Annexes A-C.

3. EU FUNDING FOR FOOD SYSTEMS R&I (FP7 AND HORIZON 2020)

- From 2007 – 2020, almost **EUR 18.4 billion** of EU funding is estimated to have been provided to projects related to food systems.² This accounts for 15% of the total EU public funding available under FP7 and Horizon 2020.
- Of this, just over **EUR 4.8 billion** of food-systems related EU public funding are aligned with the Food 2030 priorities and pathways and therefore deemed relevant within the context of this study³. This accounts for 4% of the total EU public funding available under FP7 and Horizon 2020.
- Under FP7, the European Commission contributed approximately **EUR 1.3 billion** to R&I projects aligned with the Food 2030 priorities and pathways. This represents approximately 3% of the total FP7 budget (EUR 53.2 billion).⁴
- Under Horizon 2020, this increased to a little over **EUR 3.5 billion** (almost 5% of the total EUR 70.2 billion budget)⁵.

² This refers to projects that corresponded to our keyword search. This does not include projects funded under the Green Deal call (worth EUR 1 billion of R&I funding), as projects funded under this call were awarded in 2021 and are therefore out of scope of this study. Nevertheless, it is worth highlighting that several projects funded under this call are related to food systems.

³ Not all projects aligned with both the Food 2030 priorities and pathways. Therefore, this total include all projects which aligned with one or more Food 2030 priority and/or pathway.

⁴ UK Government (2010), EU Science & Technology Funding, available at: <https://www.parliament.uk/globalassets/documents/post/postpn359-eu-science-funding.pdf>

⁵ European Commission (2020), Horizon 2020 Budget, available at: https://ec.europa.eu/programmes/horizon2020/sites/default/files/Factsheet_budget_H2020_0.pdf

- The majority of relevant funding (55%) allocated at EU level appears to focus on projects in the early stages of the value chain (primary production/food processing), with less focus on logistics (1%) and food retail (1%).
- There was a **relatively even distribution of funding between three of the four Food 2030 priorities** under FP7 and H2020: 36% (EUR 2 billion) of relevant funding was allocated to projects aligned with priority two (climate smart and environmentally sustainable food systems); 27% (EUR 1.4 billion) to priority three (circularity and resource efficiency); and 22% (EUR 1.2 billion) to priority one (nutrition for a sustainable and healthy diet).
- A little over EUR 783 million of European public funding, accounting for 15% of all relevant funding, was awarded to projects aligned with priority four (innovation and empowerment of communities).
- A **stronger focus on circularity and resource efficiency** seems to have emerged from 2012 onwards, perhaps reflecting a focus on the upcoming EU Circular Economy package (published in 2015). Under Horizon 2020, 28% of EC funding given to food-related projects aligns with this priority, compared to 20% under FP7.
- Projects related to food waste and resource efficiency in food systems, as well as projects related to the digitalisation of food systems, on the other hand, have seen an increase in their share of overall relevant EU public funding. These two pathways also map mostly onto the two Food 2030 priorities “Climate smart and environmentally friendly food systems” and “Circularity and Resource efficiency”, which gained in importance from FP7 to Horizon 2020.
- From FP7 to Horizon 2020, projects related to food safety experienced the biggest decrease in their proportion of overall relevant EU public funding awarded, from almost 18% to 12%. Although food safety remained an important focus at EU level, with numerous updates and amendments to EU Food Safety Regulations across the reference period (including updated legislation on the provision of food information to consumers in 2011, amendments to the legislation on controls in 2016 and new legislation on novel foods in 2015, updated in 2018).
- Approximately 19% of projects were assigned to the category “other”. This means that, although they aligned with one or more Food 2030 priorities, they did not fit within any of the definitions assigned to the ten Food 2030 pathways.

- More broadly, there was a decrease in the proportion of funding awarded to projects related to aspects of nutrition and health between FP7 and Horizon 2020. Projects aligned with the pathways “The Microbiome World” and “Healthy, Sustainable and Personalised Nutrition” saw their share of overall relevant funding halved. This reflects the decrease in the proportion of funding aligning with the first Food 2030 priority “Nutrition for a sustainable and healthy diet”, discussed above. This likely reflects an increased focus on environmental matters – mirrored in growing R&I funding in these areas - in EU policy (expressed through the launch of the bioeconomy strategy (2012 and updated in 2018), the Circular Economy Package (first introduced in 2015) and the European Green Deal introduced in 2019). While health and nutrition-related aspects are mentioned at times in these, no specific food and nutrition policy was published prior to the Farm to Fork Strategy (released in 2020 as part of the European Green Deal).
- As with the analysis of priorities, the extent to which projects could be viewed as delivering co-benefits was measured by analysing their alignment with more than one Food 2030 pathway. 23% of food-systems related R&I projects were found to align with two or more pathways (20% aligned with two pathways, 3% with three, and four projects - accounting for less than 1% - aligned with four different pathways).

4. NATIONAL FUNDING FOR FOOD SYSTEMS R&I IN THE EU MEMBER STATES

- Twelve of the 27 EU Member States have specific policies or initiatives in place to develop food and/or agriculture related R&I. An additional twelve countries include references to food and/or agriculture in their broader R&I strategies. The majority of food R&I policies have been introduced since 2016, however, meaning that during the reference period for this study there was no overarching policy in place in most Member States.
- Responsibilities for food systems R&I are divided between the Ministry of Education, Research and Science and the Ministry of Agriculture, with the Ministry of Economy also playing an important role in some countries. In most cases, the Ministry of Agriculture is the primary funder of food systems R&I.
- A review of public funding in 26 countries⁶ found that public R&I funding at national level appears to be channelled primarily towards universities and research institutions, and is mainly distributed via open calls and grants.

⁶ All 27 EU Member States with the exception of Greece for which no granular data was available for analysis (see Greece country report, Annex F).

- Public sector funding for food systems R&I identified at national level between 2007 and 2020 totalled EUR 5.5 billion, and ranged from 0.1% to 3% of overall government R&I expenditure.
- **The majority of funding is consistently allocated to primary production**, which accounts for almost two-thirds (63%) of overall spend across the EU Member States. Czechia and the Netherlands were notable exceptions to this rule: in both cases, the most common Food 2030 sector related to healthy people.
- **Food retail and food services together with networking and knowledge exchange** were the sectors with the lowest level of spend, accounting for 1% and less than 1% of the total respectively. In the first instance this may be due to the fact that the food retail and services sector is not traditionally viewed as a public policy concern in the same way as public “goods” such as healthcare and nutrition or areas requiring government regulation, such as food safety. The limited funding available for networking and knowledge exchange could be a symptom of the fragmentation in the food sector, with limited interaction between different stakeholders (for more information, see sections 2 and 3).
- The **majority of relevant public funding** identified at national level aligned with Food 2030 priority two: climate smart and environmentally sustainable food systems (43% of all funding identified), followed by nutrition for sustainable and healthy diets (25% of all funding identified) and circularity and resource efficiency (20%). Priority four (innovation and empowerment of communities) received just 11% of all funding identified at national level, suggesting a potential gap.
- Approximately 24% of public R&I funding on food systems in the countries for which funding was available corresponded to “the food safety system of the future” pathway, followed by “healthy, sustainable and personalised nutrition” (9%), “food waste and resource efficiency” (8%) and “food systems and data” (6%). A very small proportion of public funding (less than 1%) at national level was aligned with the “urban food systems transformation” pathway⁷.
- **Almost EUR 80 million** was spent on projects coded as “Cross sector” (i.e. those targeting the whole food supply chain).

⁷ Year on year, aggregate investment levels in this pathway fluctuated between 2007 and 2020, but remained amongst the least funded across nearly all Member States.

5. COMPARATIVE TRENDS IN CANADA, CHINA AND THE USA

Research was carried out to understand comparable levels of public investment in food systems R&I in Canada, China and the USA. These countries represent world leaders in terms of R&I investments generally, and investments in food-related R&I more specifically.

- When comparing expenditure within EU Member States to the three comparator countries, a significant difference emerges: in the EU (at both member state and EU level), there is a much stronger focus on public sector R&I expenditure than in the comparator countries; however, each of the three countries in question has a higher level of private sector R&I than can be noted within the EU.
- As a proportion of GDP, only the USA has a higher overall R&I expenditure⁸ (including government, private sector and other expenditure) in comparison with the EU-27 average. If compared to EU Member States, Canada would rank 11th in terms of government expenditure as a proportion of GDP, with the USA and China sharing joint 22nd place alongside Slovakia. In terms of private sector expenditure, however, all three countries are above the EU average.
- In Canada and the USA, primary production accounts for nearly 75% of public expenditure on food systems R&I. In China, the picture is slightly more balanced, with primary production accounting for approximately 41% of spend.
- Expenditure on waste streams, at 25% of expenditure, is much more significant in China than in the other two countries. Logistics and food processing also make up a more significant proportion of food systems R&I funding in China.

⁸ Eurostat and OECD, GERD by sector of performance and source of funds.

6. ANALYSIS OF PRIVATE INVESTMENTS IN FOOD SYSTEMS R&I

There is a dearth of data on private sector investment into food systems R&I. This study adds novel insight and evidence through two separate analyses: Overall private investment in the EU between 2012–2018 was estimated by piloting an innovative method linking company records to patent data.⁹ ¹⁰ Second, a separate analysis of equity investments into food systems relevant companies in the EU and US was undertaken using data on investment deals completed. The following key findings emerged from this analysis:

- Between 2012 and 2018, an estimated **EUR 93 billion** was invested in food-related innovation by the private sector in the EU.
- More than half of all R&I taking place in the EU food sector is carried out **by German and Dutch** companies.
- Private sector investment is concentrated in the **primary production** and **food processing** sectors.
- Overall **volume of equity investments into food technologies in the EU trailed behind the volume of equity deals in the USA** between 2007 and 2020. Overall volume of equity investments into EU companies was EUR 43 billion, compared to EUR 138 billion in the US. This confirms analysis undertaken by the EIB¹¹, suggesting that access to finance is a major bottleneck for innovative EU-based firms active in food technologies.
- The number and size of equity investment deals involving food sector companies on average **grew in both the EU and the USA** between 2007 and 2020. It increased significantly more, however, in the USA than in the EU over this time period.
- Investment deals in the EU tend to be of **smaller size** compared to those involving US-based companies.

⁹ This work was based on a similar method established by the Joint Research Centre to estimate private sector investment in climate change mitigation technologies. A detailed methodology for this work is provided in Annex C. Pasimeni, F., Fiorini, A., and Georgakaki, A. (2019). For the original paper see: Assessing private R&D spending in Europe for climate change mitigation technologies via patent data. *World Patent Information*, 59, 101927. <https://doi.org/10.1016/j.wpi.2019.101927>

¹⁰ PatStat data before 2012 and after 2018 did not provide sufficient coverage to be used for this analysis. See our detailed methodology in Annex C.

¹¹ EIB (2018), *Feeding Future Generations*, available at: <https://www.eib.org/en/publications/feeding-future-generations>

7. POTENTIAL OBSTACLES TO FOOD SYSTEMS R&I INVESTMENT WITHIN THE EU

The most significant obstacle identified is a lack of focus on food as a thematic policy area and a concurrent lack of oversight/governance for this policy area. This leads to fragmentation in the funding ecosystem, with food systems R&I funding divided between multiple entities and very little focus on measuring progress against strategic outcomes for food R&I. This has several consequences, namely:

- **Decentralisation of food policy**, with different aspects divided between different disciplines and policy areas. This means that a strong focus can be noted on specific elements of food systems R&I (for example, food safety), but there is limited evidence of an integrated systemic perspective to address FNS as a whole.
- Investments in food systems R&I are **not consistently measured or monitored**, with data often collected separately across numerous different entities. No one organisation has a clear view on what is being invested on food systems R&I at national level and how this contributes to strategic objectives laid out in the national food and/or R&I policy.
- Where data on food systems R&I investment is captured, this is usually as part of monitoring data for other policy priorities, meaning that the information being collected is not always relevant – perhaps most acutely, this means **that it is not always possible to identify funding allocated to food systems R&I**.
- There is very **limited information available on the results of R&I spending in food** (either traditional R&I outcomes such as increases in TRL level, patenting activity, publications etc or contribution to broader policy-level outcomes), exacerbated by a lack of common indicators which would allow for the collection and comparison of data.
- Estimating private sector investments across EU Member States poses a number of challenges. This study has piloted an innovative approach based on work undertaken by Pasimeni, Fiorini, and Georgakaki (2019)¹². However, this approach was limited by challenges around data availability. Results can be further improved by undertaking further cleaning of the patent data available in PatStat, and improving robustness of results by including R&D investment data for a larger number of companies as

¹² Pasimeni, F, Georgakaki, A. and Fiorini, A., Assessing private R&D spending in Europe for climate change mitigation technologies via patent data, World Patent Information, 59, 2019, <https://doi.org/10.1016/j.wpi.2019.101927>

a basis for estimation. The approach also includes assumptions on the proportion of innovative activity that results in patent applications. Future research should review these assumptions further and update the estimates provided in this study.

8. POTENTIAL SOLUTIONS TO HELP MITIGATE THE OBSTACLES IDENTIFIED

- **The European Commission has a key role to play in setting the direction for food systems R&I investment** going forward. Research at national level has noted an increasing number of food R&I policies being introduced since 2016, and interview feedback from national stakeholders suggests that in many cases countries are aligning their approaches with framing of the Food 2030 initiative.
- **The largest obstacle to increased R&I investment at national level is the fragmentation of responsibility regarding food policy** between multiple different policy areas, leading to a lack of strategic impetus at national level. An initial first step to address this problem could be to encourage Member States to develop national food R&I strategies aligned with the priorities laid out in the Food 2030 strategy. This would help create a clear focus for investment in food systems R&I across the EU and lay the basis for a more coherent and integrated approach.
- **Building on this, the European Commission could work with key stakeholder groups**, such as the SCAR Food Systems Working Group to develop a common set of outcome indicators and associated metrics, which could be used to collect outcome data against food R&I projects to understand the effectiveness of funding expended and categorise spending on food R&I. Such future analysis should be structured against the Food 2030 strategy.
- **At national level, increased collaboration is needed** both between institutions with responsibility for different aspects of food policy, and actors at different levels within the food ecosystem. This could be achieved through the creation of interdisciplinary food policy councils or similar, with representation from industry, civil society, academia and national policy and administration, with responsibility for developing and implementing a holistic national food systems strategy – including considerations of how to promote food systems R&I.
- To further improve on the private sector investment estimates provided in this report, DG RTD should work with the Joint Research Centre (JRC) to build on the work undertaken for the present study and update investment estimates in the future.

1. INTRODUCTION

In December 2020, Ipsos and SPI were commissioned by the European Commission's Directorate General for Research and Innovation (DG RTD) to carry out a comparative study related to the Research and Innovation (R&I) investment level in food systems in Europe at national and EU level. Our research has mapped existing levels of public and private sector R&I investment (covering the period 2007-2020) at national and EU level against the specific priorities and pathways described within the Food 2030 initiative. By analysing historic trends for different actors within the food system, we aimed to build a baseline picture of R&I investment within the EU food system and identify potential future areas of intervention.

1.1. Background and Context

Building a sustainable, climate-friendly Union is seen as a priority in order to future-proof the EU. In 2019, the Von der Leyen Commission introduced the European Green Deal - a set of policies to improve the sustainability of the European economy and ultimately achieve climate neutrality by 2050. Climate change and over-exploitation of planetary resources have been identified as key risks by the EU, and a particular threat to the stability of the global food system. Changes to food production, processing and consumption have been linked to significant biodiversity loss and a decrease in overall soil quality, leading to reduced agricultural productivity and a reduction in the nutritional quality of food. Combined with an ageing population, a transition away from agriculture in the workforce, increased pressure on natural resources (both land and water) and the growing prevalence of nutrient-poor diets, current production and consumption systems represent a serious threat to food and nutrition security (FNS).

A number of key policy initiatives further support the Green Deal's overall objectives. In relation to food systems, the Farm to Fork Strategy (published in 2020) aims to transform European food systems to become the global standard in sustainability while striving to supply healthy, safe, equitable, and environmentally friendly food. The Farm to Fork Strategy identifies R&I as a key driver in developing and testing solutions across all sectors of the food system to help accelerate the transition to sustainable, healthy and inclusive food systems across the EU. However, the EU has identified strong indications of a funding gap in public and private sector provision for R&I in food systems. A study carried out by the European Investment Bank (EIB) in 2018 showed that Europe lags behind other developed countries in this area. For example, it estimated a total difference of approximately EUR 21-25 billion per annum in investment levels (debt and equity), between the EU and

the USA – an amount described as “most likely a conservative estimate”.¹³ If the EU is to meet its objectives, increased R&I expenditure will be needed to help develop sustainable products and processes across the food system (from production through processing to distribution, consumption and the treatment of waste).

The EIB has identified a number of challenges within the agri-food sector that “can only be resolved with innovation”. These include a projected 98% increase in the global demand for food without a concurrent increase in the availability of arable land, meaning significantly more food will need to be produced per hectare to meet demand.¹⁴ Additionally, the food value chain is a significant contributor to greenhouse gas emissions through its high utilisation of non-renewable energy sources. Primary production, processing and logistics are estimated to account for approximately 30% of global demand for energy.¹⁵ Finally, approximately one third of food produced globally is estimated as lost or wasted annually.¹⁶ New technologies and new innovative processes are therefore needed at all levels and in all sectors of the food value chain (including food production, processing, distribution, logistics, retail, food sharing, recycling etc.) to reduce energy consumption. R&I would enable a transition to alternative energy sources, reduce waste and improve efficiency in food production whilst protecting biodiversity, ensuring good soil quality and providing high quality employment.

1.2. Food 2030

The European Commission’s approach to food systems R&I is outlined in the FOOD 2030 policy framework. Food 2030 is intended to create a coherent and comprehensive approach to EU-funded R&I on food systems transformation.¹⁷ It provides a roadmap for how R&I can be leveraged to ensure the long-term resilience and sustainability of the European food system, in order to ensure affordable, nutritious and safe food for all European citizens within healthy planetary boundaries. It also outlines an approach for EU-funded R&I for sustainable, healthy and inclusive food to be deployed via Horizon Europe instruments, including the Missions (for example the “A Soil Deal for Europe” and “Adaptation to Climate Change”), partnerships, and calls for proposals within Cluster 6 “Food, Bioeconomy, Natural Resources, Agriculture and Environment”.

¹³ EIB (2018), Feeding Future Generations, available at: <https://www.eib.org/en/publications/feeding-future-generations>

¹⁴ EIB (2018), Feeding Future Generations, available at: <https://www.eib.org/en/publications/feeding-future-generations>

¹⁵ EIB (2018), Feeding Future Generations, available at: <https://www.eib.org/en/publications/feeding-future-generations>

¹⁶ EIB (2018), Feeding Future Generations, available at: <https://www.eib.org/en/publications/feeding-future-generations>

¹⁷ FNS here refers to accessibility to a healthy and affordable diet that is also environmentally sustainable. A more detailed definition is available in: The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. <https://doi.org/10.4060/ca9692en>.

Food 2030 supports an interdisciplinary and multi-actor approach to food systems R&I, with the aim of strengthening policy coherence, leveraging funding and investment, supporting the development of a wide variety of innovations – from disruptive technologies to new governance processes – and increasing inclusion of social dimensions and market take-up of food products leading to new tools, approaches and business models to support the transition to a more sustainable and resilient EU food system.

Transforming food systems for sustainability is an ambitious challenge intertwined with issues such as climate change, natural resource scarcity, biodiversity loss, and health challenges such as obesity and malnutrition. FOOD 2030 advocates a system approach to simultaneously understand and address these challenges across the whole food system incorporating food production, packaging, transport, retail, consumption and waste management, and taking an inter and transdisciplinary and multi-actor approach consistent with the principles of Responsible Research and Innovation¹⁸.

FOOD 2030 identifies the need for a systemic approach to R&I that addresses four priorities: **Priority one:** Nutrition for sustainable and healthy diets; **Priority two:** Climate smart and environmentally sustainable food systems; **Priority three:** Circularity and resource efficiency of food systems; and **Priority four:** Innovation and empowerment of communities.

In 2020 the European Commission released its ten **Food 2030 Pathways for Action**, conceived to deliver co-benefits to these four priorities. The pathways, which focus on key leverage points where R&I can be particularly important to develop solutions for food systems transition, are being deployed within Horizon Europe¹⁹ Cluster 6 “Food, Bioeconomy, Natural Resources, Agriculture and Environment”, via calls for proposals.

The relevance of the co-benefits of each pathway to the four different Food 2030 priorities and their relative alignment is described in Figure one below.

¹⁸ More information on the responsible research and innovation approach can be found at: <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation>

¹⁹ European Commission (2020), Food 2030 pathways for action – Research and innovation policy as a driver for sustainable, healthy and inclusive food systems <https://op.europa.eu/en/publication-detail/-/publication/86e31158-2563-11eb-9d7e-01aa75ed71a1>

Figure 1: Food 2030 pathways, priorities and diversity of expected co-benefits²⁰

FOOD 2030 PATHWAYS	 NUTRITION	 CLIMATE	 CIRCULARITY	 INNOVATION
Governance and systems change	+++	+++	+++	+++
Urban food systems transformation	++	+++	+	+++
Food from oceans and freshwater resources	++	+++	++	++
Alternative proteins and dietary shift	+++	+++	++	+++
Food waste and resource efficiency	+	+++	++	++
The Microbiome world	+++	+++	+++	+
Healthy, sustainable and personalised nutrition	+++	++	+	++
Food safety systems of the future	++	+++	++	++
Food systems Africa	++	++	++	+++
Food systems and data	+++	+++	+++	+++

²⁰ European Commission (2020), Food 2030 Pathways for Action: Research and innovation policy as a driver for sustainable, healthy and inclusive food systems, available at: <https://op.europa.eu/en/publication-detail/-/publication/86e31158-2563-11eb-9d7e-01aa75ed71a1>

Food 2030 is designed to catalyse R&I to deliver co-benefits²¹ for food systems transition, particularly with regard to other key European policy ambitions such as improved public health outcomes, improved environmental impacts and improved livelihoods for workers within the food sector.²² However, according to a report by the SCAR Food Working Group into R&I on food systems by European Member States (SCAR 2018), there is currently a lack of coherence in R&I strategies and approaches to FNS²³ at EU level and between EU Member States. The report shows that R&I activity tends to address compartmentalised elements of the food system rather than taking a systemic approach. Additionally, at the European level, support for food systems R&I is distributed between different Commission services, programmes and funding instruments. Looking forward, the European Commission foresees the “Sustainable Food Systems for People, Planet & Climate” Partnership to be launched in 2023. This is intended to help address this fragmentation.

In our research, we have therefore considered R&I which addresses two or more priorities, pathways or sectors as an example of funding which provides co-benefits. Moreover, as identified by the European Observatory on Health Systems and Policies, implementing a food systems approach to achieve co-benefits requires cross-government and cross-sector collaboration as well as a broader framework of enabling policy.²⁴ In our research, we have consequently sought to identify the extent to which there is a specific food R&I policy and to what degree food systems are considered within national R&I strategies and vice versa. We have also sought to identify whether there is evidence of collaboration between institutions responsible for different aspects of food and R&I policy.

²¹ Co-benefits are commonly associated with strategic approaches to tackling climate changes and have been defined as “simultaneously meeting several interests or objectives resulting from a political intervention, private sector investment or a mix thereof. Opportunistic co-benefits appear as auxiliary or side effect while focusing on a central objective or interest. Strategic co-benefits result from a deliberate effort to seizing several opportunities (e.g., economic, business, social, environmental) with a single purposeful intervention.”

²² European Observatory on Health Systems and Policies (2018), Connecting food systems for co-benefits: How can food systems combine diet-related health with environmental and economic policy goals?, available at: https://www.euro.who.int/_data/assets/pdf_file/0007/387070/policy-brief-31-austria-eng.pdf

²³ FNS here refers to accessibility to a healthy and affordable diet that is also environmentally sustainable. A more detailed definition is available in: The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. <https://doi.org/10.4060/ca9692en>

²⁴ European Observatory on Health Systems and Policies (2018), Connecting food systems for co-benefits: How can food systems combine diet-related health with environmental and economic policy goals?, available at: https://www.euro.who.int/_data/assets/pdf_file/0007/387070/policy-brief-31-austria-eng.pdf

1.3. Methodology

This study has taken a mixed methods approach to data collection and analysis, combining analysis of data on investment levels with qualitative literature review and in-depth interviews to provide contextual analysis of the reasons for differences between countries in terms of level and types of investment as well as insights into potential trends and future requirements for food systems R&I within Europe.

Data collection was divided into three main strands:

1. **A review of EU-level R&I projects** on food systems, map them against the Food 2030 priorities and pathways, and identify any changes in terms of focus areas from 2007 to 2020.
2. **A mapping of public sector R&I investment in food systems at national level** to understand the scale and scope of R&I investment in the Food 2030 priority areas in the Member States, identify emerging trends at national level and identify areas of over/under-investment.
3. **Investigating private sector investment in food systems R&I.** This strand consisted of two separate analysis. First, it piloted an innovative method to estimate private sector research and development (R&D) investment²⁵. Separately, an analysis of equity investment into food systems was undertaken using data on completed investment deals in the US and EU.

Annexes A, B and C provide further detail on the methodology and the specific approaches used to collect and analyse the data under each strand.

²⁵ Whilst there are different approaches and interpretations, as a generalisation R&I investment is a more broadly scoped investment class than R&D per se (the 'R' in R&I). Whilst R&I relates to nine Technology Readiness Level (TRL) categories, in some schema (e.g. the EU TRL framework) R&D (as defined by the OECD Frascati guidelines) only relates to the first three TRL categories (or the first four for some industries). However, in State Aid rules the definition of R&D is broader than the Frascati definition and spans much more of the TRL spectrum. Furthermore, spending on clinical trials (classed as part of R&D) is treated as TRL 6 to 8 depending on their phase. Hence, there is no clear consensus on this issue. In this study, we have used the term R&I as a general term covering all food systems research and innovation. The only exception to this rule is private sector research and development, for which we use the term R&D.

1.4. Evidence Base

The evidence base for this report is comprised of funding data at national and EU level, interviews with national and EU stakeholders and a literature review (primarily of grey and policy literature, but including academic literature where relevant). The national research was based on consultations with almost 60 stakeholders (representing Ministries and other national-level Agencies) in 30 countries and a review of relevant national policy and strategy documents, as well as relevant data extracted from public national databases (and, in a number of cases, internal data extracted and provided directly to national researchers by national stakeholders). This was supplemented by a data request circulated to members of the FoodDrink Europe national associations via EUSurvey, which received responses from 10 countries.

EU level research was based primarily on data extracted from the European Commission's CORDIS database, supplemented by a review of relevant policy and academic literature and seven interviews with EU level stakeholders. Projects were considered in scope for this study if they had a direct applicability to the food sector and if they included a focus on sustainability. Projects which were viewed either as not directly applicable to food or not relating to sustainability were excluded from the analysis.

As regards the estimation of private sector investment levels, evidence on the use of patents as a proxy for R&D spending is provided by a series of analyses conducted by the JRC that focus on R&D in the sector of climate change mitigation technologies. Additionally, a focus group²⁶ was carried out with members of the FoodDrinkEurope ETP to contextualise the estimate of private sector R&D for the food sector. In particular, the focus group was used as an opportunity to test the assumption that patenting activity can be meaningfully utilised as a proxy for R&D investment levels in the food sector.

This study was built on two prior pieces of research:

- A **mapping of public sector expenditure on food systems R&I against Food 2030 priorities** in 11 EU Member States between 2013 and 2018, which was carried out by the SCAR Food Systems Working Group and published in 2018.
- A mapping carried out by the European Commission, DG RTD, **categorising Horizon 2020 expenditure against Food 2030 priorities, pathways and sectors**, published in 2020.

²⁶ All ETP members were invited to take part in individual interviews. Six ETP members requested to be interviewed jointly in a focus group and one took part in a separate interview.

The results of both mapping activities were shared with the study team and the data was incorporated into our research. The results presented in this report do not align exactly with the published results of the two studies mentioned above, however, for three key reasons.

1. The **keywords** used in this study are slightly different to those used in the prior studies, meaning that the search results returned cannot be expected to align completely.
2. The **definitions** used for the pathways and sectors, in particular, were further refined in the intervening period between the implementation of the two prior studies and this research, leading to some differences in categorisation. Important to highlight is in particular the definition used for the classification of project against the pathway “Food Systems and Data”: under this category, we have also included aspects interlinked with primary production (such as precision farming) as well, taking a broader definition than strictly outlined within the “Food 2030 Pathways for action: Food Systems and data” factsheet.²⁷ The projects mapped within this study are therefore to be understood as relevant to Food Systems and Data.
3. Finally, in this study **we have allocated funding to multiple priorities, pathways or sectors (where relevant)** in an attempt to identify the existence of co-benefits. Where a project is judged to align with two or more priorities, pathways or sectors, the total amount of funding is divided between the different priorities, pathways and sectors. The prior studies did not use this methodology, but rather allocated all funding to one primary priority, pathway or sector.

1.5. Limitations and Challenges

This study involves the identification and collation of several different national and EU datasets (see Annexes for more details) to provide a picture of the overall level of investment in food-systems R&I at different levels across the EU. In effect, presenting a collage made up of data of varying quality, completeness and granularity. The picture of R&I investment resulting from this study should therefore be understood as **representing the best data available to the project team, rather than providing a comprehensive view of all public and private R&I funding.**

²⁷ European Commission, Directorate-General for Research and Innovation, Food 2030 pathways for action: food systems and data, Publications Office, 2020, <https://data.europa.eu/doi/10.2777/38224>

The scope of the study necessitated data collection at both EU and national level, as well as across multiple organisations. At EU level, data analysis was limited to the relevant Framework Programmes (FP7 and H2020). Other sources of innovation funding such as the EU Structural and Innovation Funds, EU financial instruments and the European Investment Bank's **European Fund for Strategic Investments (EFSI)** are excluded from the analysis in this report..

The **fragmentation of responsibility for food policy** (and food R&I in particular) between numerous different Ministries and other institutions created problems both in terms of identifying relevant data and in monitoring the outcomes of R&I investments against an overarching systems-level objective (as most data captured relates explicitly to the specific political priorities of the institution in question). It was therefore necessary to adopt an **iterative, bottom-up approach to data collection** (attempting to collect data from all parts of the system) combined with a **top-down approach to data analysis**, using a centralised EU policy as the common point of reference for all data collected. In reality, the majority of funding data identified fell within the remit of the Ministry for Agriculture, often complemented by limited data from the Ministry for Research and Innovation and, in some cases, the Ministry for the Economy. In many cases, **data were either not consistently collected, not consistently stored, or not organised in such a way as to be able to identify food related projects**. In some cases, data on projects funded was also lacking financial information, hindering the analysis of overall levels of investment.

The study team has identified several specific data gaps and limitations, which are detailed below.

Categorisation of data

The scope of the study required the categorisation of identified R&I into a number of priorities, pathways and sectors using a food-systems approach. As the Food 2030 initiative was developed after the funding being reviewed was allocated, data had to be effectively retrofitted against its specified categories.

Project descriptions (at both EU and national level) were sometimes misleading and did not necessarily provide sufficient information to categorise them (e.g. no detailed project description was available or the description was not informative – for example, a project might be described as “innovation voucher” with no detail on the technical objectives of activities funded). Projects were excluded from the analysis in instances where not enough information was available to identify the content of a project. In instances where

there was a lack of clarity around certain types of projects, clarifications were sought at feedback sessions with the study team and from the project Steering Group. Nonetheless, it is possible that individual projects may have been excluded or miscategorised due to misleading project descriptions.

Availability of data

In many cases, databases on publicly funded R&I are not available and the study team has relied on cooperation from national authorities to support with the identification and extraction of relevant data. To compile a dataset that is as comprehensive as possible, national researchers contacted multiple agencies based on the division of responsibilities identified by the initial desk research. In some Member States, stakeholders consulted had limited knowledge of the data available (in many cases explicitly referencing the fragmentation of responsibilities described above). In some cases, respondents refused to share data or stated that there was no relevant data available. In cases where data were shared, it is possible that some sources of funding may not have been identified and/or that the data provided by national authorities were incomplete.

As funding is divided between different Ministries, agencies and institutions, the information is often fragmented and collected in different ways using different variables, sometimes requiring a keyword search to identify relevant projects. This results in inconsistent variables across datasets (e.g. on start and end dates or availability of beneficiary information) and inconsistencies in categorisation between organisations (for example, some organisations categorised projects as food or agriculture projects, while others categorised them as R&I or technological development and did not explicitly recognise them as food-related), limiting the scope of synthesis analysis. While the study team used data collection templates, internal briefings and ongoing feedback sessions to harmonise the data as far as possible, there is nonetheless a risk of some disparities between the different datasets.

Data on private R&I specific to food systems for a sufficiently representative sample across the EU is not available. There are also significant challenges in undertaking large-scale and representative fieldwork with relevant firms. Therefore an approach had to be found to approximate the share of private funding invested into food systems R&I from existing secondary data. The estimation undertaken utilised the link between firms' innovative activities and patenting and made assumptions around the proportion of innovative activity that leads to patent applications. These results can be further improved upon by improving the quality of patent data available in Patstat and increasing the availability of R&D investment data for companies of interest.

Data quality

Some data gaps have been identified in the information collected. No granular data on project outcomes and results (e.g. changes in TRL levels, commercial adoption or bibliometric impact) were identified and databases often lacked details such as amount of funding allocated, project start/end dates and detailed project descriptions. Sources of funding were not always clear. Quality assurance of some national datasets identified funding from EU sources which had been included in a breakdown of national funding. Where EU funding was identified it was removed from the national analysis, but it is possible that some projects classified as “national projects” and analysed as part of the national-level mapping may include a mixture of national and EU funds, without a breakdown of individual contributions. The team worked to mitigate this by specifying that EU and national funding should be analysed separately and excluding EU contributions from national datasets wherever these are identified during the Quality Assurance process. There is nonetheless a strong likelihood that some of the funding being analysed at national level includes a proportion of EU funding.

2. EU FUNDING FOR FOOD-RELATED R&I

This section presents the main findings from the mapping of EU public sector R&I funding provided through the two most recent Framework Programmes (FP7 and Horizon 2020) undertaken as part of this study. This includes an analysis of overall funding levels, funding by instrument and programme, and the level of alignment with the Food 2030 pathways, priorities and sectors.

Headline findings

- From 2007 to 2020, almost **EUR 18.4 billion** of EU funding is estimated to have been provided to projects related to food systems.²⁸ This accounts for 15% of the total EU public funding available under FP7 and Horizon 2020.
- Of this funding, over **EUR 4.8 billion** aligned with the Food 2030 priorities and pathways (4% of all funding available through FP7 and Horizon 2020).
- Funding for food-systems related projects aligned with the Food 2030 priorities and pathways increased over time, with **EUR 3.5 billion under Horizon 2020** compared to **EUR 1.3 billion under FP7**.
- “Climate smart and environmentally sustainable food systems” was the most-funded priority, followed by “Circularity and Resource Efficiency”. Both areas saw their share of overall funding increase over time, mirroring an increasing focus on environmental sustainability and circular economy principles in policy developments.
- The four most-funded Food 2030 pathways were “Food Waste and Resource Efficiency”, “Food Systems and Data”, “The Food Safety System of the Future” and “Food from the Oceans and Freshwater Resources”, accounting for over half of the relevant overall funding.
- The largest share (44%) of food-systems-related EU R&I funding between 2007 and 2020 went to projects in the primary production sector, amounting to just over **EUR 2.1 billion** in total.

The European Commission provides funding for research and innovation activity across the EU and associated countries through its framework programmes. Between 2007 and 2020, two framework programmes were implemented: the FP7 programme (which ran from 2007 to

²⁸ This refers to projects that responded to our keyword search.

2013) and Horizon 2020 (which ran from 2014 to 2020). FP7 funding was allocated through four over-arching programmes, each of which correlated to a specific research activity. Horizon 2020, on the other hand, included three funding “pillars” and two specific objectives²⁹.

In addition to providing continued funding for the areas previously covered by FP7 (which were mainly reflected in Horizon 2020’s “Excellent Science” pillar), Horizon 2020 specifically sought to improve innovation within industry (through its “Industrial Leadership” pillar) and address specific thematic priorities requiring coordinated action at EU level (through the “Societal Challenges” pillar, which included funding specifically for food and agriculture). Unlike Horizon 2020, FP7 did not have an overarching funding programme which specifically mentioned food-systems. However, FP7 did include a thematic focus on ‘food, agriculture and biotechnology’ under its Cooperation programme. Additionally, ERA-NETs (such as SUSFOOD) play an important role in facilitating knowledge exchange between R&I actors across Europe. ERA-NETS under Horizon 2020 largely focussed on support for networking and knowledge exchange activities and providing “top-up” funding for R&I partnerships across EU Member States.

In addition to the Framework programmes, which are the subject of this study, there are several financial instruments at EU level which support R&I but have not been included in this analysis. These include for instance the InnovFin programmes implemented by the EIB and European Investment Fund (EIF) and the European Innovation Council. Other relevant EU funding programmes not included in the present analysis include:

- The EU’s **Structural Funds**, including the European Social Fund (ESF), European Regional Development Fund (ERDF), the European Agricultural Fund for Rural Development (EAFRD), The European Maritime and Fisheries Fund (EMFF), the European Social Fund (ESF) and the Cohesion Fund. The overall budget in the period of 2007 – 2013 was EUR 347 billion and EUR 464 billion for 2014-2020. Member States provide co-financing to projects funded. R&I is not the primary focus of the structural funds, but rather an avenue through which their objectives can be achieved. This study does not include an analysis of granular data associated with R&I expenditure through the Structural Funds. Nonetheless, their role in food-systems R&I at the national level is discussed at a high level in section 3, as well as in the individual country reports. This applies in particular to the ERDF, the EAFRD and the EMFF, given their relevance to food systems. The Just Transition Fund is a new instrument and part of the Just Transition Mechanism, to support the territories most affected by the transition towards climate neutrality to avoid growing regional inequalities, from 2021 onwards.

²⁹ European Commission (2020), Research and innovation funding, available at: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-a-call/h2020-structure-and-budget_en.html

- The European Investment Bank's **European Fund for Strategic Investments (EFSI)**. The EFSI is the financial component of the EIB's 'Investment Plan for Europe', its policy initiative launched in 2014 to combat declining investment levels and spur growth and innovation. The EFSI aimed to trigger EUR 500 billion in investment by 2020, leveraged by EUR 33.5 billion of EIB resources.³⁰

As mentioned above, this study focuses on a detailed analysis of R&I funding distributed via the European Framework programmes (specifically FP7 and Horizon 2020). The dataset³¹ used for analysis included 5,660 FP7 projects and 4,962 Horizon 2020 projects. Of these, 683 FP7 projects and 1,683 Horizon 2020 projects were classified as relevant for the purpose of this study, using a combination of manual classification by the study team and machine learning.³² The following sections provide an analysis of the projects considered to be in scope for the present study. We first consider overall levels of funding for food systems R&I under FP7 and Horizon 2020, before looking at how this was allocated through different programmes and instruments. We then consider the extent to which food systems R&I funding corresponds with the different priorities, pathways and sectors identified in the Food 2030 strategy before analysing trends in EU level expenditure from 2007 to 2020.

2.1. Overview of food R&I funding through EU Framework Programmes 2007-2020

From 2007 to 2020, almost EUR **18.4 billion** of EU funding is estimated to have been provided to projects related to food systems.³³ This accounts for **15%** of the total EU public funding available under FP7 and Horizon 2020.³⁴ Of the food-systems related funding between 2007 and 2020, just over EUR **4.8 billion** of EU public funding aligned with the Food 2030 priorities and pathways.³⁵ This accounts for **4%** of the total EU public funding available under FP7 and Horizon 2020. Under FP7, the European Commission contributed approximately **EUR 1.3 billion** to R&I projects aligned with the Food 2030 priorities and pathways. This

³⁰ EIB (2018). Investment Plan for Europe Available at: https://www.eib.org/attachments/thematic/investment_plan_for_europe_en.pdf

³¹ Available for download here: <https://cordis.europa.eu/projects/en>

³² For the purposes of this study, projects were included in the initial dataset if they had a direct applicability to the food sector and if they included a focus on sustainability. Projects which were viewed either as not directly applicable to food or not relating to sustainability were excluded from the analysis.

³³ This refers to projects that responded to our keyword search.

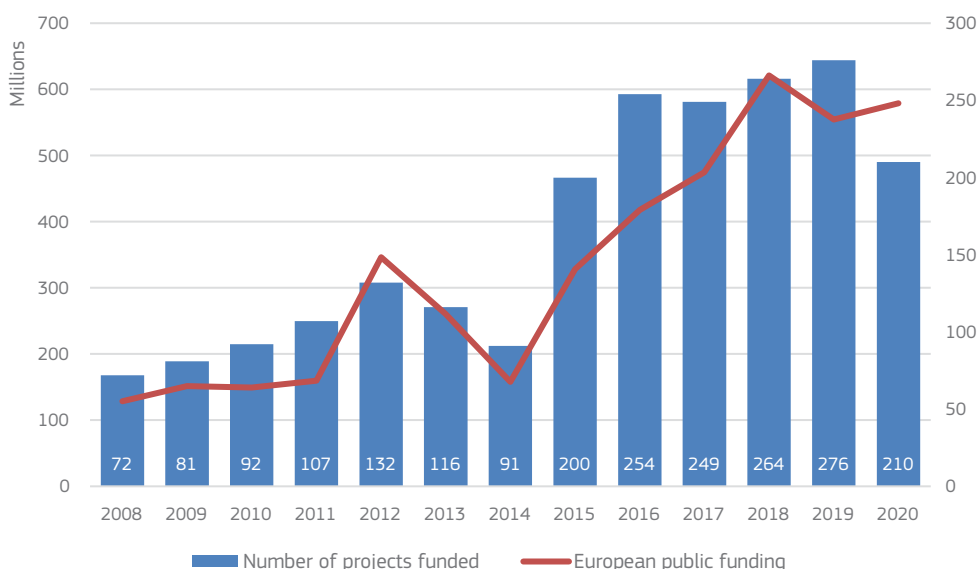
³⁴ This does not include funding awarded to food-systems related projects under the Green Deal Call launched in September 2020. Funding under this call was not awarded until Spring 2021, placing it out of scope for this evaluation (which covers projects starting between 2007 and 2020).

³⁵ Projects were excluded if they did not specifically target food systems (basic research into plant microbiology, project related to ecosystems more generally and medical research were several key categories), or if they did not have a specific objective to improve food system sustainability.

represents approximately 3% of the total FP7 budget (EUR 53.2 billion).³⁶ Under Horizon 2020, this increased to a little over **EUR 3.5 billion** (almost 5% of the total EUR 70.2 billion budget).³⁷

As can be seen in Figure 2, the number of food-related projects funded increased throughout the FP7 funding period, with a spike in 2012 (one year prior to the end of the programme).³⁸ A decrease can be observed in 2013 and 2014 both in the number of projects funded and the total amount of funding allocated. These years represent the transition period between the two Framework programmes and a lower number of calls for proposals were published because of this.

Figure 2: EU public funding for food-systems related R&I projects, 2007-2020



Source: Ipsos analysis of CORDIS data. Data for 2007 has been excluded as no full year of project data is available. The decrease in the number of projects funded in 2020 is partly due to the fact that 2020 was the final year of Horizon 2020.

³⁶ UK Government (2010), EU Science & Technology Funding, available at: <https://www.parliament.uk/globalassets/documents/post/postpn359-eu-science-funding.pdf>

³⁷ European Commission (2014), Horizon 2020 factsheet, available at : https://ec.europa.eu/programmes/horizon2020/sites/default/files/Factsheet_budget_H2020_0.pdf

³⁸ As funding is allocated using the project start date as reference, this is not unexpected. A smaller number of projects can be expected to have started in the final years of FP7.

The total number of food-systems projects funded and the total amount of funding provided was significantly higher under Horizon 2020 than under FP7.

The average project size, as well as the average amount of EU public funding granted per project, was similar across both programmes. On average, total project costs amounted to approximately EUR 2.6 million under FP7 and EUR 2.5 million under Horizon 2020. The total amount of EU public funding allocated to each project averaged approximately EUR 2 million under FP7 and EUR 2.1 million under H2020.

2.2. Funding instruments

An analysis of the distribution of food systems R&I funding between different instruments under FP7 and Horizon 2020 shows broad similarities between the Framework Programmes, with **food projects more likely to receive collaboration funding rather than funding for individual research projects.**

Under FP7, approximately two thirds (67%) of food systems R&I funding was allocated to collaborative projects (this is higher than the funding awarded to collaborative projects across FP7 as a whole, which represented 58% of total funding)³⁹. In contrast, the European Research Council funding for individual research projects, which accounts for 17% of all funding under FP7, only represents 3% of the funding awarded to food-systems related R&I projects identified within our study.

Under Horizon 2020, there was a slightly broader distribution of funding through the different funding instruments: 39% of relevant funding was awarded to Research and Innovation projects (RIAs) and 32% to innovation actions (IAs). Both RIAs and IAs can be seen as an iteration of the collaborative project funding instrument under FP7, as RIAs fund “research projects tackling clearly defined challenges, which can lead to the development of new knowledge or a new technology” and are open to consortia of industry and academia. IAs fund projects in the same vein, but with technologies which are already closer to market⁴⁰.

Under Horizon 2020, 37% of funding was awarded to RIAs and 21% to IAs. Only 6% of food-systems projects funded under Horizon 2020 were individual research projects funded by the European Research Council, compared to 19% of all projects funded under Horizon 2020.

This indicates that food-systems related projects more often take a collaborative approach, likely reflecting the interdisciplinary nature of food-systems R&I.

³⁹ European Commission (2020), Research and innovation funding, available at: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-a-call/h2020-structure-and-budget_en.htm

⁴⁰ European Commission (2020), Research and innovation funding, available at: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-a-call/h2020-structure-and-budget_en.htm

2.3. Funding programmes

An analysis of the amount of funding for food systems R&I under FP7 and Horizon 2020 shows that these are largely reflective of EU policy priorities with regard to FNS. More detailed information on the allocation of food systems R&I funding for each of the funding programmes is available in Annex D.

2.4. Alignment with the FOOD 2030 priorities

A detailed analysis and categorisation of projects, based on the content of project abstracts shows a relatively even distribution of funding between the four priorities.⁴¹ Most funding (36% of public EU funding, amounting to almost EUR 2 billion) was awarded to projects aiming to foster climate smart and environmentally sustainable food systems, making this the biggest priority in EU food-systems R&I during this time. A little over one quarter of EU public funding was given to food-systems related R&I projects aligned with “circularity and resource efficiency” (27%, EUR 1.4 billion). 22% (EUR 1.2 billion) was awarded to projects aligned with the “nutrition for a sustainable and healthy diet” priority. A little over EUR 783 million of European public funding, accounting for 15% of all relevant funding on food systems, was awarded to projects aligned with the priority “innovation and empowerment of communities”.

The extent to which projects could be viewed as delivering co-benefits was also measured by analysing the extent to which projects aligned with more than one Food 2030 priority.⁴² This accounted for 18% (432) of food-systems related projects. While the number of projects aligned with more than one priority has increased over the years, from approximately 20 per year during FP7 to 35 each year on average under Horizon 2020, the share of projects overall which align with more than one priority has decreased from FP7 to Horizon 2020.

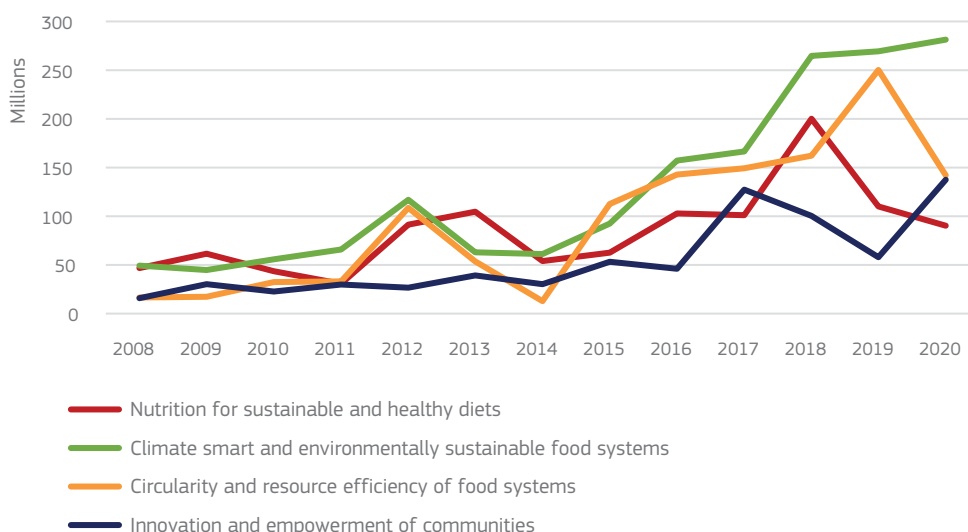
Figure 3 shows trends in food systems R&I funding between 2008 and 2020.⁴³

⁴¹ Differences between this analysis and the previously published Horizon 2020 portfolio analysis in the Food 2030 pathways for action: Research and innovation policy as a driver for sustainable, healthy and inclusive food systems report (European Commission, 2020) are due to methodological differences. These are outlined in detail in the introduction (section 1.8: Evidence Base).

⁴² The rationale for using this definition is described in more detail in the introduction.

⁴³ Data for 2007 has been excluded as no full year of project data is available.

Figure 3: EU public food-systems related R&I funding, per Food 2030 priority, 2008-2020



Source: Ipsos analysis of CORDIS data. Data for 2007 has been excluded as no full year of project data is available.

Throughout this period, **“Climate smart and environmentally sustainable food systems”** has consistently remained the most or second-most funded priority. While there was an increase in funding awarded to food-systems related projects in total, and for projects aligned with each of the four Food 2030 priorities, the amount of funding allocated to projects related to “climate smart and environmentally sustainable food systems” has grown disproportionately in comparison to the other three priorities. **“Climate smart and environmentally sustainable food systems”** received the largest proportion of funding under both FPs, growing from 34% to 37% of total funding respectively.

Projects related to the topic of circularity commanded an increasing share of overall food-systems related funding over the reference period. These trends align with an increased focus on issues such as biowaste and biofuels following the introduction of the Bioeconomy Strategy in 2012⁴⁴ (updated in 2018⁴⁵) which included elements such as

⁴⁴ European Commission (2012), Innovating for Sustainable Growth: A Bioeconomy for Europe, available at: https://ec.europa.eu/research/bioeconomy/pdf/official-strategy_en.pdf

⁴⁵ European Commission (2019), Updated Bioeconomy Strategy 2018, available at: https://knowledge4policy.ec.europa.eu/publication/updated-bioeconomy-strategy-2018_en

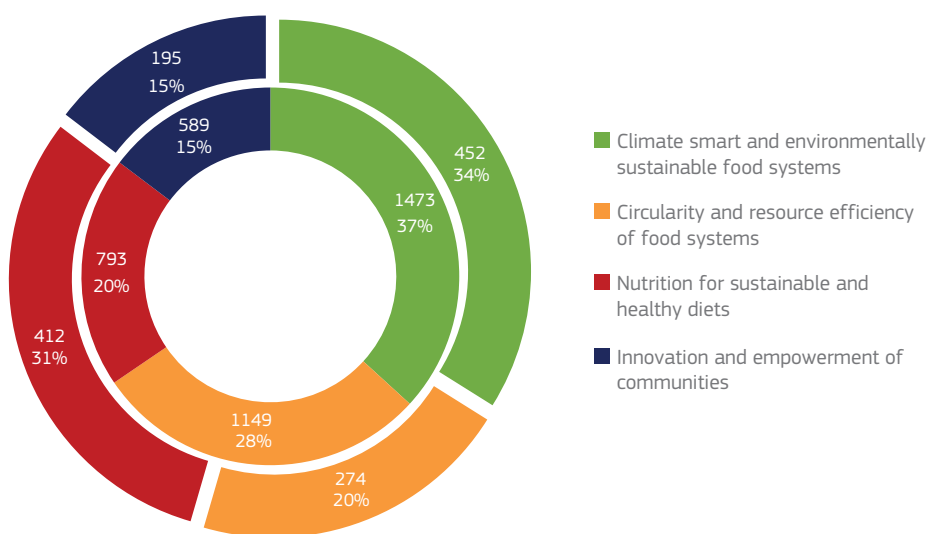
use of crops for biofuels and reuse of agricultural waste products, and on circular economy principles (particularly reducing/reusing waste products and increasing resource efficiency) in the lead up to the EU Circular Economy package in 2015.⁴⁶

In contrast, projects aligned with the Food 2030 priority “Nutrition for sustainable and healthy diets” have received a decreasing share of relevant funding over time, although until 2018 the total amount of funding aligned with this priority continued to increase.

The share of project funding aligned with the Food 2030 priority “Innovation and empowerment of communities” fluctuated over the period analysed without a clear pattern discernible, ranging from 8% to 21% of overall funding.

Figure 4 shows the breakdown of funding per priority under both FP7 and Horizon 2020.

Figure 4: EU public food-system related R&I funding, per Food 2030 priority, under FP7 and Horizon 2020 separately (EUR million, %)



Source: Ipsos analysis of CORDIS data

Inner circle = Horizon 2020; outer circle = FP7 Alignment with the Food 2030 priorities

⁴⁶ European Commission (2015), First circular economy action plan, available at: https://ec.europa.eu/environment/topics/circular-economy/first-circular-economy-action-plan_de

Thematic focus of funding under each priority

In order to gain a more in-depth understanding of the thematic content of the FP7 and H2020 projects aligned with each of the Food 2030 priorities, we conducted a word frequency query using the qualitative analysis tool Nvivo to identify the most commonly cited words and phrases within different project descriptions.⁴⁷ This was combined with an analysis of how projects categorised under each priority map on to the different Food 2030 pathways, to identify any additional alignment. The following results can be noted for each priority:

- **Nutrition for a sustainable and healthy diet (priority one):** This priority appears to focus on projects towards the end of the food value chain, with consumers and markets being key targets of projects funded under this priority. Nutrition and health emerge as two of the key themes, alongside issues such as obesity, wellness, dietary considerations, and proteins. This is reflected in the fact that, of those projects completely aligned with this priority (i.e. not mapped against multiple priorities), a third (33%) map onto the pathway “Healthy, Sustainable and Personalised Nutrition”. A second key theme under this priority is ensuring quality and safety of foods. When analysing how projects align with both Food 2030 priorities and pathways, 36% of projects completely aligned with the priority “nutrition for a sustainable and healthy diet” also map onto the pathway “the food safety system of the future”.
- **Climate smart and environmentally sustainable food system (priority two):** a significant focus under this priority is sustainable agriculture, specifically targeting plants, crops and soil quality. 40% of projects completely aligned with this priority map onto the pathway ‘other’, which mostly includes projects related to sustainable agriculture. Aquaculture also emerges as a significant focus, with 14% of projects under priority two also aligning with the pathway “Food from the Ocean and Freshwater Resources”. Another emerging topic under priority two relates to the use of data and technology, with these two keywords appearing most frequently in the textual analysis and 20% of completely aligned projects mapping onto the pathway “Food Systems and Data”.
- **Circularity and resource efficiency of food systems (priority three):** Packaging and waste are the two most frequently used (stemmed) words appearing in abstracts

⁴⁷ The query was run on all project descriptions of the projects that aligned to a significant degree with one Food 2030 priority (mapped against that priority with at least 0.5).

of projects aligned with priority three.⁴⁸ This finding is supported by a cross-analysis against the Food 2030 pathways: 54% of projects completely aligned with this priority map onto the “Food waste and resource efficiency” pathway, while 10% of projects completely aligned with this priority map onto “the food safety system of the future” pathway. This accounts for a significant number of projects related to improving packaging solutions to prolong shelf-life and reduce the risk of spoilage, which reduces waste while also improving food safety. 16% of aligned projects map onto the pathway “other”, reflecting a significant proportion of projects under this priority which aim to improve the resource efficiency of agriculture, such as more sustainable water and energy use or reducing plastic contamination.

- **Innovation and empowerment of communities (priority four):** This priority is the least defined of the four, which is reflected in the lack of a clear thematic focus when analysing project descriptions. 41% of projects completely aligned with this priority map onto the pathway “governance and systems change”, which focuses on the development of R&I governance as a means to better organise and shape the implementation and governance of science, research and innovation.

2.5. Alignment with the Food 2030 Pathways

Over 50% of food systems funding provided through FP7 and H2020 was allocated to the following four Food 2030 pathways (accounting for between EUR 550 and EUR 750 million per pathway):

- “Food Waste and Resource Efficiency” (15%),
- “Food Systems and Data”⁴⁹ (13%),
- “The Food Safety System of the Future” (13%), and
- “Food from the Oceans and Freshwater Resources” (11%).

This contrasts with the pathways “Urban Food Systems Transformation”, “Food Systems Africa”, “Alternative Proteins and Dietary Shift” and “The Microbiome World”, which each received between 3% and 4% (between EUR 135 and 175 million) of all relevant funding on food systems under FP7 and Horizon 2020.

⁴⁸ Generic words such as ‘project’, ‘process’, and ‘development’ were not considered.

⁴⁹ As outlined in the methodology, this refers to projects relevant to Food Systems and Data

Approximately 19% of projects were assigned to the category “other”. This means that, although they aligned with one or more Food 2030 priorities, they did not fit within any of the definitions assigned to the ten Food 2030 pathways.⁵⁰

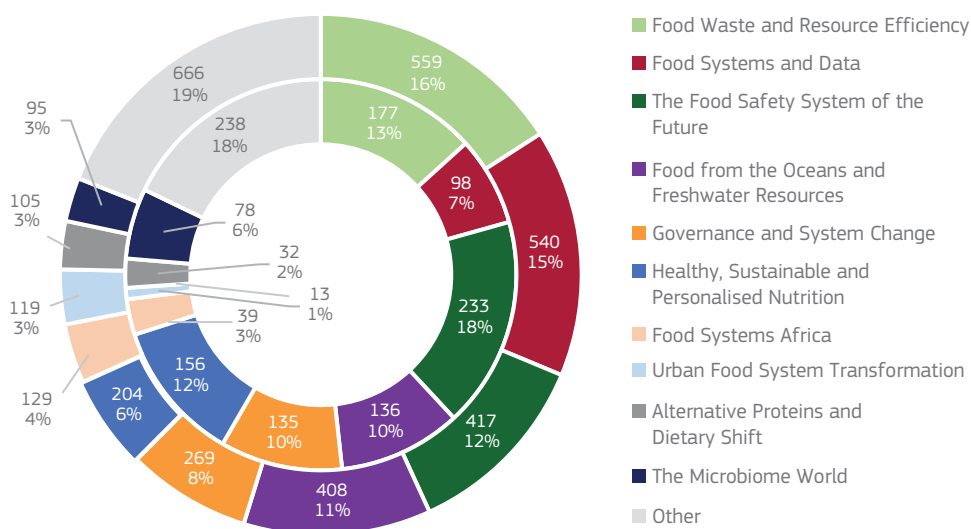
As with the analysis of priorities, the extent to which projects could be viewed as delivering co-benefits was measured by analysing their alignment with more than one Food 2030 pathway. 23% of food-systems related R&I projects were found to align with two or more pathways (20% aligned with two pathways, 3% with three, and four projects - accounting for less than 1% - aligned with four different pathways).

Projects related to urban food systems transformation were most likely to align with two or more pathways (43% of cases, most often aligning with “Governance and Systems Change”). This reflects the place-based rather than thematic scope of this pathway, which lends itself more easily to such co-benefits. The same is applicable to the pathway “Food systems Africa” – 36% of projects aligned with this pathway also align with another pathway, most often with “Food from the Oceans and Freshwater Resources” and “Food Systems and Data”. This likely reflects projects related to future-proofing primary production in Africa. Over one-third (37%) of projects related to “alternative proteins and dietary shift” also aligned with other pathways, most often with “Food from the Oceans and Freshwater Resources”, “Food Waste and Resource Efficiency” and “Personalised Nutrition”.

Figure 5 separates out Horizon 2020 and FP7 projects in order to help identify any shift between the two funding periods. The inner ring of the diagram provides information on the proportion of funding allocated to each pathway under FP7 and the outer ring provides information on the proportion of funding allocated to each pathway under Horizon 2020.

⁵⁰ During the process of mapping all food-system related R&I projects funded under FP7 and Horizon 2020, it became apparent that there were a significant number of projects which were considered relevant within the scope of this study (as per the inclusion/exclusion criteria) and that aligned with one or more Food 2030 priority, but which did not correspond to any of the Food 2030 pathways. These were captured in the category “other” for the purposes of analysing the Food 2030 pathways. Projects classified as “other” most strongly align to the Food 2030 priority of “climate smart and resilient food systems”. This covers projects related to sustainable agriculture such as environmentally friendly pest management, or projects in the realm of biology that aim to breed new climate-resistant crops for example. This is due to the fact that sustainable agriculture per se is not specifically addressed within Food 2030, but rather covered under the DG AGRI strategic approach to agricultural research.

Figure 5: EU public food-system related R&I funding (EUR million, %), per Food 2030 pathway, under FP7 and Horizon 2020 separately



Source: Ipsos analysis of CORDIS data

Inner circle = FP7; outer circle = Horizon 2020 Alignment with the FOOD 2030 Pathways

The ratio of overall EU public funding awarded to projects aligned with each of the Food 2030 pathways remained broadly similar between FP7 and Horizon 2020, with a few noticeable shifts:

- Projects related to **food safety experienced the biggest decrease** in their proportion of overall relevant EU public funding awarded, from 18% to 12%.
- More broadly, there was a **decrease in the proportion of funding awarded to projects related to aspects of nutrition and health** between FP7 and Horizon 2020. Projects aligned with the pathways “The Microbiome World” and “Healthy, Sustainable and Personalised Nutrition” saw their share of overall relevant funding halved. This reflects the decrease in the proportion of funding aligning with the Food 2030 priority “Nutrition for a sustainable and healthy diet”, discussed above.
- Projects related to **food waste and resource efficiency in food systems**, as well as projects related to the **digitalisation of food systems**, on the other hand, **have seen an increase in their share of overall relevant EU public funding**.

These two pathways (“Food waste and resource efficiency” and “Food System and Data”) also map mostly onto the two Food 2030 priorities “Climate smart and environmentally friendly food systems” and “Circularity and Resource efficiency”, which gained in importance from FP7 to Horizon 2020.

A small increase can be noted in the proportion of funding allocated to alternative proteins. This may reflect an increased focus on novel foods in the latter half of the reference period, with an updated Novel Foods Regulation introduced by the European Commission in 2018 to facilitate the introduction of new and novel foods to the EU market.⁵¹

Thematic focus of funding within each pathway

To understand the trends emerging with regard to the types of R&I funded under each of the Food 2030 pathways, we conducted a word frequency query using the qualitative analysis tool Nvivo on the project descriptions.⁵² This was combined with an analysis of the extent to which projects funded under each pathway aligned with the different sectors, in order to better understand any trends in terms of where in the food system funding is being allocated. The following results can be observed:

- **Alternative proteins and dietary shift:** Protein-rich and environmentally friendly food production are key topics under this pathway, for example R&I in plant-based alternative protein sources. A relatively large number of projects appear to target animal feed, with this being the fourth-most mentioned name in project descriptions associated with this pathway. This includes for example projects discussing the use of insects as animal feed, or projects aiming to improve the potential of aquaculture as a source of protein-rich animal feed. When analysing the distribution of funding aligned with this pathway across sectors, this variety can be seen in the fact that primary production, food processing and food system waste streams all command over 20% of the overall share, and cross-sector projects were awarded 13% of relevant funding.
- **Urban food systems transformation:** While, as the pathway title suggests, projects under this pathway aim to change food systems in cities, analysis of the project descriptions does not allow for clear trends to be discerned – almost half (47%) of funding under this pathway was awarded to cross-sectoral projects. The

⁵¹ More information on the 2018 Novel Foods Regulation, which replaced and repealed the previous 1997 Regulation, is available at: https://ec.europa.eu/food/safety/novel-food/legislation_en

⁵² The query was run on all project descriptions of the projects that aligned to a significant degree with one Food 2030 priority (mapped against that priority with at least 0.5).

key words that appear most often that might give indication as to what type of projects are being funded are “waste” – projects aiming to improve urban food waste cycles – and “chains” in combination with “local” and “regional” –referring to projects seeking to shorten supply chains. This is largely because the place-based focus on transforming food systems in town and cities began only in 2019 calls for proposals. 40% of projects aligned with this pathway began in 2019 or after. Only 8 (16%) of projects related to urban food systems transformation were funded under FP7, and no projects were funded before 2010. The uptick under Horizon 2020 and (specifically after 2015) coincides with the 2015 Milan World Expo that prompted the launch of Food 2030 and which catalysed a number of initiatives especially in the realm of cities as new and determining actors in the pursuit of more healthy, sustainable, and climate friendly food systems.

- **The food safety system of the future:** As mentioned above, a relatively large number of projects under FP7 and Horizon 2020 related to the topic of food safety. Several trends emerge from the word frequency analysis. Using technology to improve detection of contamination of foods, but also the contamination of soils and water at the first stage of food production, are key subjects of interest, with 32% of funding under this pathway targeting the healthy people sector and 23% the primary production sector. Furthermore, a significant number of projects (accounting for 22% of relevant funding) were funded investigating improved packaging solutions to prolong shelf-life and stop the risk of spoilage and contamination.
- **The microbiome world:** Projects using the potential of the microbiome to improve food systems from the perspective of sustainability and nutritional quality focus on two key areas. The first is the human gut and nutritional aspects to improve gut health, which is the key focus under this pathway. This is reflected in the fact that two-thirds of project funding are in the healthy people sector. The microbiome within soils, plants and animals to improve food production is another area of focus, and 20% of project funding aligned with this pathway was allocated to the primary production sector.
- **Healthy, sustainable and personalised nutrition:** projects under this pathway focus on nutrition and diet to tackle a number of issues. The most frequent issue raised in project descriptions is obesity. Diabetes and aging are two other key issues addressed by projects aligned with this pathway, alongside more general prevention of diseases and supporting health. Functional foods, targeting specific sub-populations (namely infants/children and the elderly) is another area targeted by projects funded under this pathway.

- **Food waste and resource efficiency:** Packaging makes up the bulk of projects funded under this pathway, with one third of funding allocated to the food processing sector (which includes packaging). This includes a large share of projects aiming to find improved materials for packaging solutions, to prolong shelf-life and reduce spoilage and thus food waste, as well as the development of biodegradable packaging solutions. Other detectable trends include efficiency improvements in water and energy use (in the food production sector) and projects aiming to boost recycling within the food chain (circular economy).
- **Food systems Africa:** The majority of projects under this pathway target the first stage of the food value chain, i.e. primary production. The word frequency analysis identifies some key trends, namely protecting ecosystems and adapting primary production to climate change. Other projects focus on fostering integration between different R&I stakeholders (e.g. creating networking and training opportunities for smallholder farmers or fostering connections between universities and other research institutions in Africa and European countries). These trends align with the Joint Africa – EU Strategy and its associated African Union –European Union High Level Policy Dialogue (HLPD), adopted in 2016, which identified food and nutrition security and sustainable agriculture as a key priority area for joint research and innovation activity.⁵³ Additionally, in 2018 the Development of Smart Innovation through Research in Agriculture (DeSIRA) initiative and the Task Force Rural Africa (TFRA) were launched, further manifesting the focus on food and nutrition security through innovation in (sustainable) primary production.
- **Food from the ocean and freshwater sources:** Several topics emerge when analysing the projects funded under this pathway. One strand of projects considered the impact of fisheries and aquaculture on the environment, addressing concerns such as depleted fish stocks and negative impacts of aquaculture on marine ecosystems. As with alternative proteins, using fish as feed (for livestock production) was another area of interest. A number of projects focused on aspects related to consumption and nutritional aspects, for example through increasing the proportion of fish and other products of the aquaculture sector (such as algae) in the human diet. R&I under this pathway focused more on the fisheries sector itself (i.e. optimising and improving sustainability of the primary production of fish and other aquaculture products) than changes in the use of the outputs from the sector. This is reflected in the fact that almost three quarters (74%) of funding aligned with this pathway are targeting R&I in the primary production sector.

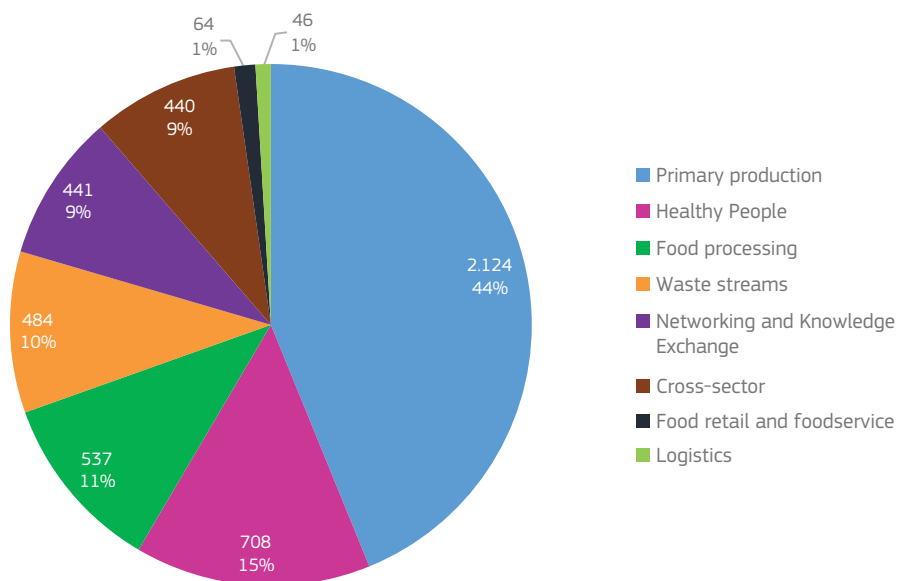
⁵³ More information available at: https://knowledge4policy.ec.europa.eu/publication/eu-africa-research-innovation-partnership-food-nutrition-security-sustainable_en

- **Governance and systems change:** True to the nature of this pathway, terms such as ‘regions’, ‘stakeholders’, ‘community’, ‘network’ and ‘policy’ are frequently mentioned, but no clear thematic focus emerges. The only exception to this rule is agriculture, with 22% of project funding under this pathway targeting the primary production sector. Such projects often aimed to find ways of supporting and strengthening the sector through upheavals, given its importance to rural areas and thus regional cohesion. Almost half (49%) of project funding under this pathway is classified as network and knowledge exchange projects, which includes projects seeking to build institutional capacity in different countries or regions. Issues related to governance and systems change only really began towards the end of Horizon 2020 (for example via the Fit4Food project) as a result of the Food 2030 framing.
- **Food systems and data:** R&I projects relevant to this pathway demonstrate a focus on a couple of key areas. One of these is the use of data and technology in agriculture, to improve efficiency (and by extension optimise resource use) in production. Precision farming, automation through use of robots, and improved monitoring of crops, soil or water through sensors are several examples of this. 78% of funding between 2007 and 2020 aligned with this pathway was in the primary production sector. This appears to have increased over time, with 82% of projects aligned with this pathway under Horizon 2020 being in the primary production sector. Another area of focus is the use of technology (especially sensors) to improve monitoring and control of food safety and food quality.

2.6. Funding in different sectors

Figure 6 provides an overview of the proportion of funding under FP7 and H2020 allocated to the different sectors identified within the Food 2030 initiative. The majority (44%) of food-systems-related EU R&I funding between 2007 and 2020, totalling more than EUR 2.1 billion, was allocated to projects in the primary production sector. At the other end of the spectrum, only 1% of relevant EU funding went to projects in the logistics sector (EUR 45.8 million) and the food retail and foodservice sector (EUR 63.6 million).

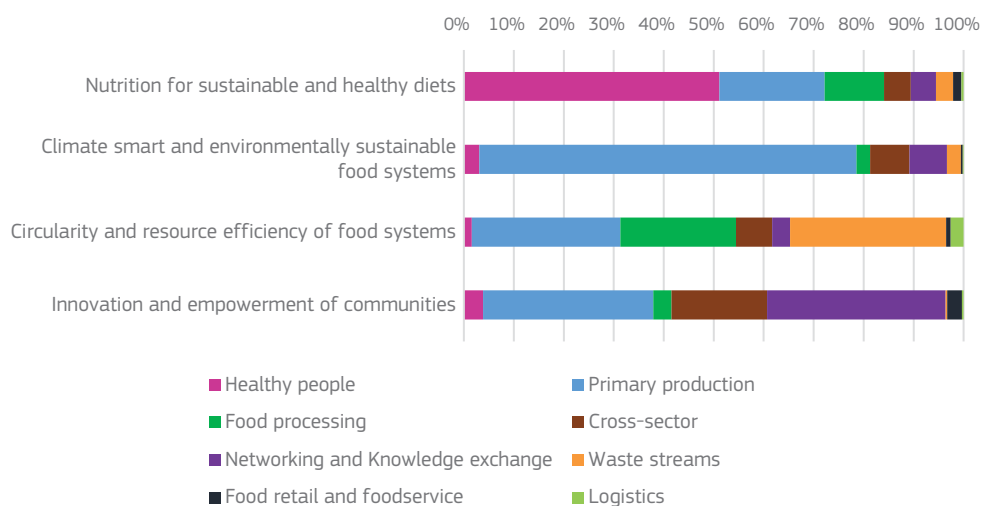
Figure 6: EU public food-system related R&I funding (in million EUR), per sector, under FP7 and Horizon 2020 (EUR million, %)



Source: Ipsos analysis of CORDIS data

To gain a better understanding of how funding allocated to each of the Food 2030 priorities is distributed along the food value chain, an analysis was also undertaken to identify the main sectoral focus for the different projects under each Food 2030 priority. Figure 7 provides an overview of the distribution of project funding (in FP7 and Horizon 2020 combined) across the different sectors for projects funded in alignment with each of the Food 2030 priorities.

Figure 7: EU public food-system related R&I funding, alignment of Food 2030 priorities and sectors, under FP7 and Horizon 2020⁵⁴



Source: Ipsos analysis of CORDIS data

A number of key pairings emerge from Figure 7:

- While EU-funded R&I projects in the primary production sector make up a significant proportion of the overall funding across all four Food 2030 priorities, **primary production is most strongly aligned with the second Food 2030 priority “Climate smart and sustainable food systems”** accounting for 75% of all projects under this priority.
- **Over half (51%) of all project funding related to nutrition for a sustainable and healthy diet can be traced to “healthy people” (which covers consumption patterns).** This priority exhibits a clear focus on health and targets the consumption rather than the production of food.
- **Projects in the food processing sector are most heavily aligned with the priorities “Circularity and resource efficiency” (where almost one quarter of all project funding was channelled to the food processing sector) and “Nutrition for a sustainable and healthy diet”.** As packaging is included within

⁵⁴ Values below 5% not displayed.

the food processing sector, this can be explained by two trends identified under the discussion of priorities above: projects which reduce packaging waste (circularity and resources efficiency); and projects aiming to improve packaging in order to increase food safety (nutrition for a sustainable and healthy diet).

- **Projects in the waste stream sector received the majority of EU public food-systems related R&I funding aligned with the priority “Circularity and resource efficiency” (31%).** Given the focus of this priority on minimising, valorising, recycling and upcycling food systems waste, this seems a natural fit.
- **A large proportion (36%) of funding aligned with the priority “Innovation and Empowerment of Communities” was targeted at projects in the networking and knowledge exchange sector,** including projects aiming to build research capacity and projects bringing together different stakeholders from across the R&I spectrum.

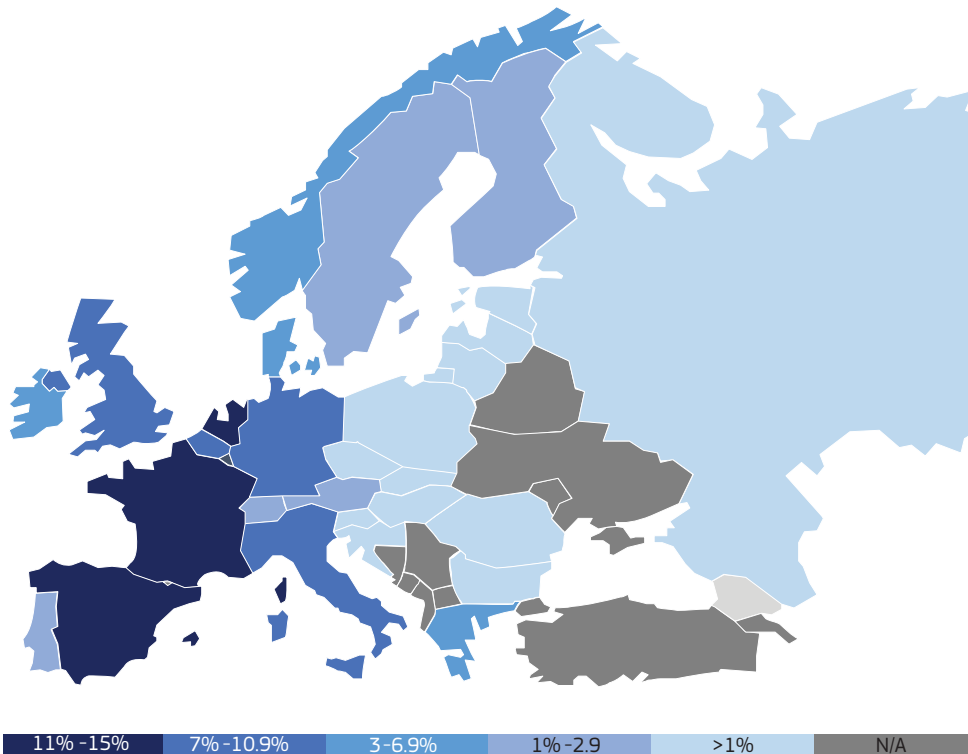
2.7. Funding in different Member States

Finally, our analysis of EU funding considers the extent to which EU funding was concentrated within different Member States. Figure 8 below demonstrates the geographical spread of EU R&I funding for food systems under both FP7 and Horizon 2020, considering the country of a project’s coordinator. Spanish entities received the most EU public food-systems related R&I funding with EUR 707 million (15% of relevant funding) over the 2007-2020 period. This is followed by coordinators from France (EUR 561.5 million, 12%), and the Netherlands (a little under EUR 546.0 million, 11%). Compared to the overall share of funding under the two framework programmes (12% for France, 10% for Spain and 8% for the Netherlands), factors such as the pre-existing R&I infrastructure (universities and research centres, skills available and other funding streams) and the availability of national R&I funding likely play a role in explaining these differences. However underlying these structural drivers, food systems research might also be a more prominent area of research in some countries.

The EU Member state receiving the least food-systems related R&I funding was Lithuania, with only EUR 300,000 of project funding related to food-systems being awarded under FP7 and Horizon 2020 (0.01% of all relevant funding). Romania also received less than one million (EUR 680,500, or 0.01%) of relevant project funding. Latvia (EUR 1.4 million), Slovakia (EUR 2.5 million), Hungary (EUR 2.7 million) and Luxembourg (EUR 4 million) each received less than 1% of total food-systems related funding awarded under FP7 and

Horizon 2020. This reflects the overall share of funding received by these countries under the two framework programmes.

Figure 8: Distribution of EU food-systems related R&I funding



Source: Ipsos analysis of CORDIS data

3. NATIONAL FUNDING FOR FOOD SYSTEMS R&I

This section presents the main findings from the **mapping of national public sector R&I funding in all 27 EU Member states** undertaken as part of this study. The national research comprised a qualitative mapping of national policies and priorities related to food systems R&I as well as more granular data collection, looking at the amount of funding provided to food-related R&I projects during the reference period (2007-2020). For the qualitative mapping of the national policy context, analysis was completed for all 27 EU Member States. This was used to carry out a cross-country comparison of the policy and strategic framework for food-related R&I within each country. Granular data on public funding for food-related R&I, allowing a comparative analysis, was available in 26 countries.⁵⁵ The more detailed analysis provides information on levels of public funding and alignment with Food 2030 priorities and pathways.⁵⁶

Headline findings

- **Twelve Member States have specific policies or initiatives** in place to develop food and agriculture related R&I. An additional twelve countries include references to food and agriculture in their broader R&I strategies. The majority of food R&I policies have been introduced since 2016.
- Responsibilities for food systems R&I are divided between the **Ministry of Education, Research and Science and the Ministry of Agriculture**, with the Ministry of Economy also playing an important role in some countries. In most cases, the Ministry of Agriculture is the primary funder of food systems R&I.
- The majority of funding is **consistently allocated to primary production, which accounts for almost two-thirds (63%)** of overall spend across the EU Member States. Czechia and the Netherlands were notable exceptions to this rule: in both cases, the most common Food 2030 sector related to healthy people.
- **Food retail and foodservices together with networking and knowledge exchange** were the sectors with the **lowest level of spend**, accounting for 1% and less than 1% respectively of the total funding identified.

⁵⁵ No data was available for Greece on public funding of food-related R&I projects.

⁵⁶ Analysis of the EU Structural Funds was not included in this research, as it was not within the scope of this particular project. A high-level analysis of the amounts of money allocated to food systems R&I is included in the national reports, however, where this information was collected through desk research.

- The majority of relevant public funding identified at national level aligned with Food 2030 priority two: **“climate smart and environmentally sustainable food systems” (36%** of all funding identified), followed by priority one **“nutrition for sustainable and healthy diets” (23%** of all funding identified) and priority three **“circularity and resource efficiency” (16%)**. Priority four **“innovation and empowerment of communities” received just 7%** of all funding identified at national level, suggesting a potential gap. 17% of the funding aligned with more than one priority, and 1% was classified as “other”.
- Almost a third (**32%**) of the expenditure did not align with Food 2030 pathways and was classified as “other”. Approximately **24%** of public R&I funding on food systems in the countries for which funding was available corresponded to **“the food safety system of the future”** pathway, followed by “healthy, sustainable and personalised nutrition” (9%), “food waste and resource efficiency” (8%) and “food systems and data” (6%). The remaining 21% of the expenditure was almost equally split among the other pathways.

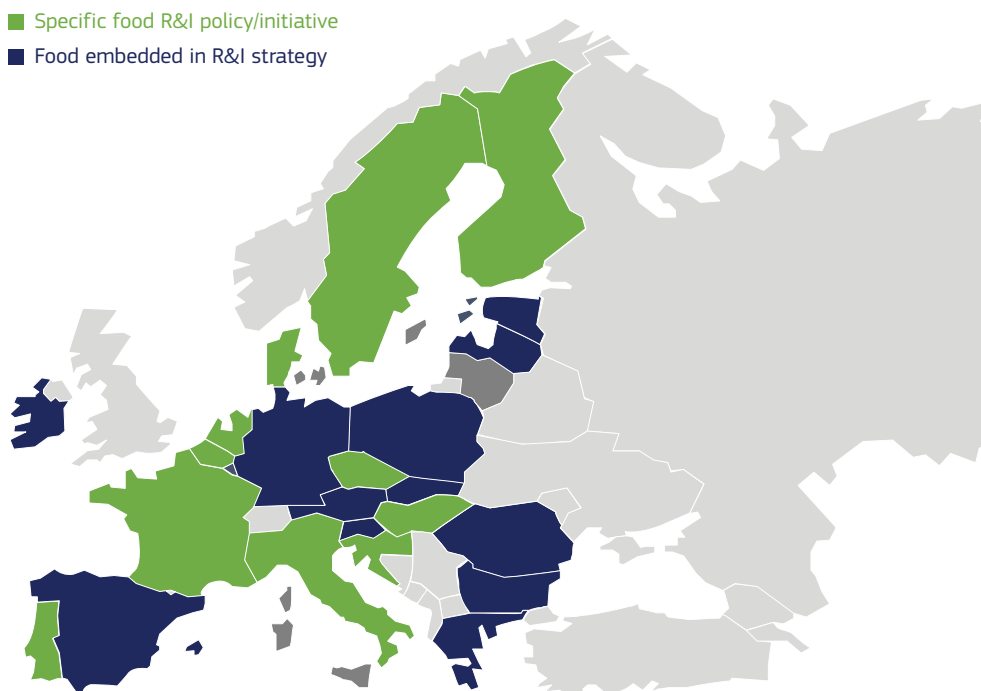
3.1. Policy context at national level

Of the 27 countries, twelve have specific policies or initiatives in place to develop food and agriculture related R&I, as illustrated in Figure 9.⁵⁷ In three countries⁵⁸, the strategies are related to the agriculture sector and in one country (Belgium) the initiative is at regional level.

⁵⁷ Belgium ([Good Food Strategy](#)), Croatia ([NARDS](#)), Czechia ([Concept Ministry of Agriculture 2016-2022](#)), Denmark ([Green Solutions for the Future](#)), Finland ([Food R&I strategy for Finland](#)), France ([Agriculture innovation 2025](#)), Hungary ([Medium- and Long-term Development Strategy for the Food Industry 2014-2020](#)), Italy ([Strategic Plan for Innovation and Research in the agricultural, food and forestry sectors 2014-2020](#)), Lithuania ([Programme for Research and Experimental Development of Agriculture, Food, Fisheries and Rural Development](#)), Netherlands ([TKI Agri&Food innovation agenda](#)), Portugal ([Agenda for Innovation in Agriculture 2020-2030](#)), Sweden ([Food research programme](#)).

⁵⁸ Czechia, France, Portugal.

Figure 9: Countries with R&I policies or initiatives related to food systems



Source: Ipsos analysis of 27 Member States policies⁵⁹

A review of national research and innovation strategies in the 27 EU Member States⁶⁰ shows that most have **embedded R&I ambitions related to food in their latest national innovation strategies**, either as a specific policy goal (Austria, Bulgaria, Germany, Ireland) or as part of a broader ambition to address societal challenges through a transformation of the food sector, often alongside the biodiversity and forestry sectors (Latvia, the Netherlands, Poland, Portugal, Romania, Spain, Sweden). This is a very recent development, however, and was not the case for most of the study reference period. Finland had already included food and agricultural R&I in two strategies published in 2010⁶¹. Most countries, however, only introduced it as an explicit objective since the introduction of Food 2030 in

⁵⁹ For information on specific sources, see Annex F.

⁶⁰ Summary of findings from 27 country reports included in Annex F. The research informing the country reports included desk research and interviews with national stakeholders, conducted in the relevant languages.

⁶¹ Tomorrow's Food – National Food Strategy Proposal (2010); Government report on food policy (2010).

2016 (in most cases, food R&I strategies were published after 2018). Six countries⁶² have explicitly embedded food R&I within their smart specialisation strategies, as exemplified by the Polish National Smart Specialisation Strategy (see case study overleaf).

National food policies, on the other hand, are marked by a **lack of explicit references to R&I**. Some exceptions are: Sweden, which references knowledge and innovation as one of the three main goals of its food policy; Hungary, with a national food chain safety strategy which contains a R&I focus to develop partnerships among stakeholders in the field; and Romania, where the strategy for the development of the agri-food sector aims to reorganise the R&I system in the sector by 2030.

The identified food-related R&I policies are⁶³:

- **Croatia's** National Agriculture Knowledge and Innovation System (AKIS), which consists of farmers, advisors, consultants, researchers, farmer's organisations, NGOs, networks, retailers, the media, services, public institutions, and ministries. This initiative seeks to strengthen the links between the research community and farmers.⁶⁴
- In **Denmark**, the government launched in late 2020 the Green Solutions of the Future – Strategy for investment in green research, technology, and innovation, which includes as one of its four priorities climate and environment-friendly agriculture and food production.⁶⁵
- **Hungary's** Medium- and Long-term Development Strategy for the Food Industry (2014-2020) served as a guide for the MoA and the Government to develop and implement measures for the entire food industry chain. The Strategy also set out an objective for R&I development through supporting technology and knowledge transfer and supporting innovation in SMEs.⁶⁶

⁶² Cyprus, Estonia, Greece, Italy, Poland, Slovakia.

⁶³ For more information on each of the strategies mentioned here, please refer to the relevant country report in Annex F.

⁶⁴ Croatia ([NARDS](#))

⁶⁵ Denmark ([Green Solutions for the Future](#))

⁶⁶ Hungary ([Medium- and Long-term Development Strategy for the Food Industry 2014-2020](#))

- In **Finland**, R&I strategic objectives related to the food sector in the period under consideration are mainly outlined in the Ministry of Agriculture and Forestry research strategy 2017–2022, and for the period 2021–2035, the Food R&I Strategy for Finland.⁶⁷
- The **Dutch** TKI Agri&Food innovation agenda (covering the period 2016–2019), which focuses on funding in research and innovation that meet the main goals for the agri-food sector.⁶⁸
- **Belgium** also has specific food strategies as part of the regional innovation plans and reform plans. An example is the Brussels Capital Region’s “Good Food Strategy – towards a sustainable food system”.⁶⁹
- In **Sweden**, Knowledge and Innovation is one of the three strategic areas of the National Food Policy.⁷⁰
- In **Italy**, the main policy is the Strategic Plan for Innovation and Research in the agricultural, food and forestry sectors 2014–2020. Other recent initiatives with a more holistic and integral approach to food national strategies are the National Technology Agri-Food Cluster (C.L.A.N), where a network of different stakeholders of the agri-food chain (such as companies and research centres) promote R&I in industry through platforms on technology for food safety, sustainability of food chain, and promotion of consumer health.⁷¹
- **Lithuania** has a Programme for Research and Experimental Development of Agriculture, Food, Fisheries and Rural Development.⁷²

In three countries, the strategies or initiatives on R&I refer to the agriculture sector:

- **Czechia:** Vision for research, development and innovation in the agriculture sector is instead outlined in a Concept of the Ministry of Agriculture 2016–2022, where the key aim is “support for innovative agriculture and forestry through advanced

⁶⁷ Finland ([Food R&I strategy for Finland](#))

⁶⁸ Netherlands ([TKI Agri&Food innovation agenda](#))

⁶⁹ Belgium ([Good Food Strategy](#))

⁷⁰ Sweden ([Food research programme](#))

⁷¹ Italy ([Strategic Plan for Innovation and Research in the agricultural, food and forestry sectors 2014–2020](#))

⁷² Lithuania ([Programme for Research and Experimental Development of Agriculture, Food, Fisheries and Rural Development](#))

procedures and technologies” and one of the three key areas is sustainable food production.⁷³

- **France:** in 2016 the government launched the plan “Agriculture Innovation 2025”.⁷⁴
- **Portugal:** Agenda for Innovation in Agriculture 2020-2030 is the Portuguese strategy for meeting the national challenges in the agri-food sector for the current decade.⁷⁵

In terms of specific policy goals, some countries targeted a particular sector (e.g. the waste sector in Sweden and Luxembourg; Spain’s Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas). However, in most cases, food R&I strategies are cross-cutting, bringing together a variety of different actors from different sectors.

The case studies overleaf provide a more detailed review of two specific national strategies. The case of Poland exemplifies the incorporation of food systems R&I into a smart specialisation strategy, while Spain provides a good example of a sector-specific strategy.

⁷³ [Czechia \(Concept Ministry of Agriculture 2016-2022\)](#)

⁷⁴ [France \(Agriculture innovation 2025\)](#)

⁷⁵ [Portugal \(Agenda for Innovation in Agriculture 2020-2030\)](#)

Case study: Polish National Smart Specialisation Strategy (NSSS)

Context

Smart specialisations⁷⁶ combine industrial, education, and innovation policies to target priority areas for investment with national comparative advantages. The Polish National Smart Specialisation Strategy 2014-2020 (NSSS) was developed considering the country's National Research Programme and InSight2030. The National Research Programme included an R&I focus on environment, agriculture, and forestry, whereas InSight2030 covered industrial biotechnologies. The NSSS aims to allow Poland to execute a more targeted growth policy focused on strategic national economic sectors. It has the objective of building an innovation culture, increasing public and private R&D expenditure, fostering cooperation between enterprises and science, increasing risk acceptance and upgrading human resources, in line with the identified priorities.

The NSSS is coordinated by the Ministry of Economy, Ministry of Science and Higher Education and Ministry of Infrastructure and Development. It is implemented by the Ministry of Economy and the Polish Agency for Enterprise Development (PAED), with the Ministry of Science and National Centre for Research and Development (NCRD). Monitoring and Evaluation is provided by the Ministry of Economy in cooperation with PAED. The NSSS is an integral part of the Enterprise Development Programme, with implementation provided through selected national programmes and EU funds.

Description of National Smart Specialisation Strategy

The NSSS was developed by engaging with entrepreneurs and scientists, government administrators, and representatives of business, science and government to identify areas of innovation and competitiveness for Poland. The NSSS priorities were defined through analyses of existing Polish R&D&I support programmes, followed by a SWOT analysis and meetings with socio-economic partners to arrive at a list of smart specialisations at the national level. In terms of food systems, the main focus of the NSSS is on innovative technologies, processes and products of the agri-food and forestry-timber industry, healthy food, biotechnological processes, and chemistry and environmental engineering.

Of the 15 priority areas covered by the NSSS seven reference food system innovation. There are also a number of regional specialisations – including safe food, high-quality food, innovative agriculture and healthy food, depending on the region.

⁷⁶ The smart specialisation strategy is part of the European Commission's Cohesion Policy. Further information at: <https://s3platform.jrc.ec.europa.eu/what-we-do>.

Impacts

172 projects (with an EU contribution of EUR 29.3 million) on food R&I in Poland have been funded by the European Structural and Investment Funds, through national and regional Operational Programmes (OP) such as OP Smart Growth, OP Development of Eastern Poland and Regional OP for Warmińsko-Mazurskie Voivodeship. These R&I projects are aligned with the food system priorities defined in the NSSS.

Lessons Learned

The allocation of a large number of food system related national priorities in the NSSS has opened the way for R&D&I activities and financing opportunities. These have contributed to innovative solutions for food system issues.

Case study: Spanish Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas

The Spanish Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas (“the Strategy”) is an example of a targeted approach to innovation in the food sector, focusing on the transformative potential of digital technologies. It aims to transform one of Spain’s most important and most conservative economic sectors to take advantage of the benefits associated with digitalisation, such as increasing the quality and quantity of food produced, and optimising production. The Strategy recognises two driving forces for change: the availability of affordable and reliable technologies in the agri-food sector, and the possibility of adapting existing technologies to the sector.

Context

The development of previous initiatives by the Ministry of Agriculture, Fisheries and Food (Ministerio de Agricultura, Pesca y Alimentación, MAPA) and other actors prompted the creation of the Strategy. Following the EIP model, MAPA created a Focus Group on Digitisation and Big Data for the Agri-Food and Forestry Sector and Rural Areas in order to explore innovative solutions to digitalisation challenges and opportunities in the agri-food sector. The Focus Group established 8 challenges for the digitisation of the agri-food sector, including the digital gap, rural depopulation or improvement of the production process - which served as a basis for the drafting of the Strategy.

Description of the Strategy

The general objective of the Strategy is to seek the elimination of technical, legislative, economic and training barriers to the digitisation of the agri-food sector, improving its economic, social and environmental sustainability, with the ultimate aim of a more attractive, lively, dynamic and diversified rural environment. The Strategy describes 27 measures and actions to achieve this goal, organised around three specific objectives:

- Reduce the digital gap, both the urban-rural gap and the gap between small and large companies, pursuing connectivity for all
- Promote the use of data as a driving force for the sector, addressing the interoperability of sector data and the opening up of data, both by the Administration and in the field of research and the private sector.
- Promote business development and new business models, considering both Industry 4.0 and the opportunities for economic diversification offered by new technologies.

Expected Impacts

The Observatory for the Digitalisation of the agri-food, forestry and rural sector has been set up to become the reference centre for the analysis and monitoring of the digitisation of the agri-food and forestry sector and rural environment in the country. Among its powers, the Observatory will be able to monitor progress (via indicators, reports, and studies), the development of the digital agri-food technological business ecosystem, relevant public policies implemented and any challenges which arise. Among the impacts foreseen in the Strategy, the most relevant for the agri-food sector include improved productivity, enhanced R&I levels, increased participation in R&I programmes, higher adoption of digitalisation in agri-food companies, and a strengthened digital innovation ecosystem.

3.2. Main R&I stakeholders

Funding organisations

A relatively consistent picture is emerging across all Member States of a division of responsibilities for food-related R&I between the **Ministry of Education, Research and Science** and the **Ministry of Agriculture**, with the Ministry of Economy also playing an important role in countries such as Bulgaria, Croatia, Latvia and Spain (usually with regard to funding activities which are closer to market). Nine countries⁷⁷ distribute food-related research funding through research and innovation agencies, which often operate under the remit of the relevant ministries. However, there are cases⁷⁸ where there is limited evidence of strong collaboration between the different Ministries and/or their associated Agencies when it comes to sharing data on research funded or deciding on funding priorities. This means that, in many cases, provision of food systems R&I is delivered in a fragmented way with different funding organisations acting effectively in siloes. This might cause difficulties in terms of ownership for food policy (and food systems R&I specifically), with no one institution holding a complete picture of what is being funded and how R&I is contributing to national food policy. In concrete terms, it often means that overall levels of funding for food systems R&I are not being captured, and that the impacts of funding food systems R&I on outcomes related to strategic policy objectives at EU level such as FNS are not being systematically captured.

Funding recipients

In 16 countries, more than half of recipients of food-related national R&I funding **are public higher education institutions (both for research and applied sciences) and independent research institutes**. This implies that public funding available for food-systems R&I is being directed towards basic research rather than later stage innovation. This finding may be a result of the main sources of food-related R&I funding being Ministries with closer links to research, and limited funding or no funding being provided by the Ministry of Economy or its equivalent (which tends to be responsible for later-stage innovation).

This finding may also reflect a data gap around funding available for later-stage innovation (which would be expected to be targeted towards industry). Anecdotal evidence from the

⁷⁷ Belgium (VLAIO), Bulgaria (SMEPEA), Czechia (CRDI), France (ANR, INRA), Netherlands (NWO,RVO), Poland (NCBR, ARiMR), Slovakia (SRDA, VEGA), Spain (AEI, CDTI), Sweden (Formas, VINNOVA, VR, Forte).

⁷⁸ And specifically in Belgium, Croatia, Hungary and the Netherlands.

Ministry of Economy and/or innovation agencies working with them in interviews and correspondence with our study team stated that they did not fund food systems R&I and were therefore unable to provide data for this study. Feedback from interviews at national level highlighted a lack of focus on specific food R&I funding within the Ministry of Economy (or equivalent), which meant that although funding provided via more general funding calls or instruments may have funded some food-related projects, there was limited information available with regard to how much funding had been provided or for how many projects.

This was not the case in all countries, however: Denmark, Spain and Malta allocated more than half of public funding for food systems to the private sector, while the Netherlands granted funding for projects to be performed by public-private partnerships through its “Topsector” approach, usually a firm and a university research institute. At the heart of the Topsector approach lie nine key sectors with strategic importance for the Dutch economy, with the aim of enterprises and knowledge institutes working together with the government to strengthen their innovation systems, competitiveness and address societal challenges through the Top Consortia for Knowledge and Innovation (TKIs).

In support of a more integrated approach to food systems R&I, since 2018 there have been initiatives to address fragmentation within the food system and develop more holistic approaches to food policy at national level. One example of this is the Luxembourg Food Policy Council (2018), which is described in more detail overleaf. The German Sustainability Strategy (DNS) in its recent 2020 iteration, also acknowledges the need for a holistic approach to food systems.

Case study: Food Policy Council, Luxembourg

Food Policy Councils (FPCs) are useful collaborative tools to achieve set policy goals. They have become increasingly popular in European cities and regions over the past decade. Since 2018-2019, Luxembourg initiated efforts to create its first-ever FPC at a national level, in order to satisfy the Luxembourg's Accord de Coalition 2018-2023, which calls for the establishment of a multi-stakeholder organism to promote closer links between agriculture and civil society.

Context

Luxembourg's FPC is managed by University of Luxembourg (UL) and the Ministry of Environment, Climate and Sustainable Development (MECDD) of Luxembourg. It was designed and will be implemented in order to address the lack of a nationwide, transformative multistakeholder food systems tool based on consensus and co-creation.

Description of the Luxembourg Food Policy Council

The national FPC in Luxembourg was started in 2018-2019 by Dr. Rachel Reckinger (University of Luxembourg - UL) and Dr. Norry Schneider (Centre for Ecological Learning Luxembourg – CELL) with the involvement of relevant Government Ministries. During the ideation phase, between 2019 and 2020, they engaged with food system stakeholders from Luxembourg's Ministry of Agriculture, Viticulture and Rural Development and collected the views of different food system stakeholders'.

The principal aims of creating a national FPC in Luxembourg are to provide:

A platform on which the national actors and stakeholders in food supply can give voice to their interests and beliefs;

A participatory think tank with all stakeholders in the food system, including from the administration and political sectors;

An initiator of innovations in the food system with the goal of optimising food supply.

As a political tool, the FPC stands out for its participative approach, diversity and local adaptability. The participation of stakeholders is expected to come from three main fields of the food system, with each of them forming one-third of the FPC: (1) Production, transformation and retail; (2) Policy and administration; and (3) Research & civil society.

Individual representatives of these three fields are selected according to their level of innovation and collaboration.

Expected impacts

The FPC will contribute towards the democratisation of policy making in the area of food systems, and integrate sustainability and resilience concepts into the political agenda. Improved innovation is also expected. It aims to result in the co-creation of a more socially and environmentally just, economically sound, and high-quality food system.

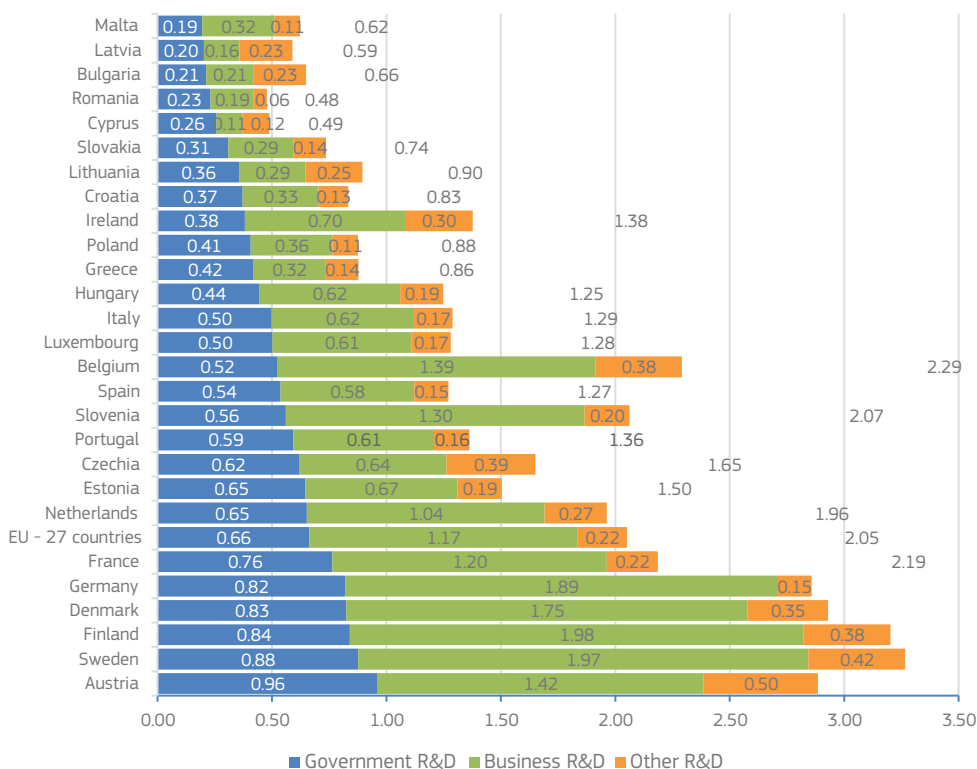
Lessons Learned

A collaborative initiative such as the Food Policy Council could be replicated in other countries and may be a useful tool in diving democratisation of food systems, creating a bridge between civil society and policymakers. However, in Luxembourg there remain obstacles relating to collaboration from different Ministries. For example, the Ministry of Agriculture, Viticulture and Rural Development recently published a bill establishing a system of food democracy at the national level without involving the Council.

3.3. Public funding available for food-related R&I

Figure 10 illustrates the level of overall government expenditure in R&I as a percentage of GDP in each of the 27 EU Member States, as well as business and other (higher education, private non-profit) R&I expenditure. This provides a useful point of reference to understand the extent of food-related R&I funding in the context of overall innovative activity in each country. Six countries have higher than average R&I government expenditure as a percentage of GDP, with the top three being Austria, Sweden and Finland. The governments of twelve countries (Hungary, Greece, Poland, Ireland, Croatia, Lithuania, Slovakia, Cyprus, Romania, Bulgaria, Latvia, Malta) spend less than 0.5% percent of GDP on R&I activity on average. Of these, ten spend less than 1% of GDP on overall R&I. Ireland and Hungary's overall R&I expenditure is slightly higher, at 1.4% and 1.3% of GDP respectively.

Figure 10: R&I expenditure as a percentage of GDP, average 2007-2019



Base: 27 EU Member States.

Source: Eurostat, GERD by sector of performance and source of funds (rd_e_gerdfund)

In terms of food-related R&I spend, an analysis of available data in 26 countries shows an estimated aggregate total of **EUR 5.5 billion** of public spend on food systems R&I at national level between 2007 and 2020.⁷⁹

Figure 11 show the average public expenditure on food systems R&I in each country as a percentage of overall GDP and as a proportion of public spend on R&I according to the data available for this study. This shows that for some countries, such as Denmark and Germany, the amount of funding available for food-related R&I as a proportion of

⁷⁹ Project level data collected at country level through Ministries and publicly available datasets.

GDP could be said to reflect their overall ranking with regard to levels of R&I funding (as described in Figure 12).

However, this is not the case for all countries. Austria, for example, tends to invest more in R&D generally but relatively less in food-related R&I. Conversely, countries such as Romania and Slovakia spend a relatively large proportion of their overall R&I expenditure on food-related R&I despite being amongst the countries with a lower proportion of R&I spend as percentage of GDP. Ireland, Hungary and Lithuania are the countries with the highest food R&I spend as a proportion of overall government R&I spend. These differences can be traced back to national policy:

- In the case of **Austria**, the national strategy for research, technology and innovation called for R&I funding to be targeted towards “Grand Challenges” facing the country, including climate change and scarce natural resources, but with no specific thematic focus on food.⁸⁰
- The national research and innovation strategy in **Romania**, as well as its National Reform Programme, have a strong focus on innovation in food and agriculture, noting the “remarkable potential” of the sector and mentioning R&I as a means to facilitate the application of new technologies to food production and to find viable solutions for conservation and sustainable exploitation of agricultural resources.⁸¹
- In **Slovakia**, within the innovation strategy, Environment, Agriculture and Food security is identified as one of the R&I priorities.⁸² Lithuania and Hungary have specific initiatives to develop R&I in food systems.
- **Lithuania** has a Programme for Research and Experimental Development of Agriculture, Food, Fisheries and Rural Development.⁸³
- **Hungary’s** Medium- and Long-term Development Strategy for the Food Industry (2014-2020) served as a guide to develop and implement measures for the entire food industry chain. The Strategy also set out an objective for

⁸⁰ Austrian Federal Government (2011), ‘National Strategy for Research, Technology and Development 2011-2020’, available at: <https://www.genderportal.eu/resources/strategie-der-bundesregierung-fur-forschung-technologie-und-innovation-national-strategy>

⁸¹ Ministry of National Education and Research (2006), Ministry of Education and Research (2006), Strategia Națională De Cercetare, Dezvoltare Și Inovare 2007-2013, page 11, available at: <https://uefiscdi.gov.ro/resource-82540%20>

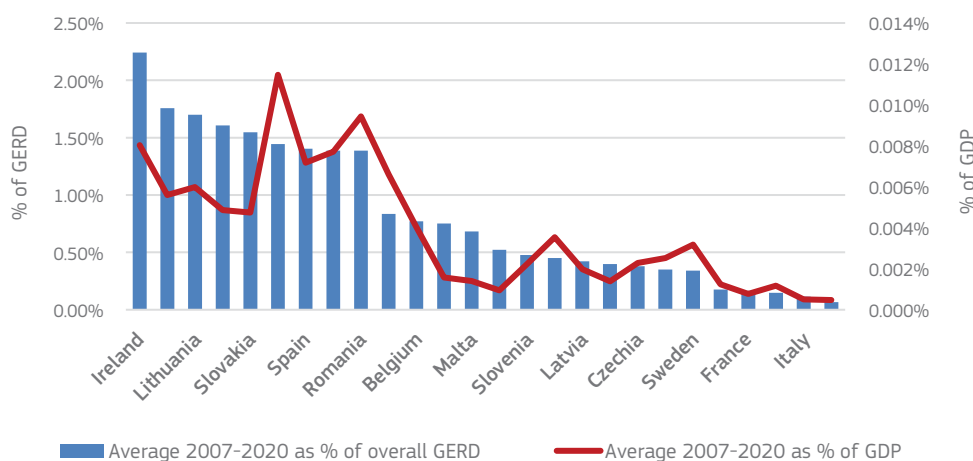
⁸² <https://www.opvai.sk/media/57255/through-knowledge-towards-prosperity-research-and-innovation-strategy-for-smart-specialisation-of-the-slovak-republic.pdf>

⁸³ Lithuania ([Programme for Research and Experimental Development of Agriculture, Food, Fisheries and Rural Development](#))

R&I development through supporting technology and knowledge transfer, and supporting innovation in SMEs.⁸⁴

- In **Ireland**, agriculture is a significant focus of the economy, accounting for almost 7% of modified Gross National Income (GNI*) and 10% of exports in value terms, and representing 7% of total employment.⁸⁵ Ireland did not have a specific food innovation initiative in the reference period for this study, but a Food Vision 2030 was published in 2021, outlining the strategy for the country to become a world leader in Sustainable Food Systems (SFS) over the next decade.

Figure 11: Public spend on food R&I as a percentage of Government R&I spend and of GDP, average 2007-2020



Source: Eurostat [nama_10_gdp and rd_e_gerdfund] and Ipsos analysis of 26 countries' datasets⁸⁶

Figure 12 illustrates the overall expenditure on food R&I in the 26 countries between 2007 and 2020. A general positive trend in terms of public expenditure can be noted over this period. The number of food-related projects funded increased throughout the 2007-2015 period, with a spike in 2015. A decrease can be noted in 2017 and 2018

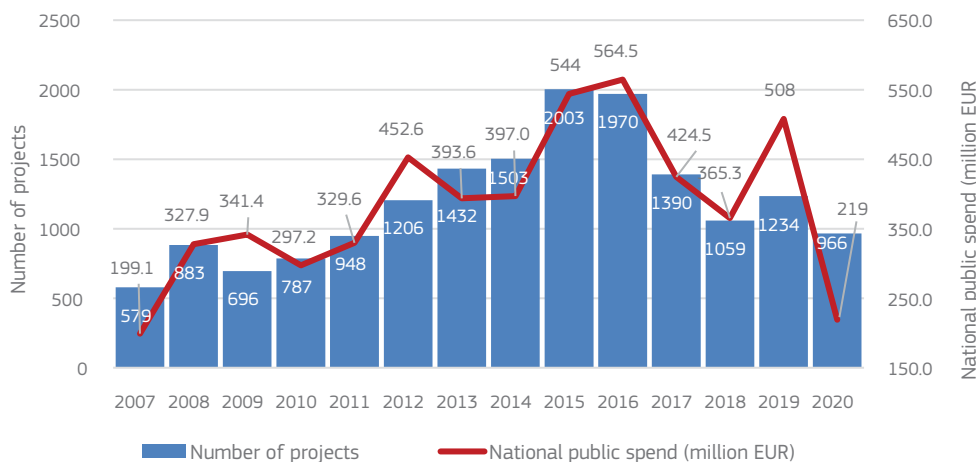
⁸⁴ Hungary ([Medium- and Long-term Development Strategy for the Food Industry 2014-2020](#))

⁸⁵ Ireland: <https://assets.gov.ie/179696/6c6b405e-7c06-4f23-82c0-9edaf7d70a8a.pdf>

⁸⁶ For information on specific sources see the relevant country reports in Annex F.

both in the number of projects funded and the total amount of funding allocated, before increasing again in 2019.⁸⁷

Figure 12: Number of projects and national public spend on food R&I 2007-2020 (million EUR)⁸⁸



Source: Ipsos analysis based on 26 countries' datasets⁸⁹

The type of funding available also varied between countries, with some such as Germany, Sweden and Czechia allocating direct funding to research institutions and at the same time running competitive grants. Countries such as Austria, Croatia, the Netherlands meanwhile, made most use of open funding calls.

⁸⁷ This information should be treated with caution, however, as many countries were not able to provide historic data on R&I expenditure. Although the cut-off dates varied, only 17 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, France, Hungary, Italy, Germany, Luxembourg, Poland, Portugal, Slovenia, Sweden) were able to provide data prior to 2010 and eleven countries were able to provide data prior to 2008. This is due to a number of different reasons, although common causes include multiple institutional changes over the study period in question (in many cases institutions has been cut, merged or reconstituted in line with changes of government or as a result of reduced spending following the 2008 financial crisis) or not having had consistent data collection in place prior to a certain date.

⁸⁸ Data for 2020 is included, but it is not believed to be complete at the time of drafting. Therefore, although there appears to be a drop-off in funding in 2020, we do not believe this is in contradiction to the overall positive funding trend.

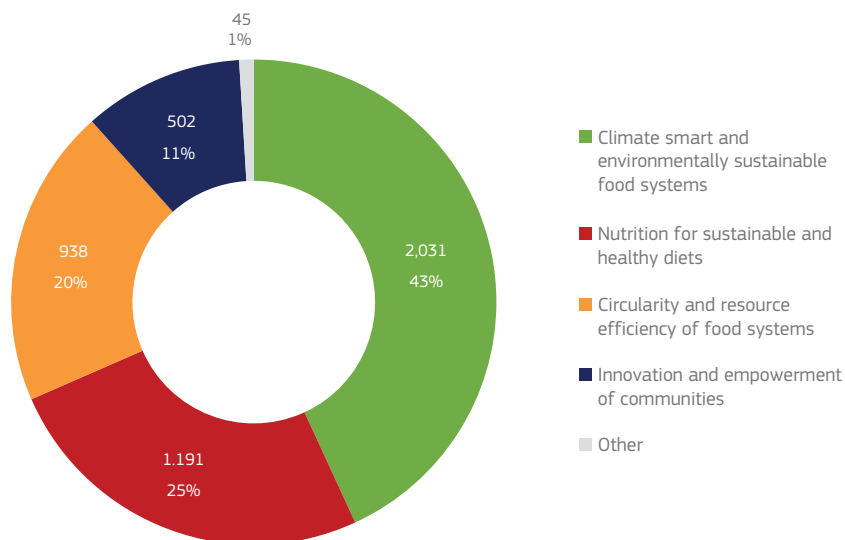
⁸⁹ For information on specific sources see the relevant country reports in Annex F.

3.4. Alignment with Food 2030 priorities

In terms of alignment with the Food 2030 priorities, national funding for R&I in food systems across the 26 countries considered mainly targeted projects focusing on **climate smart and environmentally sustainable food systems** (43%), as shown in Figure 13. A quarter of the overall spend was spent on **nutrition for sustainable and healthy diets** (25%). 20% of the overall spend was aligned with the priority circularity and **resource efficiency**, while projects addressing **innovation and empowerment of communities** received 11% of the spend across countries, while 1% of the overall amount was classified as “other”. This included projects focused on topics not directly linked with the Food 2030 priorities, such as the competitiveness of the meat chain in the market or production costs in the animal products industry.

As discussed in the introduction, we also analysed the **extent to which projects produced co-benefits** (defined within our study, as whether they contributed to two or more priorities, pathways or sectors). Approximately EUR 220 million EUR (across 522 projects) was spent on projects that meet this definition, accounting for 4% of the total spend.

Figure 13: National food R&I expenditure by Food 2030 priority (EUR million, %)

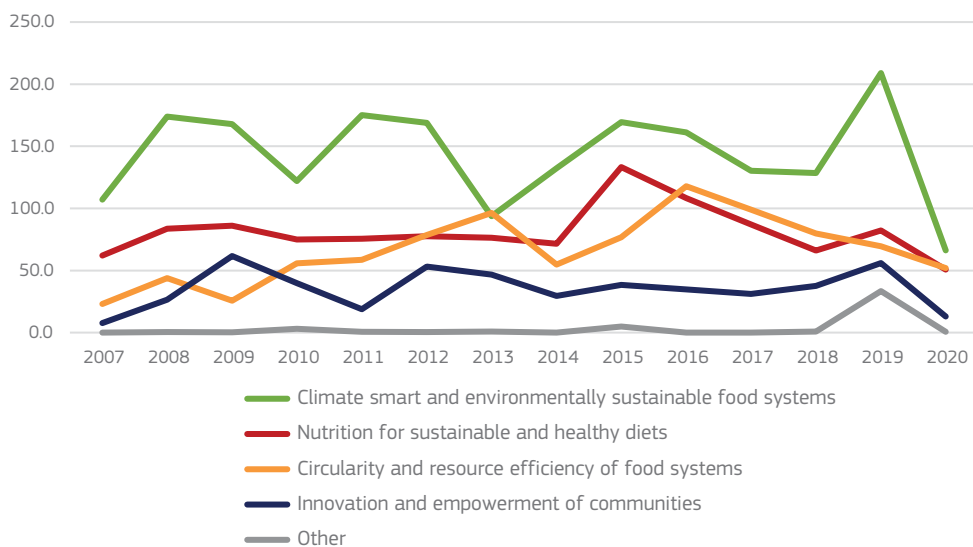


Source: Ipsos analysis based on 26 countries’ datasets⁹⁰

⁹⁰ For information on specific sources see the relevant country reports in Annex F.

Figure 14 considers the distribution of Food 2030 priorities as a proportion of national funding between 2007 and 2020. The priority “climate smart and environmentally sustainable food systems” was the most funded priority in each of the years considered. The number of projects aligned with priority 1 “nutrition for sustainable and healthy diets” remained stable between 2007 and 2014 and increased in 2015, before decreasing from 2016 onwards. A similar path can be seen on the priority “circularity and resource efficiency”. The number of projects targeted at innovation and empowerment of communities remained stable throughout the years considered, together with a small number of projects targeted at more priorities concurrently. It is worth noting that the overall amount of funding in the 26 countries appears to be less since 2017 and this might also impact the number of projects funded.

Figure 14: National food R&I expenditure by Food 2030 priority 2007-2020



Source: Ipsos analysis based on 26 countries’ datasets⁹¹

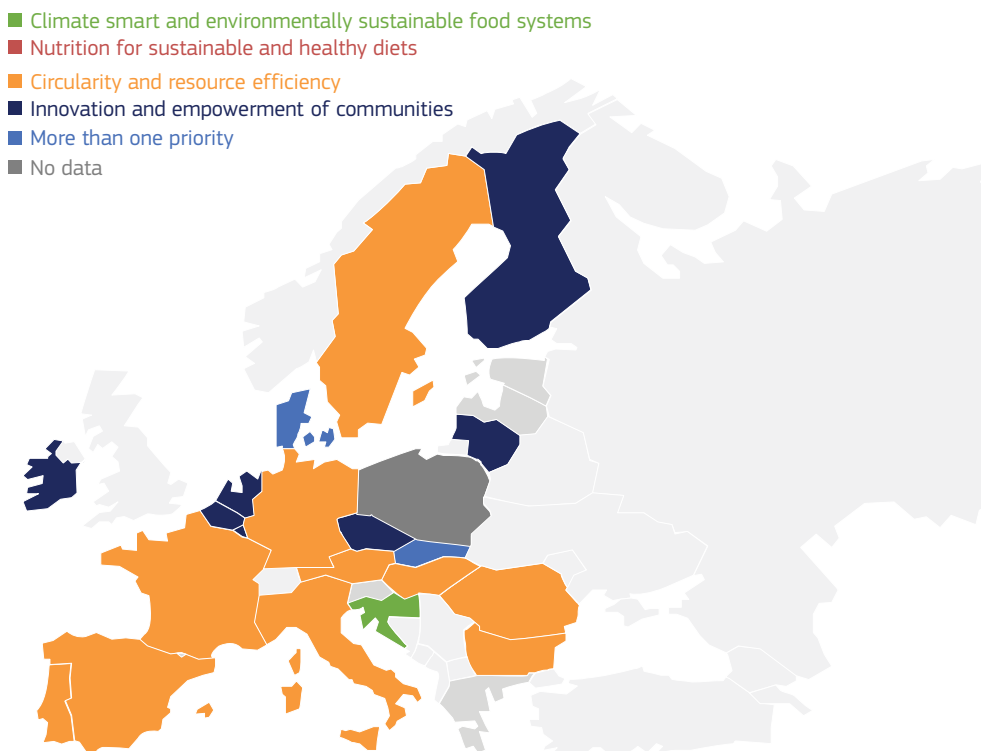
Priority 2 “climate smart and environmentally sustainable food systems” was also the most prominent among the majority of EU member states considered. This finding is aligned with the sectoral focus of these countries on primary production for the projects analysed. In seven countries the most funded priority **was nutrition for sustainable and**

⁹¹ For information on specific sources see the relevant country reports in Annex F.

healthy diets. Five of these (Belgium, Czechia, Finland, Lithuania, the Netherlands) are also the countries with the highest share of public spend in the sector “healthy people”.

An analysis of the policy context within the different countries shows that in many cases funding reflects specific strategic priorities at national level, and often appears to stem from specific policy commitments. In Denmark and Slovakia the most funded priority was related to **circularity and resource efficiency**. This reflects a strong focus on the circular economy in both countries, with explicit policies in place addressing this priority, such as “World-class Food Innovation Towards 2030” in Denmark, the “Strategy of the Environmental Policy of the Slovak Republic until 2030” and “Greener Slovakia”. In Poland, the most funded priority was related to priority 4 **innovation and empowerment of communities**, with 49% of food-related public spend aligned to this priority, compared to an average of 5% in other Member States. As discussed in the case study on page 44, the Polish food strategy is strongly focused on the improvement of the quality of life in rural areas and an efficient use of their resources and potential, including that of agriculture and fisheries, for sustainable development of the country.

Figure 15: Most funded priorities in Member States



Source: Ipsos analysis based on 26 countries' datasets⁹²

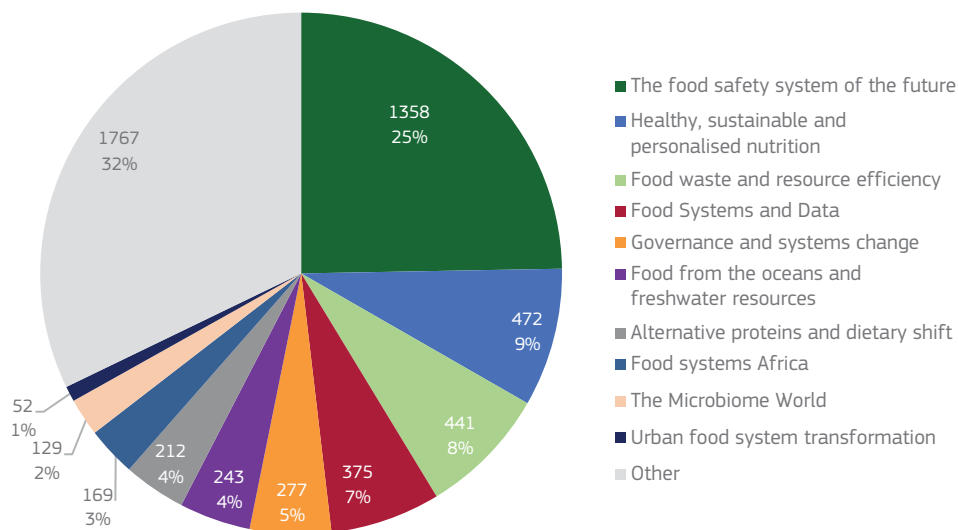
3.5. Alignment with Food 2030 pathways

Figure 16 illustrates the distribution of food-related R&I funding in the 26 Member States for which complete datasets were able to be disaggregated by Food 2030 pathway. Almost a third of the projects considered (16,370 projects in total) did not align with any of the ten pathways, and were therefore categorised as “Other”. A quarter (25%) of the relevant food systems R&I funding across all countries corresponded to pathway 3 “food safety systems of the future”, followed by pathway 5 “healthy, sustainable and personalised nutrition (9%)” and pathway 6 “food waste and resource efficiency” (8%). Projects related to pathway 10 “food systems and data” constituted 7% of the funding, while pathway 9 “governance and systems change” accounted for 5%. The remaining 16% of the expenditure was almost

⁹² For information on specific sources see the relevant country reports in Annex F.

equally split among the pathways on alternative proteins and dietary shift, food from oceans and freshwater resources, food systems Africa and the microbiome world. Only a very small proportion of the funding was related to urban food systems transformation (1%).

Figure 16: National food R&I expenditure by Food 2030 pathway (EUR million, %)



Source: Ipsos analysis based on 26 countries' datasets⁹³

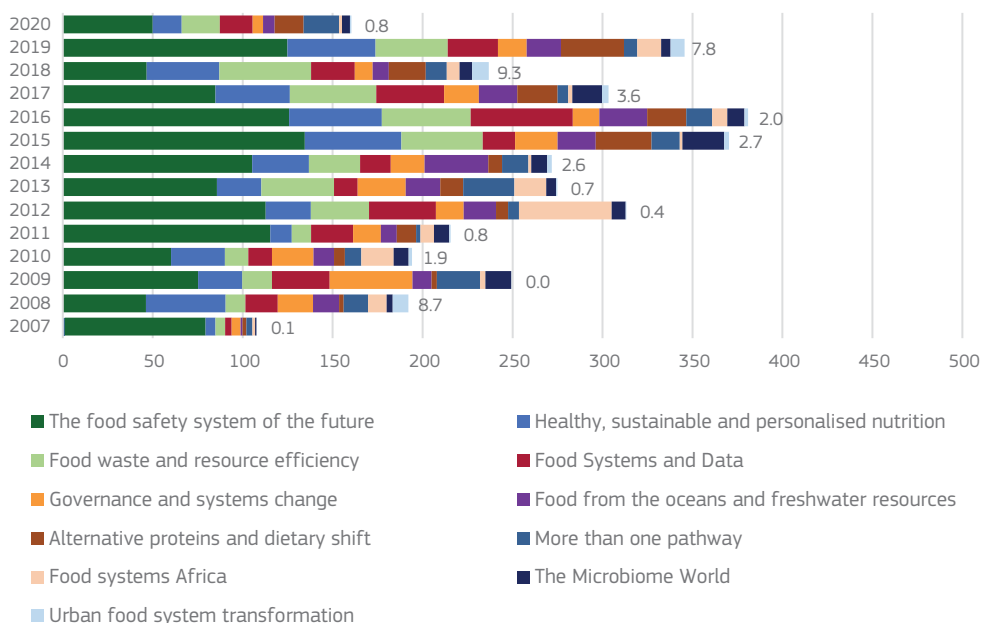
Figure 17 provides a more detailed breakdown of the amount of funding under each Food 2030 pathway by year. This demonstrates a continued and relatively steady interest in pathway 10 “food systems and data”, and pathway 5 “healthy, sustainable and personalised nutrition”. Other pathways, such as pathway 6 “food waste and resource efficiency”, pathway 1 “alternative proteins and dietary shift” and pathway 7 “Food systems Africa” appear to have increased in importance over the reference period. Pathway 6 “food waste and resource efficiency” saw the biggest increase, from EUR 5.4 million in 2007 to EUR 40 million in 2019. This increase could be partly explained by the growing importance that food waste and circularity have gained in EU and national policies since 2015/2016. Among the main initiatives at EU level in this regard there are the Council conclusions on food loss and waste (2015)⁹⁴, the establishment

⁹³ For information on specific sources see the relevant country reports in Annex F.

⁹⁴ Council of the European Union (2018), Food losses and food waste: assessment of progress made on the implementation of June 2016 Council conclusions, available at: <https://www.consilium.europa.eu/media/34583/food-losses-food-waste-en.pdf>

of an EU Platform on food losses and food waste in 2016⁹⁵, and the adoption of the Circular Economy Action Plan also in 2015⁹⁶. At the national level, most countries with specific policies and initiatives on circularity and waste introduced strategies after 2016.

Figure 17: National food R&I by Food 2030 pathway and by year (million EUR)



Source: Ipsos analysis based on 26 countries’ datasets⁹⁷

Pathway 3 “**food safety systems of the future**” was also the most funded in 18 Member States, while pathway 6 “food waste and resource efficiency” was the most prevalent in Spain and Hungary, as shown in Figure 18. **Spain** has a strong focus on circularity, having its own Circular Economy Strategy which takes an intersectoral approach and highlights the food sector as one of particular importance, with R&I recognised as a key component towards achieving this transition. Latvia and Croatia had more than one main pathway, with an even split of the funding among pathway 6, food waste and resource efficiency, pathway 5 “healthy, sustainable and personalised nutrition” and pathway 3 “food safety

⁹⁵ EU Platform on Food Losses and Food Waste, available at: https://ec.europa.eu/food/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en#:~:text=About%20the%20platform,-The%20EU%20and&text=Quantification%20of%20European%20food%20waste,sectors%20contributing%20the%20remaining%2030%25

⁹⁶ Circular Economy Action Plan, available at: https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en

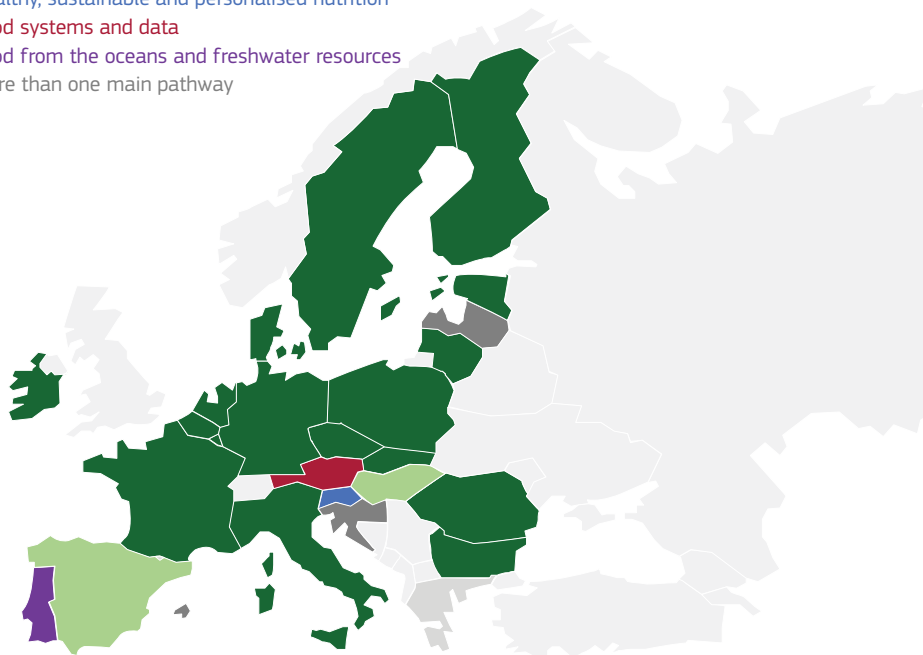
⁹⁷ For information on specific sources see the relevant country reports in Annex F.

system of the future”. This is believed to reflect the interlinking nature of these pathways, with nutrition and food safety often interlinked at national level. As with other countries, an increased focus on food waste and resource efficiency is likely to reflect the increased EU focus on circular economy principles in this time period.

In Croatia, the two most prioritised pathways (as judged by funding provided) were pathway 5 “healthy, sustainable and personalised nutrition” and pathway 1 “alternative proteins and dietary shift”. In **Austria** the most funded pathway was pathway 10 “food systems and data”. In this area, most projects in Austria were centred around research and innovation to make primary production more climate friendly. In Portugal it was pathway 8 “food from the oceans and freshwater resources”. **Portugal’s** R&I agenda on Agri-food, Forests and Biodiversity includes terrestrial, aquatic and marine ecosystems, and among the key issues that R&I aims to address there is guaranteeing the sustainability of intensive fisheries and aquaculture. In Slovenia, most of the funding was spent on pathway 5 “healthy, sustainable and personalised nutrition”.

Figure 18: Most funded pathways in Member States⁹⁸

- The food safety system of the future
- Food waste and resource efficiency
- Healthy, sustainable and personalised nutrition
- Food systems and data
- Food from the oceans and freshwater resources
- More than one main pathway



Source: Ipsos analysis based on 26 countries' datasets⁹⁹

3.6. Funding in different Food 2030 Sectors

Figure 19 provides a year-on-year view of national expenditure on food R&I in different sectors. Over the years, the primary production sector and the health sector maintained a high proportion of funding across all countries, while the sectors “Food processing” and “waste streams” saw a steady growth, especially from 2014 onwards. Primary production consistently received the most funding, accounting for almost two thirds (63%) of overall spend. This was reflected in most national reports.¹⁰⁰ Food retail and foodservices together

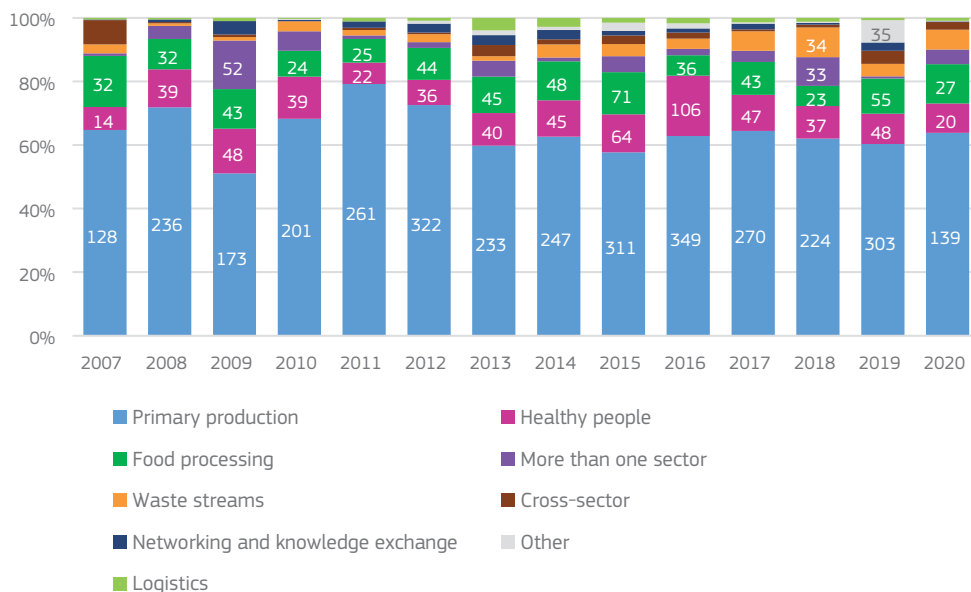
⁹⁸ Excluding projects categorised as « Other ».

⁹⁹ For information on specific sources see the relevant country reports in Annex F.

¹⁰⁰ Czechia and the Netherlands were notable exceptions to this rule: in both cases, the most common Food 2030 sector related to healthy people.

with networking and knowledge exchange were the sectors with the lowest level of spend, accounting for 1% and 1% of the total respectively. Almost EUR 80 million (2% of the total) was spent on projects coded as “Cross sector” (i.e. those targeting the whole food supply chain).

Figure 19: Overall national expenditure on food R&I between 2008 and 2020 by Food 2030 sector

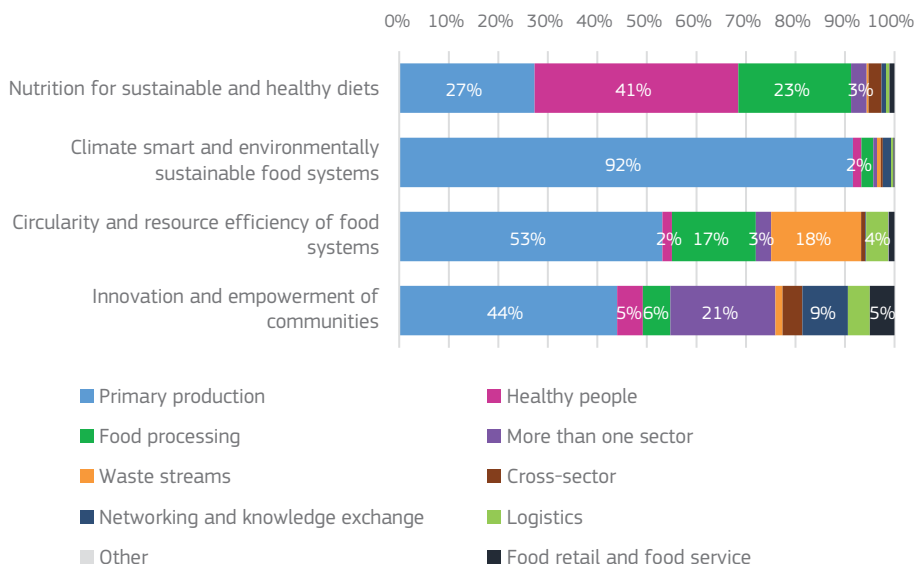


Source: Ipsos analysis based on 25 countries’ datasets¹⁰¹

Figure 20 provides an overview of the distribution of project funding across the different sectors for projects funded in alignment with each of the Food 2030 priorities.

¹⁰¹ The dataset on Bulgaria did not have any information available on sectors. For information on specific sources see Annex F.

Figure 20: Cross-cutting analysis of funding for sectors by Food 2030 priority



Source: Ipsos analysis based on 25 countries' datasets¹⁰²

Similar to EU-funded R&I projects, the primary production sector makes up a significant amount of the overall national funding awarded across all four Food 2030 priorities and it is also the sector which is most strongly aligned with the second Food 2030 priority “**climate smart and sustainable food systems**”. 92% of all relevant funding aligning with this priority was awarded to projects that targeted primary production.

National spend on nutrition for sustainable and healthy diets is mainly split between the healthy people sector (41%), primary production (27%), and food processing (23%). The waste streams sector makes up 18% of the projects on circularity and resource efficiency, which are also strongly aligned with the primary production sector (53%). The logistics sector received more funding (4%) under priority four (innovation and empowerment of communities) than under other priorities, with projects mainly focused on “last mile” distribution and deliveries in urban and rural areas.

¹⁰² The dataset on Bulgaria did not have any information available on sectors. For information on specific sources see Annex F.

3.7. Main challenges

While the majority of challenges identified in the national research are country specific, one significant challenge could be noted in all EU Member States. This relates to **the fragmentation of food policy between different entities and the lack of a specific institution with overarching responsibility for food systems** as a whole. This reflects fragmentation in the sector among different actors in the food value chain, as well as some sectors (logistics, food retail and food service, networking and knowledge exchange) receiving less funding compared to the primary production sector. This is probably linked to the Ministry of Agriculture, which has a remit focused on primary production, being viewed de facto as the primary stakeholder with regard to food policy in most countries.

This fragmentation can be noted in other areas, too. Feedback from stakeholder interviews at national level suggests that within the **National Agriculture Knowledge and Innovation System (AKIS)**, which aims to strengthen links between the research community, farmers and other food systems actors, actors are sometimes fragmented and often not connected well enough, resulting in significant challenges for the systematic and effective exchange of knowledge, information, and innovation. Some key examples of specific challenges within individual Member States, many of which are relevant to other countries, include:

- **Lack of clear governance:** one of the main challenges identified by the Ministry of Agriculture in the Netherlands concerns the lack of clear governance around food systems and no clear responsibilities for food R&I policy among different actors. Sectors in the food chain have very different structures (primary production and industry and retail, for example), making it challenging for public-private partnerships to be established across the whole food system, including both the value chain and all related stakeholders. The government of the Netherlands' attempt to address this issue lies in the "Topsector" approach, bringing together public and private interests through comprehensive programmes aligned with the KIA agenda. Lack of coordination was also highlighted in Croatia and Hungary. Looking at the Hungarian Agriculture Innovation and Knowledge System (AKIS), in 2019 SCAR reported that although elements of the Hungarian AKIS are organized and coordinated, the structure and cooperation between its different elements remained insufficient. Similarly in Croatia, AKIS actors are fragmented and often not connected well enough, resulting in significant challenges for the systematic and effective exchange of knowledge, information, and innovation.
- **Lack of thematic focus:** in Austria, the lack of a strong thematic focus in most national funding calls (disregarding those launched by or in partnership with the

European Commission) helps explain the low number of food systems projects funded since 2008. While Austria's national R&I strategy calls for funding to be structured around several societal challenges, this seems to have happened only in a few specific areas, such as digital innovation or lowering emissions in key sectors such as transport or building. An OECD review of Austria's innovation policy¹⁰⁵, conducted in 2018, assessed that R&I has not been sufficiently framed around societal challenges and called for more mission-oriented funding.

- **Decentralisation in federal and regional states:** one of the main obstacles identified in Belgium concerned little coordination between federal and regional authorities regarding food systems. Therefore, all the information and opportunities related with food systems are highly decentralised.

¹⁰⁵ OECD (2018), OECD Reviews of Innovation Policy: Austria 2018, available at: <https://www.oecd.org/publications/oecd-reviews-of-innovation-policy-austria-2018-9789264309470-en.htm>

4. ANALYSIS OF THIRD COUNTRY FUNDING FOR FOOD SYSTEMS R&I

This section presents a review of the national public sector R&I funding in three non-European countries – Canada, China and the USA. Similarly to the 27 EU Member States, the research for these three countries included a qualitative mapping of national policies and priorities related to food systems R&I, as well as the collection of more granular data with a focus on the funding amounts provided for food systems R&I projects during the reference period (2007-2020). Country reports for each of the comparator countries are included in Annex E.

Headline findings

- As a proportion of GDP, only the USA has a higher overall R&I expenditure (including government, private sector and other expenditure) in comparison with the EU-27 average. If compared to EU Member States, Canada would rank 11th in terms of government expenditure as a proportion of GDP, with the USA and China sharing joint 22nd place alongside Slovakia. In terms of overall private sector expenditure on R&I, however, all three countries are above the EU average (0.7%).
- The amount of food systems R&I spending identified in the three comparator countries places ranks the US and China at similar levels to some Member States, with China allocating around EUR 5 billion to food systems R&I over the reference period and the USA EUR 4 billion sitting towards the higher end of the distribution of EU Member States in terms of public expenditure. Canada spent EUR 109 million over the reference period.
- In Canada and the USA, primary production accounts for nearly 75% of public expenditure on food systems R&I. In China the picture is slightly more balanced, with primary production accounting for approximately 41% of spend.
- Expenditure on waste streams, at 25% of expenditure, is much more significant in China than in the other two countries. Logistics (2%) and food processing (15%) also make up a more significant proportion of food systems R&I funding in China than in Canada or the USA.

4.1. Policy context at national level

A review of national R&I strategies in the three countries shows that each has specific strategies and policies aimed at food systems in particular. Relevant examples from each country include the following:

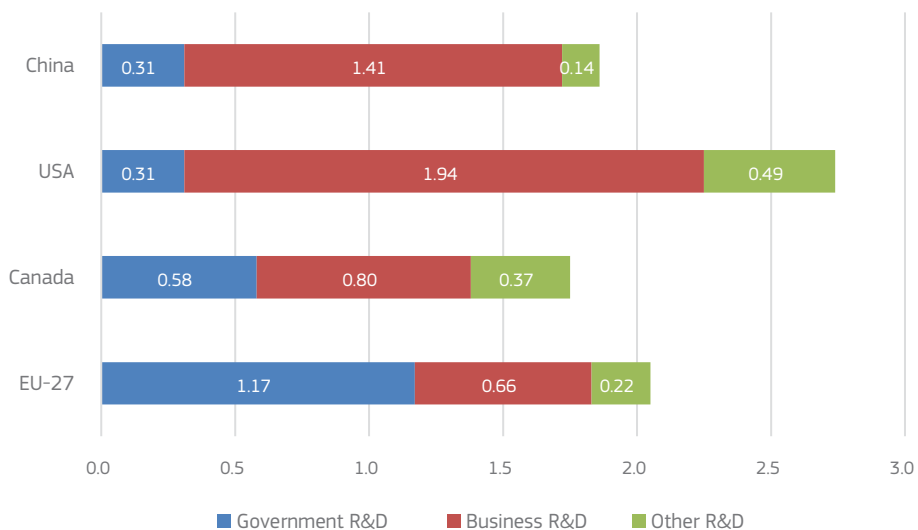
- In the USA, the **Farm Bill** is the primary agricultural and food policy tool, which contains the guidelines for food policy. In terms of R&I, the Farm Bill promotes education and use of biotechnology through the removal of tariffs, foresees the application of technology to food distribution programmes, reauthorises the Rural Revitalisation Technology programme, and establishes a task force for identifying gaps in broadband precision farm connectivity. Other areas related to food systems are legislated by other federal policies. For example, the National Nutrition Monitoring and Related Research Act defines dietary guidelines, while the Federal Food, Drug and Cosmetic Act and the Nutrition Labelling and Education Act overview food labelling.
- In China, the **14th Five-Year Plan for National Economic and Social Development** and the long-term 2035 Vision give priority to developing agriculture and rural areas, promoting agricultural modernisation and rural revitalisation on all fronts, ensuring national food security, and participating in the global supply chain of agricultural products.
- In Canada, the first-ever **Food Policy for Canada** was published in 2019, with the aim to help Canada build a healthier and more sustainable food system¹⁰⁴. It identifies actions in several areas: vibrant communities, increased connections within food systems, improved food-related health outcomes, strong Indigenous food systems, sustainable food practices and inclusive economic growth.

Of the three, Canada's Food Policy seems much more focused on food systems as a whole, while the US Farm Bill and China's 14th Five Year Plan are particularly focused on agriculture and the production sector, which highlights the different priorities of each country. As for the incorporation of R&I in the policies, despite more explicit references in the USA's Farm Bill, it can be considered that all three countries include references of R&I related to food systems in their national food policies.

¹⁰⁴ OECD, 2020. Agricultural Policy Monitoring and Evaluation 2020. Available at: <https://www.oecd-ilibrary.org/sites/22e46c5d-en/index.html?itemId=/content/component/22e46c5d-en> (Accessed 16 February 2022).

The figure below illustrates the level of expenditure on R&I as a percentage of GDP in each of the three non-European countries (Canada, China and the USA). The EU-27 average is also shown for comparison.

Figure 21: R&I expenditure as a percentage of GDP in Canada, China and the USA, and comparison with the EU, average 2007-2019



Source: Eurostat and OECD, GERD by sector of performance and source of funds

Only the USA has a higher overall R&I expenditure in comparison with the EU-27, with 2.74% of GDP. Both China and Canada present lower R&I expenditures than the EU average, with 2% and 2% of GDP respectively. Business funded R&I is predominant in these three countries, while the EU favours government funded R&I. None of the countries exceeds the EU average with regard to government expenditure as a proportion of GDP. Indeed, if compared to EU Member States, Canada would rank 11th in terms of government expenditure as a proportion of GDP, with the USA and China sharing joint 22nd place alongside Slovakia.

4.2. Main R&I stakeholders

Funding agencies and other public organisations

Food-related R&I funding responsibilities at national level are distributed differently in each country: in China, the **Ministry of Science and Technology** manages funding allocations; in Canada, two major funding programmes (the Canada Foundation for Innovation and the Scientific Research and Experimental Development Program) were created by the Canadian Government to fund R&I in the country, with food-related R&I being coordinated by the **Department of Agriculture and Agri-Food**; in the USA, R&I is funded and performed by a variety of different organisations, including the federal and state governments, businesses, academia and non-profit organisations.¹⁰⁵ The business sector and the federal government provided the majority of this investment. In terms of food-related R&I, the National Institute for Food and Agriculture (NIFA), created by the **U.S. Department of Agriculture** (USDA), emerges as the nation's leading funding provider.

Funding recipients

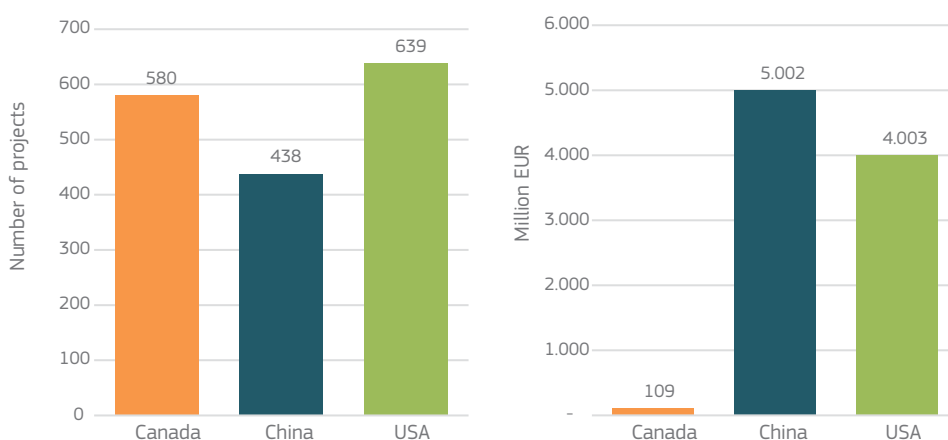
Higher education institutions (e.g., universities, colleges and institutes) made up the large majority of the funding recipients in the three countries. In the USA and China, these institutions received 90% and 99% of food-related R&I funding respectively. In Canada, while higher education institutions are still a major recipient of funding, with 44%, the network of research and development centres coordinated by the Department of Agriculture and Agri-Food received 56% of funding in the 2007-2020 period.

4.3. Public Funding available for food systems R&I

The following figures show the available data for the three countries, presenting the number and estimated values of public funding available for food-related R&I projects.

¹⁰⁵ Congressional Research Service (2021), U.S. Research and Development Funding and Performance: Fact Sheet, available at: <https://fas.org/sgp/crs/misc/R44307.pdf>

Figure 22: Number of food-related R&I projects and estimated funding (million EUR) in Canada, China and the USA.



Source: SPI analysis based on three non-European countries’ datasets (Canada, China, USA)

Of the three countries, China had the highest level of funding, closely followed by the United States. Individual projects could not be identified for all the programmes included in the estimate of total spending, and therefore a selection of projects is analysed in more detail in the next section. Budgets for key programmes such as NIFA and the Chinese Academy of Agricultural Sciences are only available up to 2018 – this means that our thematic analysis of projects covers the period 2007-2020, whilst the overall budget data covers the period 2007-2018. Relevant funding identified in China and the USA is comparable in scale to that identified at EU level (EUR 4.8 billion), while funding identified in Canada is significantly less.

4.4. Alignment with Food 2030 priorities, pathways and sectors

Alignment with Food 2030 priorities

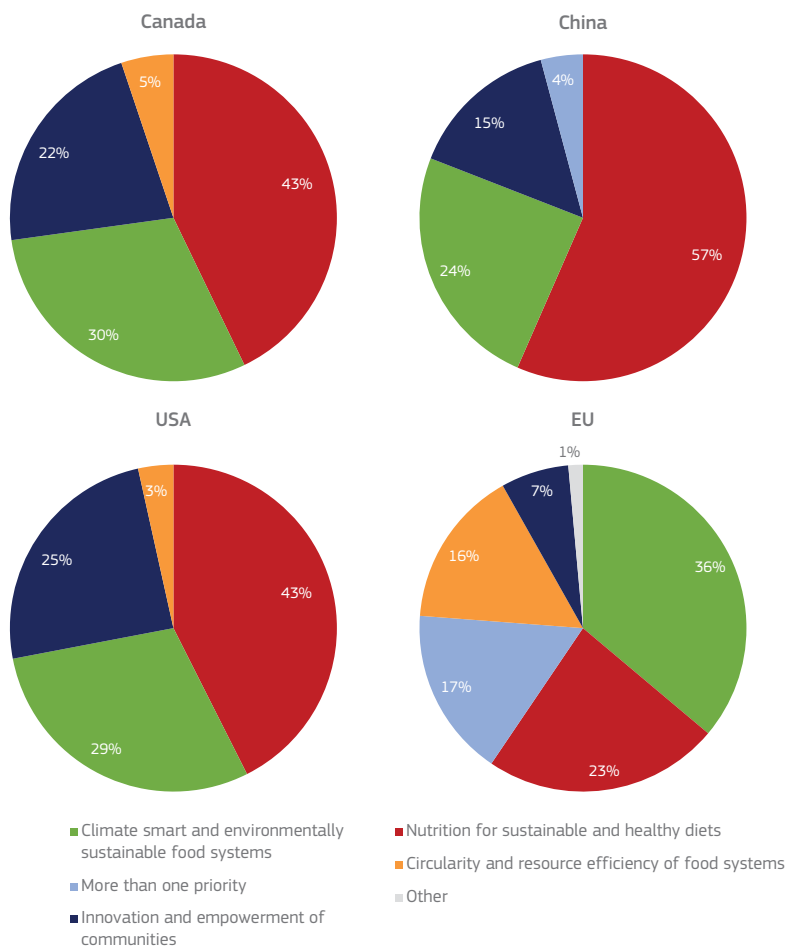
Figure 23 shows the alignment of the projects funded in Canada, China, and the United States with the Food 2030 priorities. All three focused most heavily on priority one “Nutrition for sustainable and healthy diets, followed by “climate smart and environmentally sustainable food systems” and “innovation and empowerment of communities”. The relative proportions of funding differed slightly from country to country, however a significantly larger share of funding in China was allocated to nutrition for sustainable and healthy diets. These results contrast with the number one priority of the EU, as seen previously,

which was “climate smart and environmentally sustainable food systems”. This contrast in priorities between the three countries and the EU could be explained by the different food policies in these countries:

- In China, the most populated country in the world, malnutrition is still a real problem that has hindered its development. To combat that, the Chinese government has established policies that prioritise the supply of agricultural products that meet the public need for more nutritious, healthier and safer foods, which is reflected in “Nutrition for sustainable and healthy diets” being China’s first Food 2030 priority.
- In contrast, both the USA’s and Canada’s population suffer greatly from health conditions related to nutrition and food consumption, such as obesity. The two countries’ obesity rates (37% and 31% respectively¹⁰⁶) place them in the top 20 of countries with the largest rate of obesity, far ahead of most European countries, which seem to fall in the 20-26% range. This urgent issue is reflected in both countries food policies.
 - The USA’s Farm Bill targets a broad set of agriculture and nutrition assistance concerns, allocating mandatory spending targets to nutrition programs.
 - Similarly, Food Policy for Canada sets improved food-related health as one of its long-term outcomes, ensuring improved health status of Canadians related to food consumption and reduced burden of diet-related diseases, particularly among groups at higher risk of food insecurity. Therefore, the nutrition and health of its citizens seems to be their number one priority.

¹⁰⁶ Global Obesity Observatory, available at: <https://data.worldobesity.org/rankings/>

Figure 23: National food R&I expenditure by Food 2030 priority in Canada, China and the USA (% of overall spend)



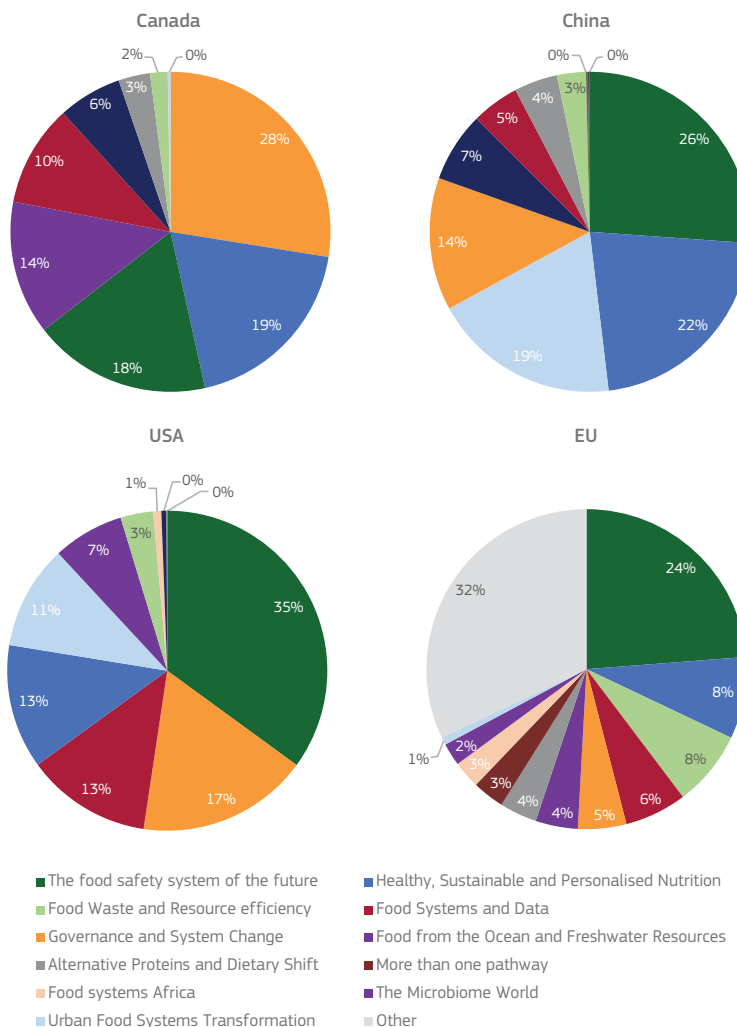
Source: SPI analysis based on three non-European countries’ datasets (Canada, China, USA)

Alignment with Food 2030 pathways

Categorising the projects by Food 2030 pathways, shown in Figure 24, it can be seen that each country has a different funding distribution, while still maintaining some top pathways in common. The “food safety system of the future” comes in first in both China and the USA,

while in Canada it's third in the list of most funded pathways. "Governance and system change" (first in Canada, second in the USA and fourth in China) and "healthy, sustainable and personalised nutrition" (second in Canada and China and fourth in the USA) are also among the most funded pathways.

Figure 24: National food R&I expenditure by Food 2030 pathway in Canada, China and the USA (% of overall spend)



Source: SPI analysis based on three non-European countries' datasets (Canada, China, USA)

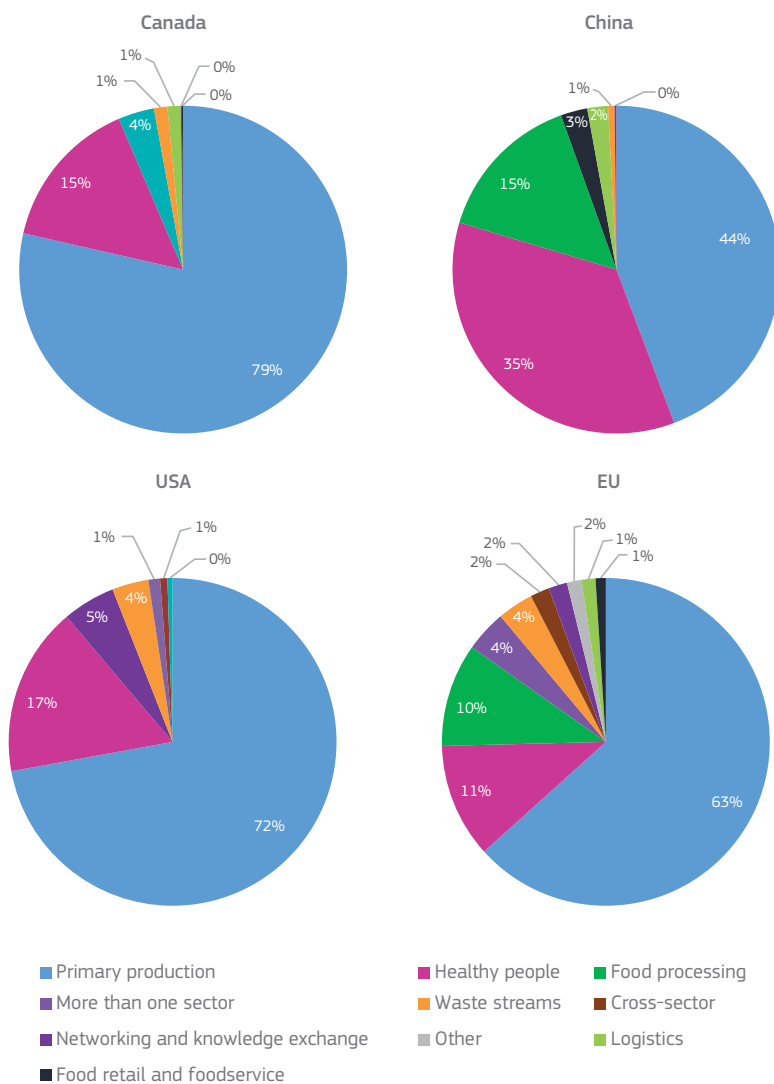
Comparing these results with the EU, despite 32% of the projects being assigned to other pathways, the most funded pathway (“food safety system of the future”) is also one of the top pathways in the three non-EU countries in study. In fact, it appears that food safety is an issue that is being tackled at the global scale. For example, the USA’s 2018-2020 Strategic Plan from the Agricultural Research Service outlines “Nutrition, Food Safety and Quality” as one of four strategic research areas, seeking, among other objectives, the definition of the role of food in optimising food safety, the control of the spread of toxins in agriculture and the enhancement of agricultural quality. The “healthy, sustainable and personalised nutrition” also appears to be a constant interest of research among all. One big difference found between the EU and the three countries lies on the “food waste as resource efficiency” pathway. While in Europe it comes in third, with 8% of funds, it appears near the bottom of Canada’s, China’s and the USA’s most funded pathways.

Alignment with Food 2030 sectors

Comparing the sectors of focus of national expenditure on food R&I, primary production accounted for the most funding across the projects in all countries. In Canada and the USA it accounts more than 75% of investments in the former and almost 75% in the latter. In China the picture was slightly more balanced, with primary production accounting for approximately 44% of investments. Healthy people also accounted for a significant proportion of public sector expenditure across all three countries, coming in second in all of them (15% in Canada, 35% in China and 17% in the USA) (Figure 25). Expenditure on food processing was much more significant in China than in the other two countries. Logistics and food processing also made up a more significant proportion of food systems R&I funding in China. Although there is no clear policy explanation for this, it may reflect the fact that the main funder identified in China was the Ministry of Science and technology (as opposed to the Department or Ministry for Agriculture in Canada, USA and most EU countries)

The graph for the EU is very similar to Canada’s and the USA’s, as the primary production sector accounts for more than half of funding, with the healthy people sector coming in second. As for the food processing sector, it is more aligned with China’s percentage of funding in this sector.

Figure 25: Overall national expenditure on food R&I by Food 2030 sector in Canada, China and the USA (% of overall spend)

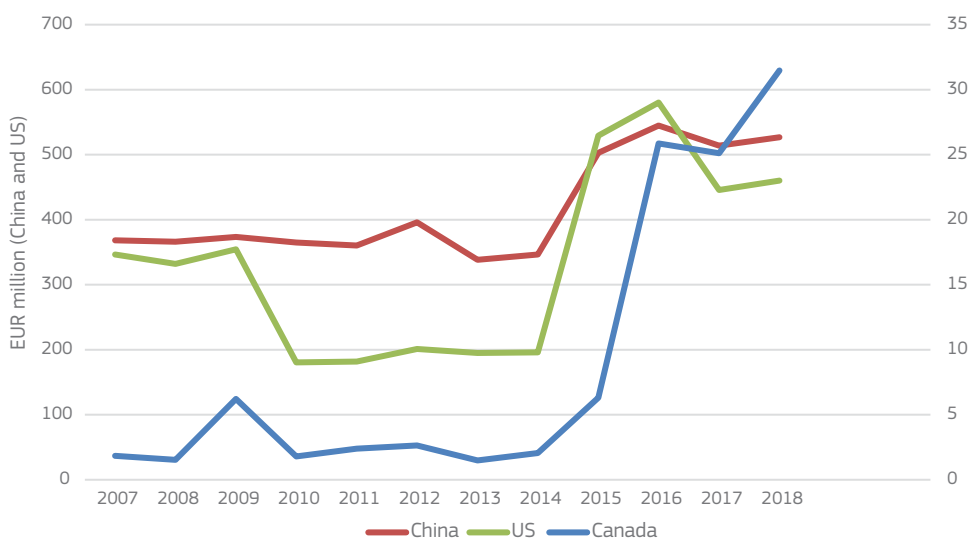


Source: SPI analysis based on three non-European countries' datasets (Canada, China, USA)

4.5. Analysis of trends: 2007-2020

Investment levels in the three countries changed considerably over the 2007-2018 period. Figure 26 shows the expenditure per country. Very limited data were available in Canada prior to 2015, as reflected in the sharp increase in food systems funding that can be noted after this period. Public expenditure on food systems R&I in China appears to be at a continuously high level in comparison with the two North American countries, with Canada's investment rising significantly from 2013 onwards (which is likely to be more of a reflection of the limited data available for Canada during this period). Investments in the US also see a significant increase in 2013, likely due to the introduction of several new initiatives such as the Agriculture and Food Research Initiative (AFRI).¹⁰⁷

Figure 26: National food R&I expenditure in Canada, China and the USA, 2007-2018 (million EUR)



Source: SPI analysis based on three non-European countries' datasets (Canada, China, USA)

With regard to investment priorities, Figures 27 through 29 show how funds were allocated over the 2007-2018 period by Food 2030 parameters and how the priorities have changed over-time in the three countries and in comparison with the EU.

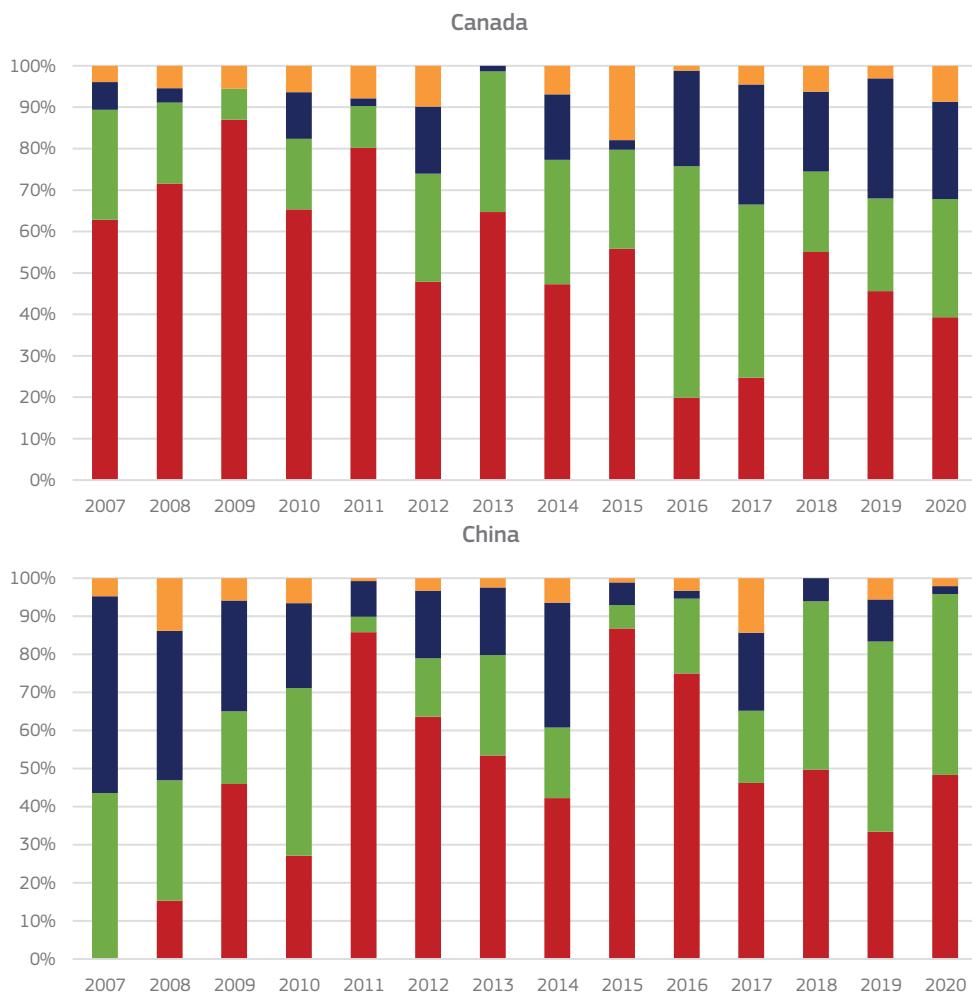
¹⁰⁷ National Institute of Food and Agriculture, Agriculture and Food Research Initiative (AFRI), available at: <https://nifa.usda.gov/program/agriculture-and-food-research-initiative-afri>

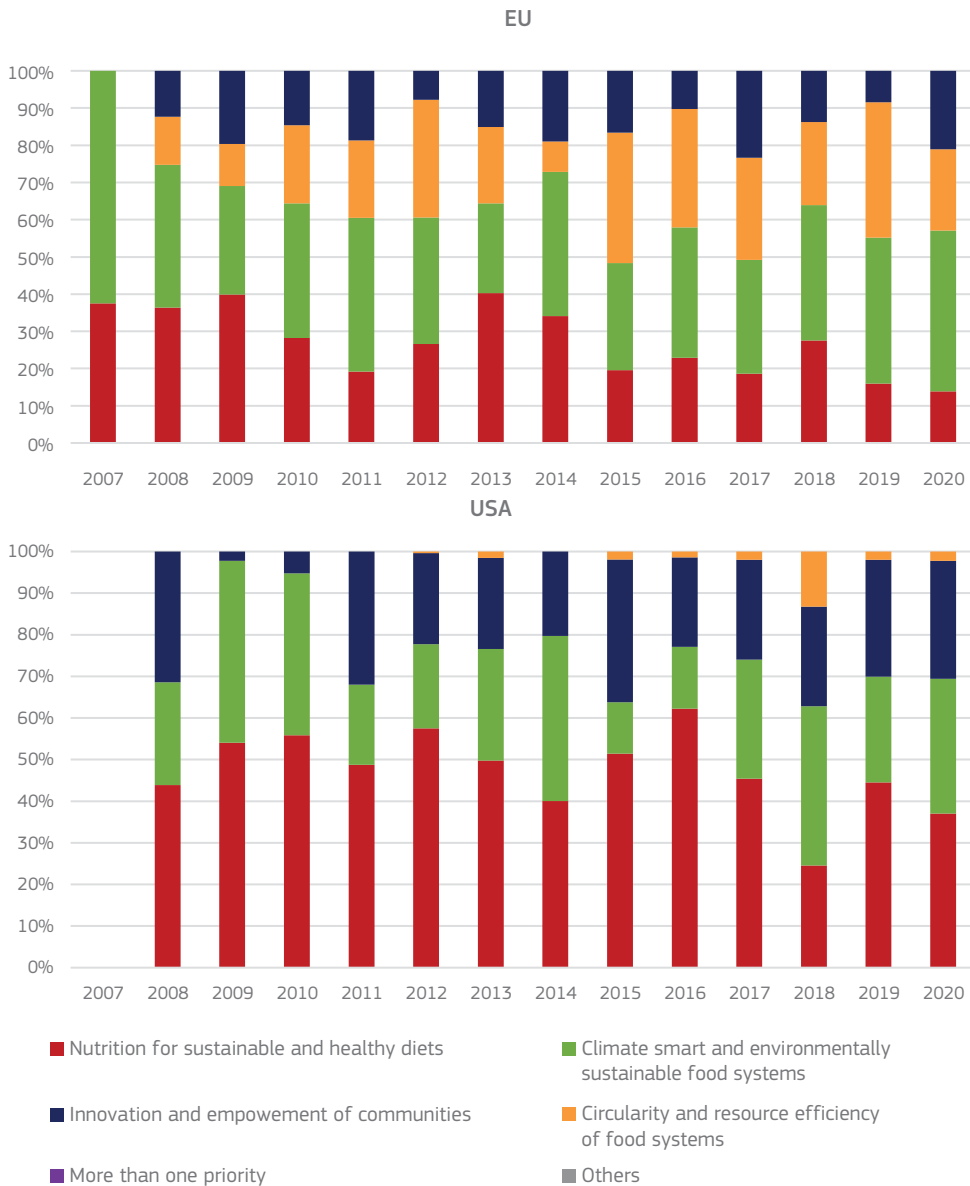
Overall, “nutrition for sustainable and healthy diets” remained the first priority in the reference period in all three countries, despite small decreases in recent years in Canada and reaching a peak between 2011 and 2015 in China. In the USA, the funding for this priority has remained quite constant over the years. As mentioned before, China’s issue of malnutrition and the North American health related issues like obesity have shaped their food policies and the distribution of R&I funding.

Although there is fluctuation year on year with regard to investment in “Climate smart and environmentally sustainable food systems”, this has remained a significant area of funding across the reference period in all three countries. Meanwhile, “innovation and empowerment of communities funding” increased in Canada, decreased in China and remained constant in the USA as the years passed. Circularity and resource efficiency of food systems remains the least prioritised in the three countries. In the USA, in particular, spending on this priority only started in recent years. This may imply that **the existence of a European Circular Economy Strategy has been a key driving force** in terms of both EU and national expenditure on this priority in Europe.

Compared with the EU, despite the difference in the ranking of the priorities previously mentioned, the distribution of funding through the years shows minimal relative changes, which indicates that the priorities have remained the same since 2007.

Figure 27: Overall national expenditure on food R&I in Canada, China and the USA, 2007-2020 by Food 2030 priority (% of total expenditure)





Source: SPI analysis based on three non-European countries' datasets (Canada, China, USA)

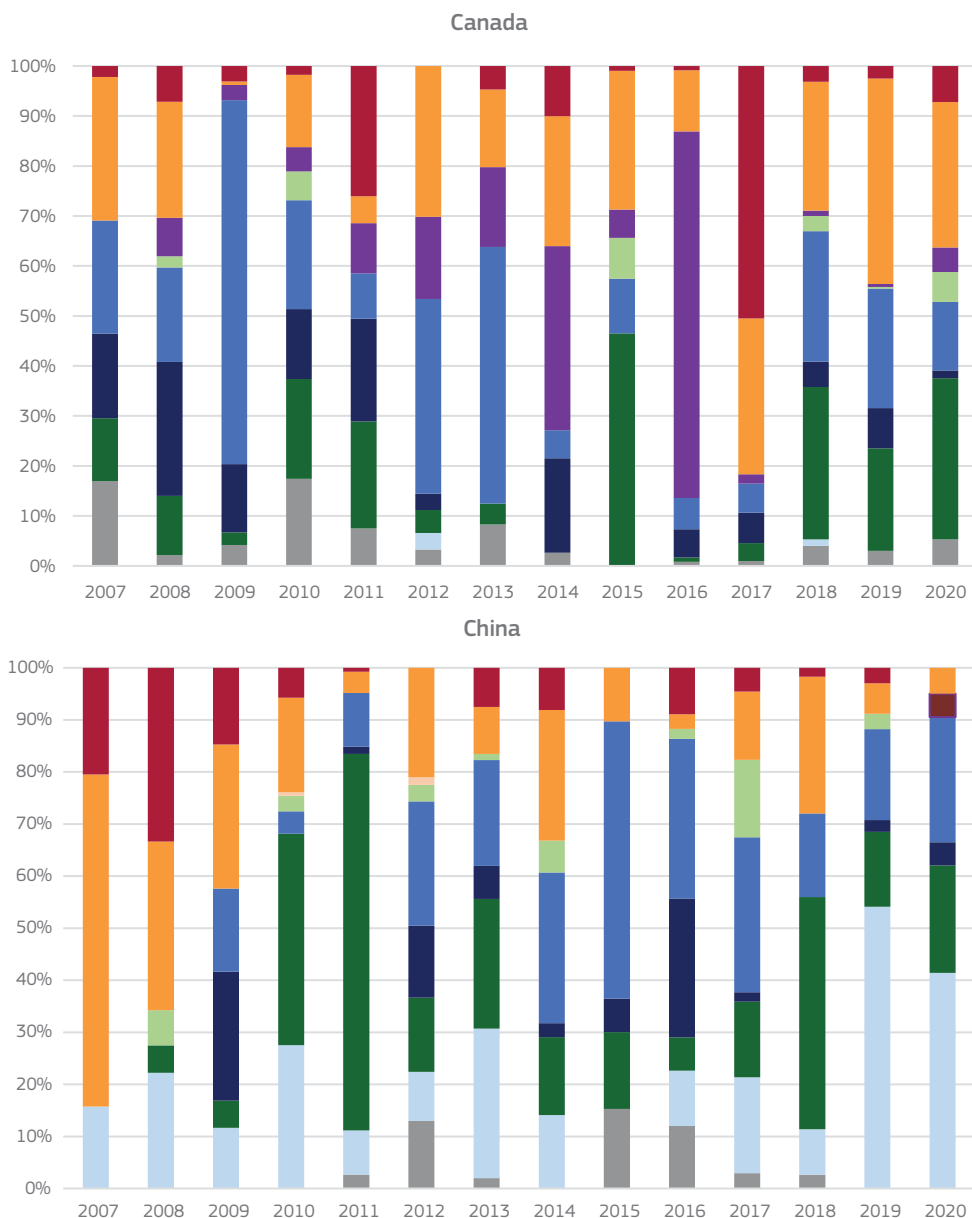
Taking into consideration the Food 2030 pathways, 2007-2020 trends differ significantly from country to country:

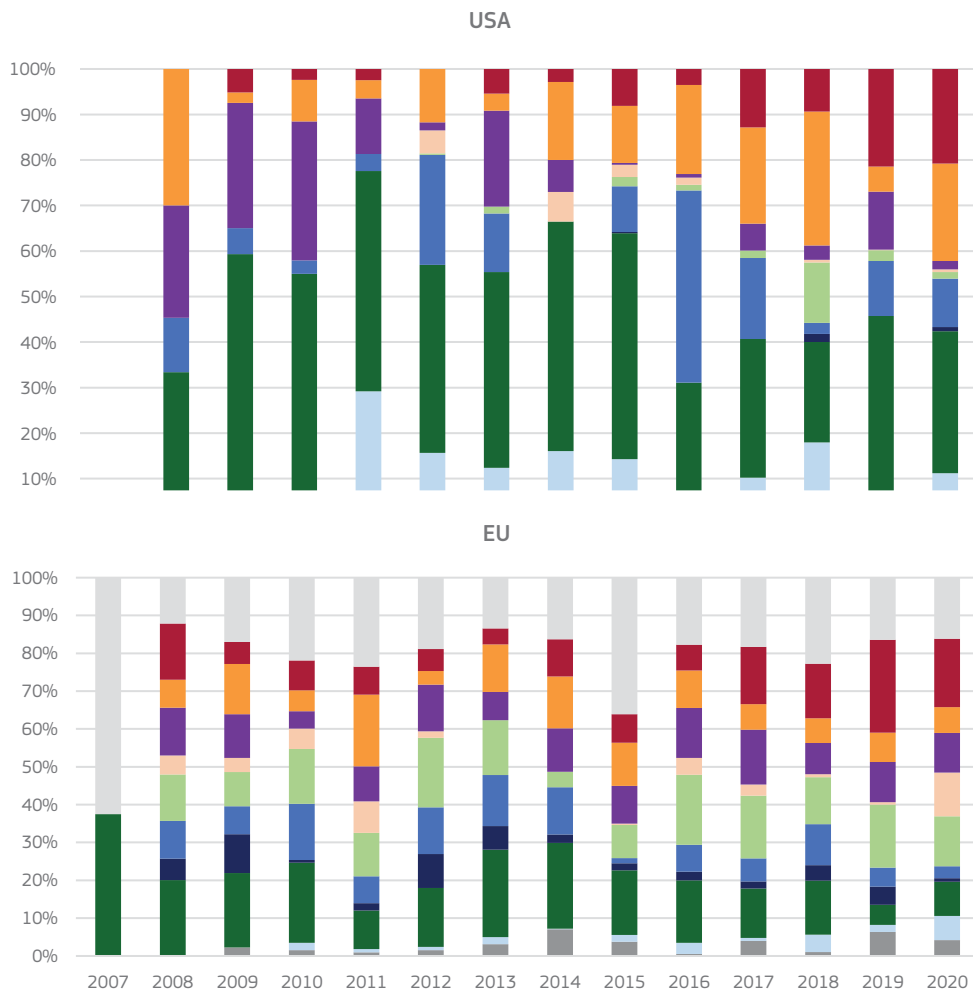
- In **Canada**, “Governance and system change” is the most funded pathway and has continued to receive increases funding in recent years. “Healthy, sustainable and personalised nutrition” had relatively higher funding in the 2007-2013 period, accounting for more than 70% of all food systems funding identified in Canada in 2009. Other standouts include “The food safety system of the future”, which reached a peak in 2015 and had a strong showing in 2018-2020, and “Food from the ocean and freshwater resources”, which accounted for more than 70% of funding in 2016, possibly following the launch of a government initiative to protect marine and coastal areas in 2015¹⁰⁸.
- In **China**, the “Food safety system of the future pathway” received the most funding overall with a peak in 2011. “Governance and system change” is another pathway which reached its peak early in the report period and slowed down a lot in recent years. On the other hand, “Healthy, sustainable and personalised nutrition” has been receiving an increasing proportion of funding since 2012. Finally, it is important to note “Urban food systems transformation pathway”, whose funding has increased in recent years, despite remaining relatively low overall.
- As for the USA, the funding panorama is more stable in comparison with China and Canada. The top 2 pathways, “The food safety system of the future” and “Governance and system change”, have remained relatively consistent in terms of funding levels through the years. Other pathways of note include “Food systems and data” and “Urban food systems transformation”, both of which have received increased funding in recent years, and “Food from the ocean and freshwater resources”, which in contrast has decreased in funding since 2008.

Once again, the changes seen in the three countries in the 2007-2020 period are more significant than the changes seen in the EU, where the funding of the different pathways stayed relatively consistent year on year, with only minor changes.

¹⁰⁸ Government of Canada, 2021. Government of Canada making significant progress and investments to protect Canada's oceans. Available at: <https://www.canada.ca/en/fisheries-oceans/news/2021/07/government-of-canada-making-significant-progress-and-investments-to-protect-canadas-oceans.html> (Accessed 16 February 2022).

Figure 28: Overall national expenditure on food R&I in Canada, China and the USA, 2007-2020 by Food 2030 pathway (% of total expenditure)



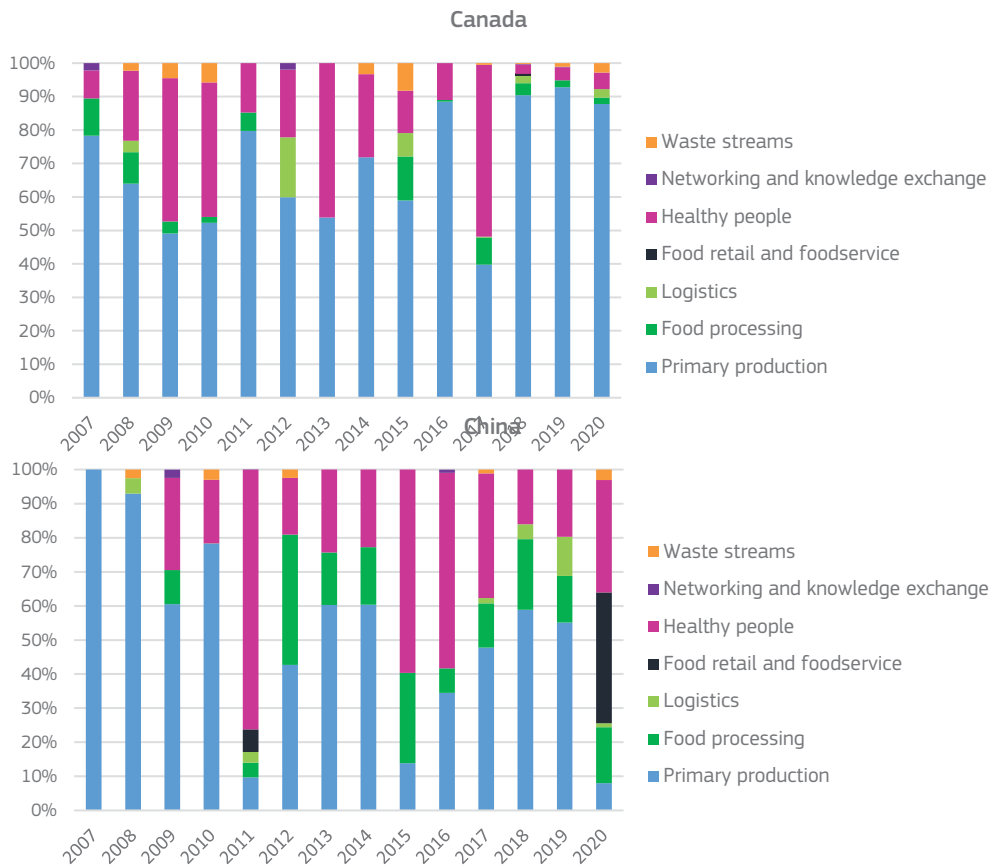


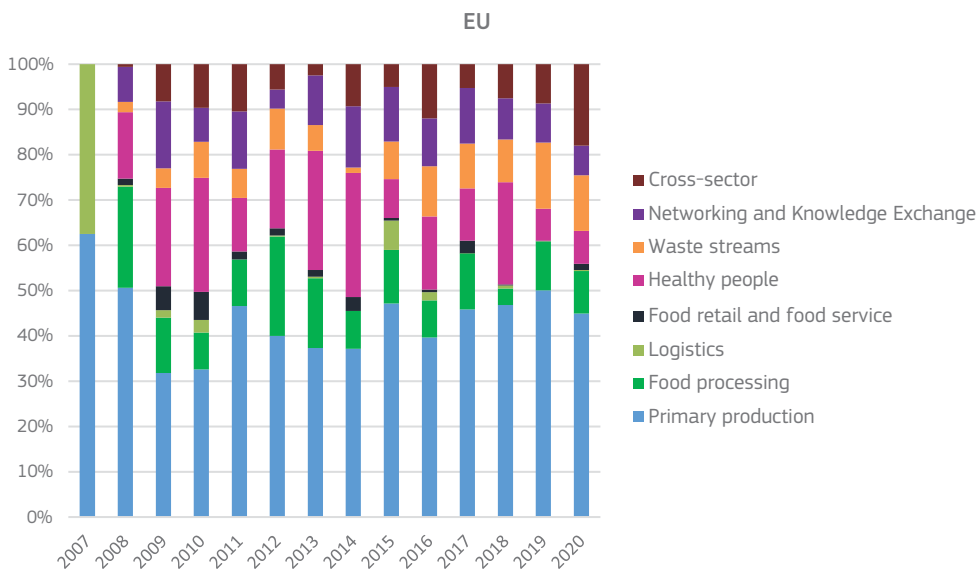
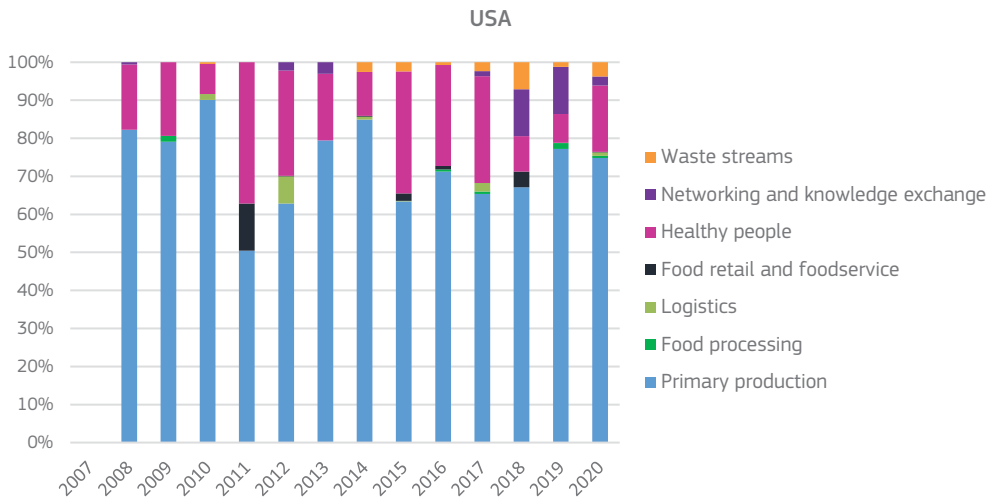
Source: SPI analysis based on three non-European countries' datasets (Canada, China, USA)

Finally, looking at the Food 2030 sectors, it is clear that most funding was allocated to the primary production sector in all three countries, especially in Canada and the USA. In China, the funding for this sector has slowly been decreasing as the years go by and as other sectors gain traction. The healthy people sector was the second most funded sector in all three countries, reaching a considerable position in China in recent years. The other four sectors had lower percentages of total funding, never reaching more than 30% of combined funding in Canada and the USA.

Comparing with the EU, whose funding per sector has seen little changes from 2007 to 2020, similarly to the three non-European countries, the primary production sector remained the most funded in this period. A difference from those countries lies in the proportion of funds allocated to both the healthy people and food processing sectors, which in the EU have similar funding each year.

Figure 29: Overall national expenditure on food R&I in Canada, China and the USA, 2007-2020 by Food 2030 sector (% of total expenditure)





Source: SPI analysis based on three non-European countries' datasets (Canada, China, USA)

4.6. Drivers of investment in food systems R&I

A factor that drives investment in food-related R&I is the ever-growing focus on the sustainability and safety of food systems – which results in a search for new and innovative methods, products and services. Indeed, the Food 2030 pathways related to these topics are among the most prioritised and funded in the 2007-2020 period. The three non-European countries studied have, in the last few years, implemented different ways to boost investment in R&I in those pathways.

The creation of favourable conditions that enable research, such as tax breaks and incentives, can promote and drive investment in food systems R&I projects. An excellent example is the Scientific Research and Experimental Development Program created by the Canadian Government, which uses tax incentives to encourage Canadian businesses of all sizes and in all sectors to conduct R&I. Good conditions and infrastructures for the researchers also contribute to promote investment in food-related R&I. The wide network of Research Centres administered by the Canadian Government is an example of such a good practice. The Governments of Canada and Ontario are also investing around \$2.5 million to strengthen the agri-food sector in Canada's most populous province (Ontario) to turn innovative ideas and solutions into marketable products that will strengthen its agri-food sector. This initiative is part of the Canadian Agricultural Partnership, a five-year \$3 billion investment by Canada's Federal, Provisional and Territorial Governments to boost the agri-food and products sectors in the country¹⁰⁹. To reach its growth targets, and according to the "Report of Canada's Economic Strategy Tables: Agri-food", Canada also needs to invest in innovation, increase technology adoption and boost competitiveness through increased automation and digitisation. This can be achieved by encouraging investment and technology adoption through significant incentives including an accelerated capital cost allowance for machinery, equipment and digital automation tools¹¹⁰.

The USA's success on food-related research projects has been built on a strong foundation of investments in agri-food R&I over the last century. However, the USA has started to fall behind some other countries which are now investing heavily in agricultural R&I. Indeed, agri-food federal funding in the USA lags behind most other federal R&I areas. To increase funding, both at the USDA and through external collaborative agriculture research and capacity-building at universities, it is necessary to provide workers and companies tools that can improve reliance and scale up climate-smart agriculture. To this end, a recent bill

¹⁰⁹ Food Matters Live, Canada's agri-food sector gets a boost with \$2.5M investment, available at: <https://foodmatterslive.com/discover/article/canadas-agri-food-sector-gets-a-boost-with-2-5m-investment/>

¹¹⁰ Canadian Gov (2020), Report of Canada's Economic Strategy Tables: Agri-food, available at: <https://www.ic.gc.ca/eic/site/098.nsf/eng/00022.html>

has been approved that will provide more than \$3 billion for USDA's R&I programmes¹¹¹. Venture capital is a further opportunity for policymakers, to invest in: i) increased incentives and improved mapping to connect communities to the digital economy; ii) easier ways for farmers to utilize new forms of capital and to practice conservation; iii) policies that support the use of food as a preventive treatment and as a means of lowering healthcare costs; and iv) repurposed commercial real estate for controlled environment agriculture¹¹².

While the USA is still a pioneer in this field due to its entrepreneurial spirit and strong financial markets, China has been closing the innovation gap by increasing, throughout the last decade, both public and private agri-food R&I expenditure. In the three years from 2013 to 2016, China registered the fastest increase in total venture capital of any economy, rising from approximately \$3 billion to \$34 billion. For agri-food start-ups alone, China's investments increased more than 200% in 2018. In order to achieve this, China has fuelled its agricultural R&I through an increase in science and engineering graduates. This surge in higher education investment has also led to an increase in food-related science publications.

¹¹¹ Agri-Pulse (2021), Opinion: Significant federal investment in food and agriculture research and development is long overdue, available at: <https://www.agri-pulse.com/articles/16186-opinion-significant-federal-investment-in-food-and-agriculture-research-and-development-is-long-overdue>

¹¹² Agri-Pulse (2021), Opinion: Policymakers have a huge opportunity to leverage venture investment in food and agriculture. Here's how., available at: <https://www.agri-pulse.com/articles/15424-opinion-policymakers-have-a-huge-opportunity-to-leverage-venture-investment-in-food-and-agriculture-heres-how>

5. ANALYSIS OF PRIVATE SECTOR EXPENDITURE ON FOOD SYSTEMS R&I

This section sets out our analysis of private sector expenditure on food systems R&I. It is presented in two parts. The first part presents the results of analysis estimating overall private sector investment using patent data. These results are based on a sample of firms of interest and depend on the significant assumption that a certain proportion innovative activity is patented – further research is necessary to validate these initial results. The second part of the section provides an analysis of equity investment in the EU and USA, using data on completed investment deals.

Headline findings

- Intellectual property in the food sector is protected in a variety of ways, including trademarks, trade secrets, and patents, with **collaboration on R&I intensifying between larger companies and start-ups**.
- According to the initial results obtained by applying an innovative analytical method, between 2012 and 2018, an estimated **EUR 93 billion** was invested in food-related innovation by the private sector in the EU. More than half of all R&I taking place in the EU food sector is carried out by **German and Dutch companies**.
- Private sector investment in the EU is concentrated in the primary production sector. A preliminary analysis of patent data seems to suggest that at **least some of the investment identified did not align** with the priorities and pathways identified in the Food 2030 initiative – suggesting that private sector investments may follow primarily individual corporate strategies, which in turn are likely to be influenced by consumer demand trends.
- Of the expenditure that did align with the Food 2030 priorities, **the largest proportion of investment (32%) aligned with priority two “climate smart and environmentally sustainable food systems”**. None of the investment identified aligned with priority four “innovation and empowerment of communities”
- The most relevant Food 2030 pathways in the dataset analysed were **‘food system waste streams’ (7%)**, followed by ‘The food safety systems of the future’ (6%), ‘Food systems and data’ (4%) and ‘Harnessing the potential of the microbiome’ (3%).

- Overall **volume of equity investments into companies active in food systems in the EU trailed behind the volume of equity deals in the USA** between 2007 and 2020 (11,910 deals in the US (worth EUR 138 billion) and 4,364 in the EU (EUR 43 billion). This confirms analysis undertaken by the EIB¹¹³, suggesting that access to finance is a major bottleneck for innovative EU-based firms active in food technologies. In part, this could be explained by regulatory differences across national markets, for instance in terms of language and labelling requirements¹¹⁴. United States-based companies account for 76% of all investment between the years 2007 and 2020.
- The number and size of equity investment deals involving food sector companies on average **grew in both the EU and the USA** between 2007 and 2020. It increased significantly more, however, in the USA than in the EU over this time period.
- Companies in the EU tend to complete a **smaller number of deals** compared to the US counterparts. Investment deals in the EU tend to be of **smaller size** compared to those involving US-based companies.

For the purpose of this analysis, private sector is broadly defined as the companies operating in the agriculture, food, and drink industry, from seed and farming equipment producers, to businesses manufacturing packaging, distributors, and food-related waste treatment businesses, therefore covering the entire food system. More specific, operational definitions are adopted in each of the two parts of this section.

This section contributes to existing evidence in the field in two ways:

- First, we use an exploratory method to estimate overall levels of private sector investment in food innovation using patenting data as a proxy. This is a very novel method built on the experience of Pasimeni et al.'s (2018)¹¹⁵ analysis of investment into climate change mitigation technologies, and is intended as an initial step in the direction of an estimation of private investment levels in the food sector. Our

¹¹³ EIB (2018), Feeding Future Generations, available at: <https://www.eib.org/en/publications/feeding-future-generations>

¹¹⁴ For example, the Food Labelling Regulation (Regulation (EU) 1169/2011) gives Member States the discretion to impose additional labelling requirements for specific categories of foods or where there are no harmonised rules at EU level. An increase in national labelling requirements for food and drinks has been noted in a recent report produced for the European Parliament: Dahlberg, E. et al., Legal obstacles in Member States to Single Market rules, page 39, Publication for the committee on Internal Market and Consumer Protection, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2020.

¹¹⁵ Pasimeni, F., Fiorini, A., and Georgakaki, A. (2019). Assessing private R&D spending in Europe for climate change mitigation technologies via patent data. *World Patent Information*, 59, 101927. <https://doi.org/10.1016/j.wpi.2019.101927>

analysis presented here would benefit from further validation at a later stage (see detailed discussion of method in the annexes)

- Second, we provide an analysis of equity investments into companies active in the food sector, comparing deals in the US and Europe. This frames our analysis in the remainder of this section by illustrating the level of risk finance available to firms in start-up, growth or acquisition phase.

5.1. Estimating private sector investment in food innovation

The food industry is generally viewed as a sector with medium- to low- research and innovation (R&I) intensity^{116,117}. Out of a total of 289,000 companies in the EU food and drink industry, only a small minority will undertake major R&I investments¹¹⁸. Most innovations in the food industry are of an incremental nature, rather than breakthrough¹¹⁹. The low degree of R&I in the agricultural and food sector is at least in part explained by the fact that the EU agricultural and food sector is mainly composed of SMEs, which tend to have less resources to conduct research. In addition, there appears to be a tendency to adopt innovation developed in other industries (such as in the case of packaging, machinery, and manufacturing supplies)¹²⁰. Innovation activity in the sector is also characterised by close interaction and collaboration between primary producers and their supply chain.

EU-based companies in the food and drink industry also tend to invest relatively less in R&D compared to other international competitors. Between 2015 and 2017, EU businesses in the food and drink industry invested around 0.2% of their total output for R&D activities. This was lower compared to companies located in South Korea (0.7%), Japan (0.7%), or in the United States (0.6%)¹²¹

Feedback gathered during a focus group held in November 2021 with senior representatives of six large companies representing the European Technology Platform (ETP) “Food for

¹¹⁶ Hockmann, H. et al., 2018. Corporate R&D and the performance of food processing firms: Evidence from Europe, Japan and North America. *Bio-based and Applied Economics*, 7(3), pp. 233-247.

¹¹⁷ Bigliardi, B., & Galati, F., 2013. Innovation trends in the food industry: The case of functional foods. *Trends in Food Science & Technology*, 31, pp. 118-129

¹¹⁸ FoodDrink Europe, 2021. *Data & Trends EU Food & Drink Industry 2021*, Brussels: FoodDrink Europe.

¹¹⁹ Ciliberti, S., Bröring, S., & Martino, G., 2015. Drivers of innovation in the European Food Industry: Evidences from the Community Innovation Survey. *Int. J. Food System Dynamics*, 6(2), pp. 175-190.

¹²⁰ Hockmann, H. et al., 2018. Corporate R&D and the performance of food processing firms: Evidence from Europe, Japan and North America., *Bio-based and Applied Economics*, 7(3), pp. 233-247.

¹²¹ FoodDrink Europe, 2021. *Data & Trends EU Food & Drink Industry 2021*, Brussels: FoodDrink Europe.

Life¹²² indicates that R&I takes place along all the parts of food systems, from farming and agriculture to consumer-facing innovation and waste streams¹²³. Because of how the various parts of food systems are interlinked and synchronised, innovation in one segment of the chain can trigger innovation elsewhere in the chain in a cascade effect¹²⁴. The focus group furthermore suggested that around 10% of all inventive activity is protected through patents.

Around 10,000 innovative firms from the food industry, a sample spanning across different partners of the food system value chain, were identified using patent data and form the population of interest for our estimation of private sector R&I.¹²⁵

Results

Table 1 shows the estimated unitary cost for a single patent in food systems. Fluctuation in the estimates may be given both by the fact that not all companies in the sample have been consistently active in the food-related patent codes (CPC) throughout the reference period, and by the fact that total R&I investment varied over time.

Table 1: Average unitary cost of patents for companies active in the food sector (EUR thousand)

	2012	2013	2014	2015	2016	2017	2018
Unitary cost	954.6	839.1	892.9	1,008.0	1,067.1	996.7	1,075.4

Source: Ipsos analysis of Patstat data.

These unit cost allow an estimation of overall R&I investment levels in food systems across all EU Member States. This is represented in Figure 30. Our estimate of overall private R&I investment steadily increased between 2012 and 2018, from an initial EUR 11.7 billion in 2012 to 16.4 bn in 2018. In total, our estimation suggests that companies across EU

¹²² European Technology Platforms (ETPs) are industry-led stakeholder fora recognised by the European Commission as key actors in driving innovation, knowledge transfer and European competitiveness. ETP Food for Life is a food-themed ETP, which aims to create a step-change in the innovation power and impact of the European food industry to the benefit of a sustainable society. Consultations with ETP "Food for Life" were facilitated by FoodDrinkEurope - an industry association based in Brussels that coordinates the work of more than 700 experts through its Committees and Expert Groups on food and consumer policy, environmental sustainability, and competitiveness.

¹²³ Focus group –ETP."Food for Life" Leadership Team

¹²⁴ Focus group – ETP."Food for Life" Leadership Team

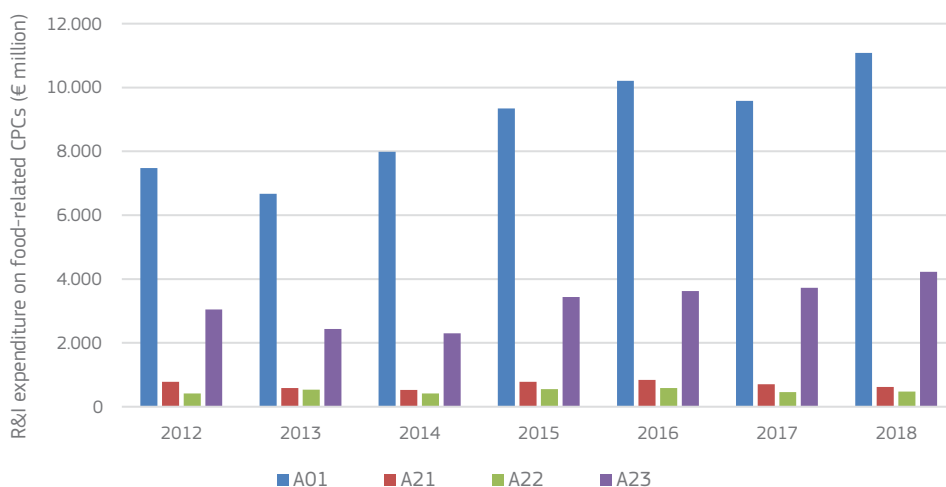
¹²⁵ For a detailed discussion of the methodology please see Annex C.

Member States invested around EUR 93 billion over the period between 2012 and 2018 (or EUR 46.5 billion under the assumption that 20% of innovation is patented). It should be noted that these estimated are highly dependent on the underlying assumption on the proportion of R&I spending reflected in patenting activity. For instance, if we assume that not 10% but 20% of research & innovation investment is reflected in patents, these estimates halve and the estimate of total investment across the period is EUR 46.5 bn.

EU companies invested to a different extent in the various technology areas (or CPC codes, as shown in Figure 30).

Investment was directed mainly towards technologies in the A01 group, followed by technologies in the A23 group, but investment is limited in the CPCs relating to technologies for bakeries and meat processing. This intuitively reflects results in other sections.

Figure 30: R&I expenditure on food-related CPCs (EUR million)



Source: Ipsos analysis of Patstat data. It should be noted that these estimated are highly dependent on the underlying assumption on the proportion of R&I spending reflected in patenting activity, derived from the focus group with FoodDrinkEurope members. For instance, if we assume that not 10% but 20% of research & innovation investment is reflected in patents, these estimates halve.

Unitary costs can also be used to estimate the overall level of R&I expenditure on food-related technologies at national level. National estimates are influenced by the presence of large food-sector companies headquartered in the country. Table 2 shows estimated R&I investment levels in the food sector by Member State.

Table 2: Private R&I investment into EU food sector, by Member State (EUR million)

Country	2012	2013	2014	2015	2016	2017	2018
AT	270.3	436.7	432.6	405.3	528.3	389.5	487.2
BE	498.0	424.4	521.0	791.9	896.1	1,047.3	1,106.1
CY	0.6	1.5	0.3	18.8	4.6	34.4	N/A
CZ	75.5	73.5	54.0	46.4	34.2	112.8	104.8
DE	4,256.0	3,389.7	4,280.7	5,185.1	5,935.6	5,423.7	6,253.5
DK	339.1	441.9	448.2	448.1	608.0	590.7	836.5
EE	N/A	1.3	7.5	5.0	16.4	13.3	5.4
EL	82.9	37.9	26.3	85.7	10.7	22.9	13.6
ES	514.7	516.2	694.0	756.8	758.1	770.2	546.5
FI	288.2	218.9	188.2	242.7	238.0	243.0	318.8
FR	1,499.6	1,149.9	1,445.6	1,622.9	1,656.6	1,621.7	1,708.4
HU	60.4	4.2	31.5	115.7	115.2	92.7	80.8
IE	65.1	64.9	79.4	89.5	41.2	26.9	123.1
IT	1,303.8	1,259.4	714.3	1,272.4	1,739.6	1,502.2	1,321.7
LT	1.3	22.5	37.8	0.4	1.2	2.9	N/A
LU	105.5	33.3	54.7	121.2	54.7	41.3	15.2
LV	6.3	3.4	N/A	5.9	10.7	2.6	10.8
NL	1,656.6	1,569.3	1,666.4	2,240.9	1,945.2	1,912.1	2,592.4
PL	68.1	29.4	64.3	114.2	65.4	67.6	72.6
PT	48.2	30.0	29.3	33.0	54.4	59.3	31.8
SE	475.2	456.6	401.7	465.4	509.2	463.7	735.4
SI	36.6	39.3	15.6	16.8	13.3	28.2	34.6
Total	11,652	10,204.2	11,193.4	14,084.1	15,236.7	14,469	16,399.2

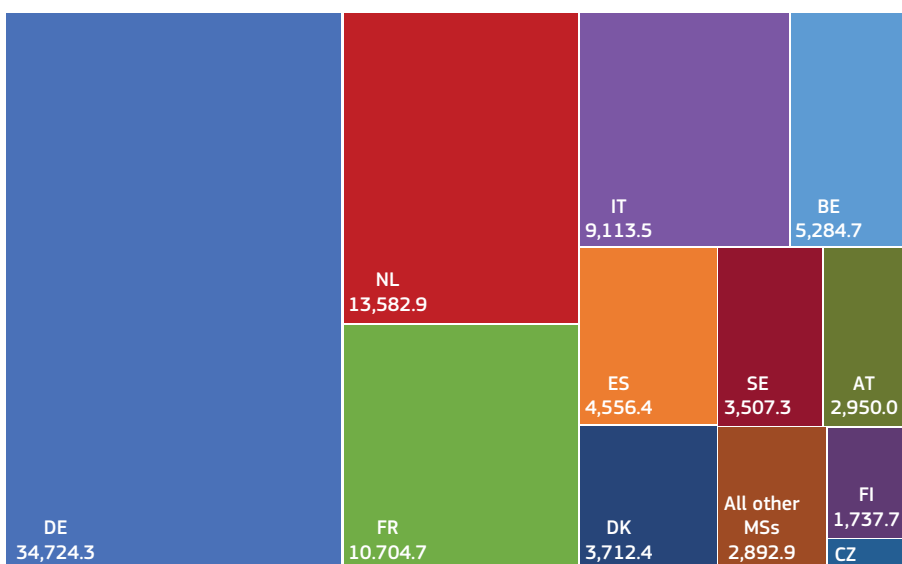
Source: Ipsos analysis of Patstat data.

Note: Member States with more than two missing years of data have been omitted (HR, MT, RO, SK, BG). N/A cells are years where no patenting activity in relevant patent classification has been recorded in PatStat for the respective country. It should be noted that these estimates are highly dependent on the underlying assumption on the proportion of R&I spending reflected in patenting activity, derived from the focus group with FoodDrinkEurope members. For instance, if we assume that not 10% but 20% of research & innovation investment is reflected in patents, these estimates halve.

These estimates will vary due to changes in R&I expenditure at company level, and to the fact that not all companies in the sample have been active in the food sector every year between 2012 and 2018.

Companies based in Germany appear to be investing the most in R&I for food, with almost EUR 35 billion invested between 2012 and 2018, as illustrated in Figure 31. The Netherlands follows, with investments in excess of EUR 13 billion. Together, the top two Member States account for over half (52%) of all R&I investment in food-related technologies between 2012 and 2018 in the European Union.

Figure 31: Companies ‘ total investment in food R&I, 2012-2018, by Member State (EUR million)



Source: Ipsos analysis of Patstat data.

Note: All Member States are included in the chart, including those omitted in the previous table (HR, MT, RO, SK). It should be noted that these estimated are highly dependent on the underlying assumption on the proportion of R&I spending reflected in patenting activity, derived from the focus group with FoodDrinkEurope members. For instance, if we assume that not 10% but 20% of research & innovation investment is reflected in patents, these estimates halve.

5.2. Mapping of inventive activity to Food 2030 sectors

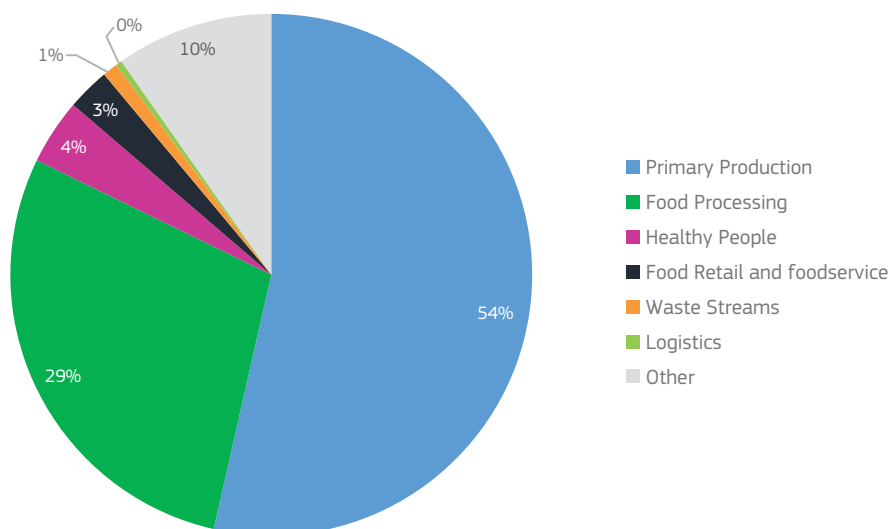
As a further step in the analysis, a sample of 1,319 first filing patent applications¹²⁶ with abstracts in English were reviewed and classified against Food 2030 sectors to provide a thematic breakdown of inventive activity in the food sector. As discussed above, this analysis focusses on private R&I reflected in patent application, and does not consider other forms of inventive activity.

Inventive activity by sector

Figure 32 shows the share of total patent applications across the entire period (2012-2018). Primary production received a share of 54% of the sample, followed by food processing at 29%, healthy people at 4.1% and food retail and foodservice at 2.7%. Waste streams and logistics both had a low share of sample patent applications at 0.9% and 0.4% respectively. Both Networking and knowledge exchange and Cross-sector received a 0.5% share of patent applications. The remaining 9.7% of patent applications could not be categorised into any of the above sectors, and hence are categorised as “other”. This included technologies relating to household cooking equipment, inventions relating to the disposal of timber or process patent applications related to biological production of particular food additives. Interview feedback from the FoodDrinkEurope ETP suggests that innovation is widely spread across the food system, although it might be more limited around process innovation. There is a wide range of technologies, processes and products used within primary production and hence many patent applications will be captured by this sector in the analysis. Patent applications within this sector found in the analysis include patents relating to the prevention of pests (pesticides and fungicides), efficiency and functioning of agriculture tools and systems (automated/improved machinery related to agriculture, irrigation and livestock) and technologies related to plant genetics.

¹²⁶ First filing refers to the first patent application made for an invention. The same invention, depending on the patenting route chosen, can then be filed in other offices to seek protection in additional jurisdictions. Many first filings are not made in English, therefore restricting the data available for this analysis.

Figure 32: Total patent applications in the European food industry, by sector, 2012-2018



Source: Ipsos analysis of Patstat data.

5.3. Private equity

This analysis seeks to compare private investment patterns and trends in food systems in the European Union and in the United States. The data used is obtained from PitchBook based on user-defined queries (further explained in the annex).

The analysis that follows looks at equity investments in the food sector in the EU and the US. This section complements our analysis of patenting activity as a proxy for private R&D investment, by providing an overview of financing available to firms active in the food sector who are in start-up or growth phase. Firms in the sector also raise equity for acquisitions and mergers. This analysis presents some examples of notable deals that have been completed between 2007 and 2021¹²⁷. Types of deals included in the analysis are listed below.

- **Venture capital (VC):** This is a form of financing where an investor provides capital (usually to a start-up or small business) in return for equity. Venture capital investments are often made by specialised firms that, in addition to funding, provide mentorship to the companies they invest in. Venture capital includes a variety of stages.

¹²⁷ Until and including 30th November 2021.

- **Pre/accelerator/incubator:** VC funds set up pre-seed, accelerators, and incubators programmes. Early-stage companies can thus apply for these programmes in order to receive funding and development support. In particular, accelerators aim to lead companies to quick, exponential growth, in return for an equity stake. Incubators instead often work in partnership with universities or business schools and seek to develop a company with a business model and growth prospects.
 - **Angel:** This type of investment is broadly similar to VC, although investors are normally individuals rather than venture capitalist firms.
 - **Seed:** Seed VC is generally one of the first forms of VC that an early-stage company may receive. It involves small amounts of capital for activities such as product testing or the development of a business plan. Investors normally receive convertible notes, future equity, or preferred stocks. It normally precludes to further VC investment.
 - **Early-stage VC:** This form of VC is normally for companies that are in the development phase. Funding is generally provided in rounds (also called 'series').
 - **Later stage VC:** This is funding for companies that have reached a higher degree of maturity (although they are not necessarily profitable yet). Also in this case, funding is provided via funding rounds.
- **Private equity:** Private equity refers to the investment of capital in mature businesses in traditional industrial sectors, in exchange for equity, or ownership. PitchBook includes two main types of investments under 'private equity'.
 - **Private equity growth/expansion:** Growth capital (or 'expansion capital') is a type of investment directed generally towards mature companies with a potential to expand. As this type of investment is mainly reserved for mature companies, it is not affected by the risks typically associated with investment in early-stage companies.
 - **Private investment in public equity (PIPE):** This name defines investments made in publicly traded businesses, generally when the value of a company has fallen and therefore leaves the company in need of new sources of capital.

- **Public investment:** This type of investment relates to companies that sell shares on a stock exchange. This includes investments in stocks or bonds. There are two types of public investment that are taken into account in this analysis
 - **Initial public offerings (IPOs):** These are processes that take place when a private company is floated on the stock market, allowing it to raise investment from public investors.
 - **Secondary offerings (2POs):** 2POs are linked to IPOs because they are essentially the purchase of equity from early backers (or founders).

All these types of deals are referred to as ‘investments’ in the ensuing sections, for the sake of conciseness.

Investors include a variety of organisations, from more ‘traditional’ actors such as investment divisions of banks and insurance brokers, to private equity firms such as multinational investment management corporations and smaller venture capitalists.

Overall investment trends in the food sector

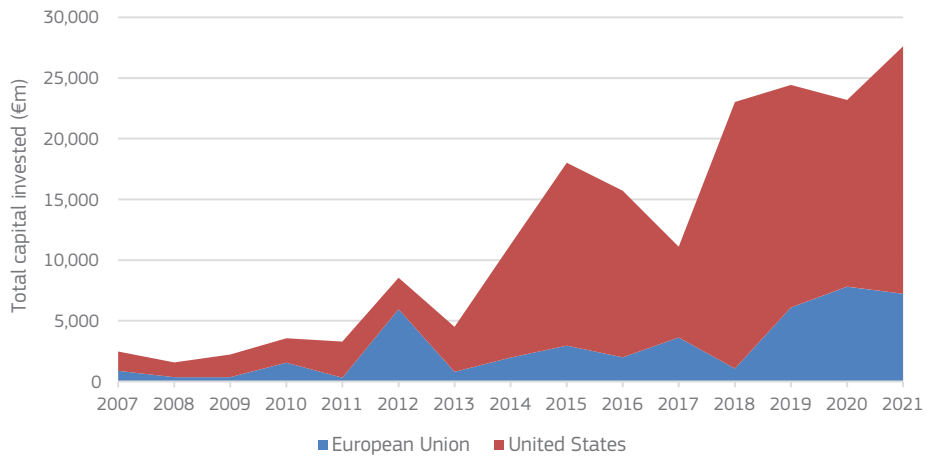
After a period of sluggish growth until 2011, the private equity market for the food sector¹²⁸ has overall followed a positive trend in the European Union and the United States through to 2021, as reported in Figure 33. Despite the average growth of investment, there has nevertheless been a certain degree of volatility driven by a number of specific deals.

The COVID-19 pandemic might have initially caused investors to defer some of their planned investments, but it does not appear to have significantly affected investment levels in 2020 and 2021. However, the absence of a sharp decrease in investment levels around 2020 might be explained by a trend that was already in motion prior to COVID-19, which has seen a general shift from funding on public markets to private transactions, especially in more mature capital markets such as the United States¹²⁹.

¹²⁸ The companies included in this analysis were selected based on user-defined queries on PitchBook that included a combination of industries, verticals, and keywords relating to the broad definition of food systems used in Food 2030. Further information on the criteria used for this analysis is presented in Annex D.

¹²⁹ Lehmann, A., 2020. Private equity and Europe's re-capitalisation challenge, <https://www.bruegel.org/2020/09/private-equity-and-europes-re-capitalisation-challenge/> (Accessed 1 December 2021).

Figure 33: Total equity investment (venture capital, growth capital via private equity, and public fundraisings)

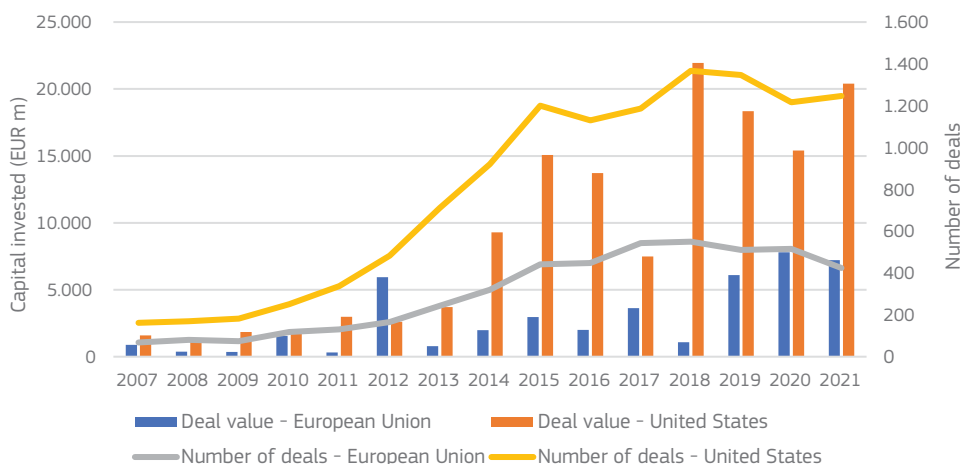


Source: PitchBook (2021), Ipsos user-defined queries.

Note: Data for 2021 is inclusive up to 30 November 2021. Methodological details available in Annex D.

The difference between the European Union and the United States both in terms of number of deals and capital invested can be seen in Figure 34.

Figure 34: Trends in in venture capital and growth capital via private equity investments and public fundraisings in the EU and the US



Source: PitchBook (2021), Ipsos user-defined queries.

Note: Data for 2021 is inclusive up to 30 November 2021. Methodological details available in Annex D.

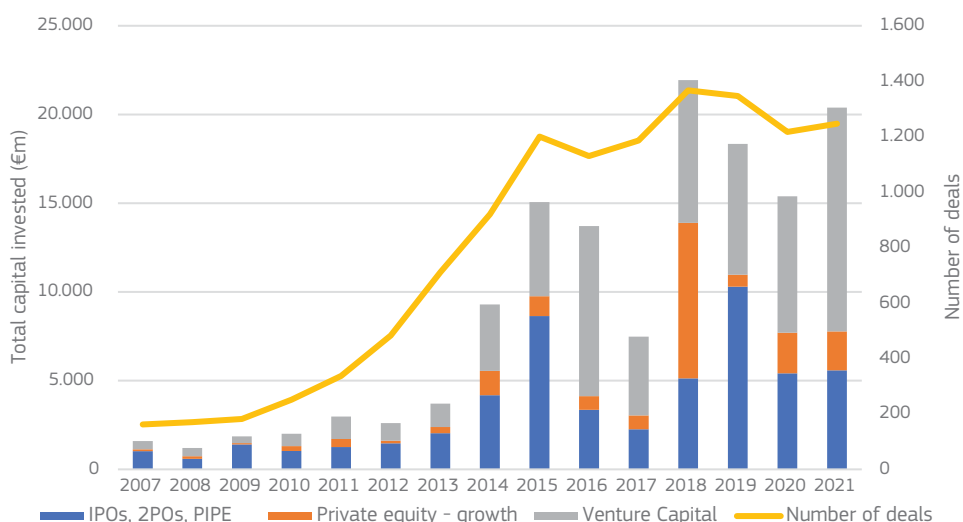
United States

United States-based companies account for 76% of all investment between the years 2007 and 2021. Among the most notable deals in terms of size are:

- **Keurig Dr Pepper:** Keurig Dr Pepper is a producer and distributor of hot and cold drinks headquartered in the United States, which was formed in 2018 following the merger of Keurig Green Mountain and Dr Pepper Snapple Group. The deal was funded via a private equity growth investment of EUR 7.4 billion in January 2018.
- **Uber:** Uber, originally a ride-sharing platform based in the US, launched Uber Eats, its online food ordering and delivering platform, in 2014. In May 2019, the company attracted an IPO of EUR 7.2 billion.
- **Mondelez International:** Previously part of Kraft Foods, the company owns a number of snack brands and operates in over 150 countries. It received EUR 5 billion PIPE development capital investment in August 2015.

Private investment in US-based companies in the food system has increased considerably from 2013, as illustrated in Figure 35. IPOs, secondary offerings, and PIPE deals account on average for around half of the funding each year. At the same time, VC investments raised increasingly larger sums of capital, and accounted for 62% of all investments in 2021¹³⁰. Apart from a significant expansion in 2018, driven by the deal for Keurig Dr Pepper, the share of growth equity investment has increased mainly in 2020 and 2021, possibly as a result of companies facing liquidity constraints.

Figure 35: Trends in in venture capital and growth capital via private equity investments and public fundraisings in US-based firms



Source: PitchBook (2021), Ipsos user-defined queries.

Note: Data for 2021 is inclusive up to 30 November 2021. Methodological details available in Annex D.

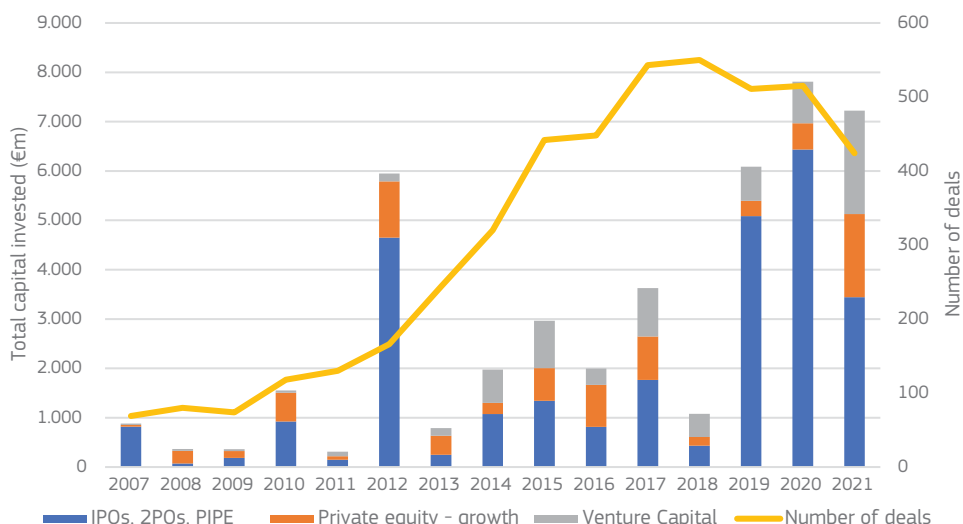
EU investments

Overall, the number of deals in the EU between 2007 and 2021 was on average 40% of the number of deals taking place in the US. This is reflected in the size of funding raised: the value of investments in EU companies stood at 45% of the investments made in companies headquartered in the United States. This means that not only that the number of deals in the EU food sector compared to the US was smaller, but also that the average size of

¹³⁰ Until and including 30th November 2021.

deals in the US is considerably larger, as can be observed by comparing trends in the US (Figure 35) and in the EU (Figure 36).

Figure 36: Trends in in venture capital and growth capital via private equity investments and public fundraisings in EU-based firms



Source: PitchBook (2021), Ipsos user-defined queries.

Note: Data for 2021 is inclusive up to 30 November 2021. Methodological details available in Annex D.

As shown in Figure 36, funding in the EU is predominantly raised through IPOs, secondary offerings, or PIPE, with VC accounting for a limited share of overall investment (19% on average), in striking contrast with the US market.

In the European Union, some of the largest deals included the following.

- **JDE Peet’s:** The coffee and tea producer based in the Netherlands attracted a EUR 4.6 billion investment during their IPO on the Amsterdam stock exchange in June 2018.
- **Budweiser Brewing:** The brewing company, headquartered in Belgium, raised EUR 4.5 billion in its IPO in September 2019.

- **Industria Macchine Automatiche:** The Italian-based packaging company that designs automatic machines for the processing and packaging of food, tea, and coffee (but also pharmaceutical products and cosmetics) received EUR 1.3 billion PIPE in July 2020.

Conclusion

Private investment in the food sector between 2007 and 2020 has shown a growth pattern on average, with fluctuations after 2013 mainly due to large deals involving individual companies. However, a comparison of deal numbers and values, as well as types of investments, suggests that the EU market lags behind compared to the US. Whilst between 2007 and 2020 US-based companies in the agriculture and food sector were involved in 11,910 deals, EU companies concluded only 4,634 deals. In particular, deals in the EU appear to be generally worth less compared to US deals. EU deals, on average, were worth EUR 9.7 million, whilst the average US deal was worth over EUR 11.5 million. Furthermore, the VC market in the EU appears to be not as developed as it is in the US market, potentially limiting growth prospects for start-ups and scale-ups.

It is possible that the differences in investment patterns between the EU and the US observed in the food sector are a reflection of broader, structural issues that affect equity markets in Europe.

Overall, companies in Europe face a lack of financial support at early stages, and in later funding stages when trying to scale up¹³¹. In addition to this, larger companies tend to rely more on debt financing compared to companies in the US¹³². This lag between the EU and the US may be explained by a number of factors.

Firstly, investors in the European Union and the United States are inherently different. Companies in the United States have access to **significantly larger investors**, capable of leveraging larger sums of money¹³³, such as pension funds, which do not have as much of a prominent role in the EU's finance landscape. Differences in the types of investors therefore

¹³¹ World Economic Forum, 2019. Europe is no longer an innovation leader. Here's how it can get ahead. Available at: <https://www.weforum.org/agenda/2019/03/europe-is-no-longer-an-innovation-leader-heres-how-it-can-get-ahead/> (Accessed 13 January 2022).

¹³² European Investment Bank, 2019. Investment Report 2018/2019: Retooling Europe's Economy, p. 233. Luxembourg: European Investment Bank. Available at: https://www.eib.org/attachments/efs/economic_investment_report_2019_en.pdf (Accessed 11 February 2022).

¹³³ European Investment Bank, 2020. Investment Report 2019/2020: Accelerating Europe's Transformation, p. 215. Luxembourg: European Investment Bank. Available at: https://www.eib.org/attachments/efs/economic_investment_report_2019_en.pdf (Accessed 11 February 2022).

influence the types of **financing instruments available**. Venture capital is generally a much more common private equity tool in the United States than it is in the EU¹³⁴. Vice versa, bank lending is prevalent in the EU, whereas the US market is split almost equally between bank loans and securities¹³⁵.

Member States and the EU have put in place programmes to help overcome at least the 'valley of death' that start-ups and scale-ups typically go through. However, efforts have mainly concentrated on the early phases of R&I, rather than on the scale-up phase¹³⁶. For this reason, support programmes could concentrate on the full journey to commercialisation, ensuring that support is available where the risk linked to innovation is greater and investors are less likely to provide financial backing.

¹³⁴ European Investment Bank, 2020. Investment Report 2019/2020: Accelerating Europe's Transformation, p. 306. Luxembourg: European Investment Bank. Available at: https://www.eib.org/attachments/efs/economic_investment_report_2019_en.pdf (Accessed 11 February 2022).

¹³⁵ European Investment Bank, 2019. Investment Report 2018/2019: Retooling Europe's Economy, p. 233. Luxembourg: European Investment Bank. Available at: https://www.eib.org/attachments/efs/economic_investment_report_2019_en.pdf (Accessed 11 February 2022).

¹³⁶ European Investment Bank, 2020. Investment Report 2019/2020: Accelerating Europe's Transformation, p. 337. Luxembourg: European Investment Bank. Available at: https://www.eib.org/attachments/efs/economic_investment_report_2019_en.pdf (Accessed 11 February 2022).

6. ZERO MEASUREMENT

In this section, we present a “zero measurement”¹³⁷ with regard to the current state of play in terms of food R&I across the EU in the previous two funding periods (FP7 and Horizon 2020). This is intended to act as a starting point, or baseline measure, against which EU R&I investments can be monitored and evaluated in future in view of EU food and nutrition-related policies.

Our zero measurement is divided into three parts:

1. Consideration of the current state of play with regard to the policy context to help understand the extent to which food systems R&I is explicitly considered at national level.
2. Consideration of the current state of play with regard to overall R&I expenditure and expenditure on food systems particularly to understand the extent of investment in R&I prior to the introduction of Horizon Europe.
3. Consideration of the overall alignment of food systems R&I with the sectors, priorities and pathways identified in the Food 2030 initiative to understand the extent to which there was a pre-existing alignment with these strategic concerns prior to the introduction of Food 2030 and Horizon Europe.

¹³⁷ A “zero measurement” or baseline measure reflects the state of play before an action has been implemented. For the purposes of this study, the zero measurement therefore represents a summary of the state of play under the last two programming periods (FP7 and H2020) against which expenditure under the 2021-2027 programming period (Horizon Europe) can be measured. This will help to analyse the extent to which there is an overall increase in food R&I investments and identify any trends in terms of alignment with and focus on the different Food 2030 pathways.

Table 3: Zero Measurement (FP7 and H2020 funding programmes)

Indicator	Funding programme	Current State of play at:	
		EU level	National level
Policy Context			
Explicit reference to food within national R&I policy	FP7	Food included as a specific funding stream within FP7 and H2020 programmes	Food explicitly referenced in 23 national R&I policies
	H2020		
Explicit reference to R&I within national food policy	FP7	Food 2030 initiative introduced in 2016	R&I included within food policy in 11 countries
	H2020		
Existence of specific food R&I policy	FP7	Food 2030 initiative introduced in 2016	11 MS have specific Food R&I policies in place (most since introduction of Food 2030 in 2016)
	H2020		
R&I Expenditure			
Government funding for R&I as a proportion of GDP	FP7	EU average: 1.5%	Ranges from 0.4% to 3.5% of GDP
	H2020	EU average: 1.6%	Ranges from 0.5% to 3.3% of GDP
Public sector funding for food-systems R&I as a percentage of overall innovation funding	FP7	2.6% of total funding provided aligned with the Food 2030 priorities and/or pathways	Ranges from 0.1% to 2.1% of overall government R&I expenditure
	H2020	5% of total funding provided aligned with the Food 2030 priorities and/or pathways	Ranges from 0.1% to 2.7% of overall government R&I expenditure
Alignment with Food 2030 initiative			
Distribution of R&I funding according to the Food 2030 priorities			
<i>Priority one: Nutrition for sustainable and healthy diets</i>	FP7	31% of relevant funding EUR 411.8 million	27% of identified funding EUR 521 million
	H2020	20% of relevant funding EUR 793.1 million	28% of identified funding EUR 704 million

<i>Priority two: Climate smart and environmentally Sustainable food Systems</i>	FP7	34% of relevant funding EUR 452.3 million	46% of identified funding EUR 887 million
	H2020	37% of relevant funding EUR 1.472 billion	43% of identified funding EUR 1.1 billion
<i>Priority three: Circularity and resource efficiency of food systems</i>	FP7	20% of relevant funding EUR 274.5 million	16% of identified funding EUR 312 million
	H2020	28% of relevant funding EUR 1.149 billion	22% of identified funding EUR 535 million
<i>Priority four: Innovation and empowerment of communities</i>	FP7	15% of relevant funding EUR 195.1 million	10% of identified funding EUR 191 million
	H2020	15% of relevant funding EUR 588.6 million	7% of identified funding EUR 169 million
Distribution of R&I funding according to the FOOD 2030 pathways¹³⁸			
<i>Alternative proteins and dietary shift</i>	FP7	2% of relevant funding EUR 32.1 million	2% of identified funding EUR 44 million
	H2020	3% of relevant funding EUR 104.9 million	5% of identified funding EUR 155 million
<i>Urban food systems transformation</i>	FP7	1% of relevant funding EUR 12.5 million	1% of identified funding EUR 13 million
	H2020	3% of relevant funding EUR 119.2 million	1% of identified funding EUR 29 million
<i>Food safety systems of the future</i>	FP7	18% of relevant funding EUR 232.5 million	25% of identified funding EUR 574 million
	H2020	12% of relevant funding EUR 416.7 million	23% of identified funding EUR 673 million
<i>The microbiome world</i>	FP7	6% of relevant funding EUR 77.7 million	2% of identified funding EUR 49 million
	H2020	3% of relevant funding EUR 95 million	3% of identified funding EUR 75 million

¹³⁸ Pathways do not add up to 100% as some projects align with a Food 2030 priority but not a pathway, and therefore a proportion are marked as "other". These are not relevant for the purposes of the zero measurement and have therefore not been included in this table.

<i>Healthy, sustainable and personalised nutrition</i>	FP7	12% of relevant funding EUR 155.7 million	7% of identified funding EUR 167 million
	H2020	6% of relevant funding EUR 204 million	10% of identified funding EUR 289 million
<i>Food waste and resource efficiency</i>	FP7	13% of relevant funding EUR 177.1 million	6% of identified funding EUR 130 million
	H2020	16% of relevant funding EUR 558.6 million	10% of identified funding EUR 283 million
<i>Food systems Africa</i>	FP7	3% of relevant funding EUR 39.3 million	5% of identified funding EUR 109 million
	H2020	4% of relevant funding EUR 128.8 million	1% of identified funding EUR 36 million
<i>Food from the ocean and freshwater resources</i>	FP7	10% of relevant funding EUR 135.7 million	4% of identified funding EUR 84 million
	H2020	11% of relevant funding EUR 407.8 million	5% of identified funding EUR 139 million
<i>Governance and system change</i>	FP7	10% of relevant funding EUR 134.9 million	7% of identified funding EUR 151 million
	H2020	8% of relevant funding EUR 269.5 million	4% of identified funding EUR 108 million
<i>Food Systems and Data</i>	FP7	7% of relevant funding EUR 98.4 million	6% of identified funding EUR 141 million
	H2020	15% of relevant funding EUR 539.6 million	7% of identified funding EUR 200 million

Areas of high investment density (based on analysis of Food 2030 sectors, pathways and priorities)	FP7	<p>Sectors: primary production; healthy people</p> <p>Thematic areas: food waste/resource efficiency (especially packaging); food safety; healthy, sustainable and personalised nutrition.</p> <p>Type of research: strong focus on academic institutions (basic research)</p>	<p>Sectors: primary production;</p> <p>Thematic areas: food safety, food systems and data; food waste/resource efficiency (especially packaging); healthy, sustainable and personalised nutrition.</p> <p>Type of research: strong focus on academic institutions (basic research)</p>
	H2020	<p>Sectors: primary production</p> <p>Thematic areas: food waste/resource efficiency (especially packaging); food systems and data; food safety.</p> <p>Type of research: strong focus on academic institutions (basic research)</p>	<p>Sectors: primary production;</p> <p>Thematic areas: food safety, food systems and data; food waste/resource efficiency (especially packaging); healthy, sustainable, and personalised nutrition.</p> <p>Type of research: strong focus on academic institutions (basic research)</p>
Areas of low investment density (based on analysis of Food 2030 sectors, pathways and priorities)	FP7	<p>Sectors: Logistics; food retail and food service</p> <p>Thematic areas: Urban food systems; alternative proteins; Food systems Africa</p>	<p>Sectors: Logistics; food retail and food service</p> <p>Thematic areas: Urban food systems; alternative proteins; the microbiome; Food systems Africa; governance and systems change; food from the ocean and freshwater resources.</p>
	H2020	<p>Sectors: Logistics; food retail and food service</p> <p>Thematic areas: Urban food systems; alternative proteins; the microbiome world; Food systems Africa</p>	<p>Sectors: Logistics; food retail and food service</p> <p>Thematic areas: Urban food systems; alternative proteins; the microbiome; Food systems Africa; governance and systems change; food from the ocean and freshwater resources.</p>

7. RESEARCH FINDINGS

In this section, we draw on the research outputs described in the previous four chapters to provide answers to the research questions defined in the Terms of Reference for this study.

7.1. What is the current state of play with regard to public and private R&I expenditure on food systems in Europe (at EU and national level)?

Our review of R&I funding at both EU and national level shows that it continues to be determined by traditional separations into distinct policy areas (with basic research, for example, often viewed as more closely linked to education and research institutes, while applied innovation is more closely tied to industrial strategy). In general, food policy appears to be closely tied to agriculture and the majority of R&I funding (at both EU and national levels as well as in the private sector) was provided to the primary production sector.

Around 15% of EU Framework Programme funding was provided to food systems R&I

- From 2007 to 2020, almost **EUR 18.4 billion** of funding from the EU Framework Programmes is estimated to have been provided to projects directly or indirectly related to food systems.¹³⁹ This accounts for **15%** of the total EU public funding available under FP7 and Horizon 2020.
- Under FP7, the European Commission contributed approximately EUR 1.3 billion to R&I projects aligned with at least one of the Food 2030 priorities and pathways. This represents approximately 3% of the total FP7 budget (EUR 53.2 billion).¹⁴⁰ Under Horizon 2020, this increased to a little over EUR 3.5 billion (almost 5% of the total EUR 70.2 billion budget)¹⁴¹, bringing the total amount of funding for food-related R&I projects aligned with Food 2030 during the 2007-2020 period to EUR 4.84 billion.
- Project size, as well as the average amount of EU public funding granted per project, were similar across FP7 and Horizon 2020. On average, total costs of a food-systems

¹³⁹ This refers to projects that responded to our keyword search (as described in the methodology and in annex A)

¹⁴⁰ UK Gov (2010), EU Science & Technology Funding, available at: <https://www.parliament.uk/globalassets/documents/post/postpn359-eu-science-funding.pdf>

¹⁴¹ European Commission website, Horizon 2020, available at: https://ec.europa.eu/programmes/horizon2020/sites/default/files/Factsheet_budget_H2020_0.pdf

related project amounted to EUR 2.6 million under FP7 and to EUR 2.5 million under Horizon 2020 and the total amount of European public funding to EUR 2 million and EUR 2.1 million per project respectively.

At least EUR 5.5 billion of public funding was provided to food systems R&I at the national level

- At national level, it was hard to determine a specific figure for the total amount of food systems R&I expenditure. This relates to the fact that food is a multi-disciplinary policy area and therefore, in most cases, there is no centralised collection of food-related expenditure. Instead, food systems R&I is fragmented between different ministries, agencies and institutions.
- Additionally, the period in question (2007 to 2020) incorporated the 2008 financial crisis, which led to many reorganisations and consolidations of different Ministries.
 - In many cases, data is not published publicly, leaving researchers dependent on data extracts provided by national ministries, as well as research and innovation agencies, from internal databases. Although this was done in response to a set of agreed keywords, in many instances databases were not organised to accommodate this and national level stakeholders therefore provided lists of what they perceived to be the most relevant projects.
 - In other cases, national level stakeholders were not able to locate relevant data on food systems R&I expenditure, either because the data had been lost or not recorded in a way that allowed for it to be identified as “food-related”.
- Our research has therefore identified a **total expenditure of EUR 5.5 billion** in national-level expenditure on food systems R&I between 2007 and 2020¹⁴², but this figure is believed to be an under-estimate as a number of data gaps have been identified in this study (see section 1.9).
- Additionally, in some cases national databases did not distinguish between EU and national funding. Therefore, although all best efforts have been made to remove duplication, some EU funding may be included in this estimate.

¹⁴² Data available for 26 Member States.

German and Dutch companies account for half of all private sector R&I into food systems

- An estimation of private sector funding based on a review of food-related patents¹⁴³ filed calculated EUR 93 billion had been invested by European firms (both those headquartered in the EU and those which act as subsidiaries of firms headquartered in the EU) between 2012 and 2018.
- Of these, companies in Germany (EUR 35 billion) and the Netherlands (EUR 13 billion) appear to be the most active in R&I, accounting for over half (52%) of all private sector R&I investment identified in food-related technologies between 2012 and 2018 in the European Union.

7.2. What trends can be identified in public and private expenditure on food systems in Europe (at EU and national level) from 2007 to 2020? To what extent does R&I expenditure on food systems match the priorities and pathways identified in Food 2030?

Amounts of funding allocated to Food2030 priorities and pathways have increased over the last few years

- A positive trend in overall expenditure on food systems R&I can be noted in the public sector at both EU and national level, with increased amounts of funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.
- This trend is mirrored in the private sector analysis, which shows an increase both in private sector R&I investment and private equity investment (venture capital and growth funds) over the period of interest.
- Although 11 of 27 EU Member States have a food R&I policy in place as of October 2021, in the majority of cases these have been introduced in recent years (post-2016), meaning that for most of the reference period for this study there was no high level policy or strategy guiding expenditure on food systems R&I.
- At EU level, the launch of Horizon 2020 in 2014 marked a notable uptick in terms of expenditure on food systems R&I, linked to the inclusion of a specific Societal

¹⁴³ Patents filed by companies covering the entire food system. Our analysis covered companies operating in the agriculture, food, and drink industry, from seed and farming equipment producers, to businesses manufacturing packaging, distributors, and food-related waste treatment.

Challenge dedicated to Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy.

- The introduction of Food 2030 also seems to have had an impact, with a number of Member States adopting food systems-specific R&I strategies since 2016. Interview feedback from others suggested an increasing alignment with the Food 2030 policies and priorities can be expected over the coming years.

Public and private R&I expenditure mainly target primary production

- When considering expenditure at different points in the food system, public sector funding for primary production has remained consistently high at both EU and national levels across the reference period for this study.
- Although there are some variations year-on-year, primary production consistently represents between 60 and 80% of national public sector R&I expenditure within Europe. At EU level, primary production also represents the largest proportion of R&I expenditure, at 44% of overall EU funding analysed.
- Since 2012, however, there has been a notable increase in public R&I expenditure on waste streams (particularly following the introduction of the EU Circular Economy Package in 2015) and on food processing (believed to be linked to an increased focus on innovations in packaging technologies).
- Primary production also dominated when considering food-related patents as a proxy of private sector activity - representing 54% of all patent applications analysed, although there is a more equal spread of investment along the supply chain. Food processing, in particular, receives a more significant proportion of private sector investment than that identified in the public sector analysis.
- This reflects the feedback received from Research Directors of six major food companies, who reported that innovation is taking place at all stages of the food value chain. It may also reflect the fact that a large amount of the value added for the food industry in terms of consumer prices takes place in the processing sector.

Influence of Food 2030 on R&I spending varied by thematic focus, programme and country

- The introduction of Food 2030 in 2016 acted as a clear signal of intent at EU level regarding the importance of investment in food systems R&I.
- Interviews with national stakeholders in the EU Member State suggests that going forward, national funding will be increasingly aligned with the Food 2030 pathways and priorities.

Alignment with Food 2030 priorities:

- EU-level funding for all four Food 2030 priorities increased between 2007 and 2020, however there are some notable differences in terms of the proportion of funding allocated to each priority.
- Most significantly, the proportion of funding allocated to priority one “nutrition for sustainable and healthy diets” decreased from 31% to 20% between FP7 and Horizon 2020, while the proportion of spending on priority three “circularity and resource efficiency of food systems” increased from 20% to 28%. Again, this is believed to reflect the EU’s policy priorities, with a significant focus on Circular Economy principles from 2015 onwards.
- The highest proportion of funding allocated under both FP7 and Horizon 2020 aligned with priority two “climate smart and environmentally sustainable food systems”, accounting for 34% of relevant spending under FP7 and 37% under Horizon 2020.
- A relatively similar trend can be seen at national level, with priority two “climate smart and environmentally sustainable food systems” receiving the largest proportion of funding in any given year, and funding for priority one “nutrition for sustainable and healthy diets” and priority three “circularity and resource efficiency of food systems” increasing in relative significance over time.
- Priority four “innovation and empowerment of communities” consistently received the least funding at EU and national level.

- A few individual countries bucked this trend, however:
 - Poland allocated the largest proportion of national funding to priority four “innovation and empowerment of communities”, a priority which is believed to align closely with the Polish food strategy’s focus on quality of life in rural areas;
 - In five countries (Belgium, Czechia, Finland, Lithuania, the Netherlands), a strong focus on the “healthy people” sector aligned with increased spending on priority one (nutrition for sustainable and healthy diets).

Alignment with Food 2030 pathways:

At EU level:

- An increase can be noted in the proportion of funding allocated to food waste and resource efficiency (13% to 16%), food systems and data¹⁴⁴ (7% to 15%) and urban food system transformation (1% to 3%).
- A concurrent decrease in the proportion of expenditure allocated to the following pathways can be seen between FP7 and Horizon 2020: food safety system of the future (18% to 12%), healthy sustainable and personalised nutrition (12% to 6%) and the microbiome world (6% to 3%).
- As overall expenditure increased over time, this decrease in relative expenditure is believed to reflect the broader focus of H2020, which took a more systemic approach to R&I expenditure as a whole, including on food systems.
- Finally, expenditure has been consistently low across four pathways (with each pathway representing 6% or less of all funding): alternative proteins and dietary shift, the microbiome world, Food Systems Africa and urban food system transformation.
- The proportion of projects deemed relevant for this study but not aligning with any Food 2030 pathways remained relatively stable at just under 20% of overall expenditure.

¹⁴⁴ Under this category, we have also included aspects interlinked with primary production (such as precision farming) as well, taking a broader definition than strictly outlined within the “Food 2030 Pathways for action: Food Systems and data” factsheet.

- Although equal funding for each pathway is not a desirable outcome, it is possible to identify some pathways which appear to be relatively underfunded, namely “urban food system transformation”, “the Microbiome world” and “Food systems Africa”.

At national level, the picture is slightly less clear and it is hard to pick out much in the way of consistent trends:

- A clear focus can be identified on the food safety system of the future, which represents 25% of funding across all Member States and has consistently been responsible for the largest proportion of overall spending (with the exception of 2018).
- From 2012 onwards, an increased focus may be discernable with regard to food waste and resource efficiency (perhaps reflecting the increased focus on this at EU level) and healthy, sustainable and personalised nutrition.
- Similarly to the trends identified at EU level, food systems Africa, the microbiome and urban food systems transformation receive very limited amounts of funding in the Member States across the entire reference period.

Future Trends

Looking forward, feedback from interviews with national level stakeholders (representatives from national ministries, agencies and other relevant national bodies) suggested that – in many cases – there is an increasing alignment with the priorities and pathways identified in the Food 2030 strategy at national level. It may therefore be expected that a similar exercise five or ten years in the future would yield a stronger strategic alignment between national food policies and Food 2030.

7.3. To what extent does public and private R&I expenditure on food systems differ between Member States and in comparison to other leading economies? How has the situation evolved over time?

Data available suggests significant differences in food systems R&I between EU Member States

Any analysis of expenditure is significantly hampered by a lack of consistent data with regard to food systems R&I. This means that our data is in many instances incomplete. The data collected for this study nonetheless provides a good indication of the proportional amount of funding provided at Member State level (i.e. in general, suspected data gaps are often linked to a lack of explicit monitoring of food systems R&I expenditure at national level, suggesting that it may not be a strong policy focus within the countries in question).

The data available shows the following differences in expenditure between Member States:

- There is a significant difference in terms of overall levels of expenditure on food systems R&I between Member States.
- In one Member State no funding was found at national level for food systems R&I.¹⁴⁵ In the other 26 countries, some expenditure was identified but this was relatively limited.
- Of those countries where we have data, funding varies significantly between countries. At national level, public sector funding for food systems R&I ranges from 0.1% to 2.7% of the GDP of different Member States over the reference period.
- After Germany, the most significant food systems R&I expenditures in overall terms were identified in Denmark, France, Spain, the Netherlands, Sweden and Ireland.
- In most cases, this is reflective of overall government R&I expenditure as a proportion of GDP. In Spain and Ireland, however, overall government expenditure is relatively low (at 0.5% and 0.4% respectively). Food systems R&I can therefore be assumed to be a significant focus in these countries.
- In terms of private sector investment into R&I in food systems, more than half of all investment during the period of investigation was carried out by German and Dutch

¹⁴⁵ European Structural and Investment Funds were not considered as part of this study and therefore "national funding" refers to funding provided by the national government outside of any co-funding provided as part of the EU Structural Funds.

companies. These results are based on a sample of firms of interest and depend on the significant assumption that a certain proportion innovative activity is patented – further research is necessary to validate these initial results.

Comparator countries have higher levels of private sector investment in food systems R&I than EU Member States

- In the EU (at both Member State and EU level), there is a much stronger focus on public sector R&I expenditure than in the comparator countries (USA, Canada and China)
- However, each of the three countries in question has a higher level of private sector investment in R&I as a proportion of GDP than the EU average.
- When comparing equity investments between the EU and US, it is noticeable that the overall volume of equity investments into food systems¹⁴⁶ in the EU trailed behind the volume of equity deals in the USA between 2007 and 2020.
- The overall volume of equity investments into EU companies was EUR 43 billion, compared to EUR 138 billion in the US. The average size of equity investment deals in the US was also significantly larger than in the EU during this period.
- This confirms the analysis undertaken by the EIB, suggesting that access to finance is a major bottleneck for innovative EU-based firms active in food technologies.

7.4. What level of R&I investment on food systems may be needed in order to meet the EU's broader policy goals and the ambitions of the European Green Deal, which aims to make food systems more sustainable, fair, healthy and environmentally-friendly?

The European Commission has proposed to spend EUR 10 billion in Horizon Europe on food, bioeconomy, natural resources, agriculture and environment. This is expected to deliver significant progress towards delivery of the Food 2030 initiative and Farm to Fork strategy, ultimately resulting in supporting the ambition of the European Green Deal.

¹⁴⁶ The companies included in our analysis of equity investment were selected based on user-defined queries on PitchBook that included a combination of industries, verticals, and keywords relating to the broad definition of food systems used in Food 2030. Further information on the criteria used for this analysis is presented in Annex C.

So far under Cluster 6, the Food Systems Intervention Area and Agriculture, Forestry and Rural Area Intervention Area have respectively earmarked EUR 229 million and EUR 682 million EUR as EC contributions via the Horizon Europe 2021 and 2022 calls (without counting Mission topics). Missions and food-related candidate Partnerships have the potential to leverage further public sector investments as follows:

- Partnership “Sustainable food systems for people, planet and climate” (EUR 175 million from European Commission, combined with additional Member States investments)
- Partnership “Accelerating farming systems transition: agroecology living labs and research infrastructures” (EUR 150 million from European Commission, combined with additional Member States investments)
- Partnership “Animal health and welfare” (EUR 180 million from European Commission, combined with additional Member States investments)
- Partnership “Agriculture of data” (EUR 100 million from European Commission, combined with additional Member States investments)
- Mission A Soil Deal for Europe (combined with additional investment from other EU financial instruments)

The data available for this study was not sufficient to be able to calculate the level of R&I investment which would be required to meet the EU’s broader policy goals. In fact, one of the main findings of this study is that there is a significant data gap in terms of the scale and scope of food systems R&I at national level, as well as how it is categorised. This makes meaningful comparison very difficult and means that any estimate of public sector expenditure is likely to miss a significant proportion of relevant funding.

Proposed next steps

In order to estimate the levels of investment needed to meet the ambition of the European Green Deal, and to measure progress against its specific objectives, relevant funding would need to be categorised in a reliable and consistent manner across EU Member States and at EU level. This would require the development of common metrics and mutually agreed definitions and categories, which could be applied to EU and national level food systems R&I funding and the definition of a desired benchmark to meet.

Such a benchmark would have to be co-designed with the respective characteristics of EU and national research & innovation systems, as well as food systems in mind, also to align with Farm to Fork Strategy objectives. Such a benchmark would also have to define comparable benchmark metrics across Member States, and define a methodology for reporting progress towards the benchmark in a meaningful way.

Once these metrics had been established, Member States would need to:

- Tag relevant projects so they can be identified in a reliable and consistent way; and
- Enable impacts of these projects to be tracked, e.g. by tagging them in a cross-Member States database such as Dimensions¹⁴⁷ which would allow tracking of follow-on funding, bibliometric and patent citations.

This would allow for the elimination of duplicate information on specific organisations and individual researchers (solving attribution of input) supported and the linking of different impact measures (such as bibliometric data, information on patents granted relevant policy impacts etc.) to projects funded, thus solving some of the data limitations present for this study.

Indications from national interviews suggest that the publication of Food 2030 is beginning to help in this regard, with a number of Member States having recently published food R&I policies – many of which are aligned with the priorities and pathways described in Food 2030. This should provide a useful framework for the collection and recording of data at national level against common EU-level categories going forward.

7.5. What obstacles can be identified which are preventing the EU from achieving the level of (public and private) R&I investment required? Is there sufficient access to finance in this area?

Our research has identified a number of obstacles to investment in food systems R&I within the EU. The most significant of these are:

- a lack of focus on food systems as a thematic policy area in its own right; and
- a lack of oversight/governance for this policy area. This leads to fragmentation in the funding ecosystem, with food systems R&I funding divided between multiple

¹⁴⁷ Dimensions database, available at : <https://www.dimensions.ai/>

sectors and entities and very little focus on measuring progress against strategic outcomes for food R&I.

In many cases, even those working within government departments struggled to identify funding being allocated to food systems R&I. This problem was exacerbated in the reference period by changes following the financial crisis of 2008, which led to significant rearrangements of governing structures in some Member States, leading to some data loss and multiple inconsistencies in terms of where and how data was collected and recorded.

This was followed by a decentralisation of food policy, with different aspects divided between different disciplines and policy areas.

- This means that a strong focus can be noted on specific elements of food systems R&I (e.g. food safety), but there is limited evidence of an integrated systemic perspective to address FNS and food systems transformation as a whole.
- This also means that investments on food systems R&I are not consistently measured or monitored. Indeed, in most countries, data is collected separately across numerous different entities.
- Therefore, no one organisation has a clear view on what is being invested on food systems R&I at national level and how this contributes to strategic objectives laid out in the national food and/or R&I policy.

The SCAR Food Systems Working Group identified similar issues in their 2018 mapping: a lack of political commitment and confusion around the provision of data as barriers to change, and recommended the development of a platform for the collection and collation of food consumption data.

Other obstacles identified in the research include:

- **Relevance of data:** Where data on food systems R&I investment is captured, this is usually as part of monitoring data for other policy priorities, meaning that the information being collected is not always relevant. It is not always possible to identify funding allocated to food systems R&I.
- **Measurement of systemic outcomes:** There is very limited information available on outcomes (either traditional R&I outcomes such as progression of TRL levels, knowledge creation measured through e.g. bibliometric impact, commercial

exploitation of project results, or contribution to systemic outcomes such as broader policy-level objectives) beyond the outputs reported by FP7 and Horizon 2020 projects, exacerbated by a lack of common indicators which would allow for the collection and comparison of data. This meant that an analysis of how effective funding is dispensed and the added value of R&I funding in the food sector has not been possible across the countries in scope of the analysis.

- Focus on funding for early-stage research at the expense of commercialisation: In terms of the funding available at both national and EU level, this appears to have a strong focus on far-from-market research and be targeted primarily towards primary production, with limited funding available at national and EU level for commercialisation of research outputs. This finding is echoed by research from the EIB, which cites lack of finance as “by far the most prominent barrier” to innovation for European agri-food companies. This obstacle is believed to be relevant primarily to SMEs, with larger-scale companies not believed to suffer from significant issues in accessing finance. Our analysis of equity finance into the US and EU food sector confirms this assessment. The SCAR Food Systems Working Group additionally identified that a “non-negligible share of public finance and some agricultural subsidies” are supporting practices that are not in line with the objectives of both the Food 2030 initiative and the Farm to Fork Strategy, namely “directed towards unsustainable and unhealthy foods”.

7.6. What solutions could be used to help mitigate any obstacles to achieving the level of (public and private) R&I investment required to meet the EU’s broader policy goals?

Solutions at EU level

- An initial first step to address the problems identified under 12.5 could be to encourage Member States to develop national food R&I strategies aligned with the priorities and pathways laid out in the Food 2030 strategy and Farm to Fork Strategy.
- This would help create a clear focus for investment in food systems R&I across the EU and lay the basis for a more coherent and integrated approach.
- Building on this, the European Commission could work with key stakeholder groups such as the SCAR Food Systems Strategic Working Group, the Joint Programming

Initiatives (JPI), European Technology Platforms and the European Institute of Technology Knowledge and Innovation Communities (EIT KIC), ICLEI -Local Governments for Sustainability, Milan Urban Food Policy Pact (MUFPP), etc. to develop a common set of outcome indicators and associated metrics.

- These could be used to collect data on how funded projects contribute to progress against the Green Deal, Farm to Fork Strategy and Food 2030 strategy and to categorise expenditure on food systems R&I.

Solutions at national level

- Increased collaboration is needed both between institutions with responsibility for different aspects of food policy, and actors at different levels within the food system.
- This could be achieved through the creation of inter and trans-disciplinary food policy councils or similar, with representation from industry, civil society, academia and public administrations, with responsibility for developing and implementing holistic food strategies at the most appropriate levels (national to local) – including considerations of how to promote food systems R&I.

7.7. Points for consideration

The European Commission could explore the merits of:

- **Working with the JRC** to further develop methodologies to estimate private sector investment in food systems R&I and improve the availability of data.
- Creating an **internal food systems R&I working group**, bringing together representatives from all relevant DGs (e.g. AGRI, SANTE, RTD, ENV, MARE, ENER GROW, JRC, etc) to ensure that the food systems approach is considered and integrated into all relevant policy discussions, understanding that food systems are interconnected with other systems (e.g. energy system, health system) with partly competing, partly enforcing demands and dynamics.
- **Leveraging the expertise of the Standing Committee of Research (SCAR)** based on knowledge in their Member States to enable best practice sharing across countries on R&I in the agri-food industry

- **Working with relevant stakeholders to develop common metrics and mutually agreed definitions and categories**, including outcome and impact categories, which could be applied to EU and national level food systems R&I funding. This would help to identify food related R&I funding and share learnings on the effectiveness of R&I funding in this space. These metrics could use the categories defined in the Food 2030 report (and elaborated by the SCAR Food Systems Working Group as well as in this study) as a starting point. This work could be coordinated through the Partnership “Sustainable Food Systems for People, Planet & Climate”, which has plans to standardise metrics. These metrics and definitions could then be used to establish a centralised European food systems R&I database to provide a knowledge repository of available data at EU and national level.
- **Encouraging Member States to create mission-oriented national food R&I policies** aligned with the priorities and pathways laid out in the Food 2030 initiative, as a precursor to ensuring appropriate investment in the pathways to impact.
- Providing technical assistance to Member States wanting to **establish/strengthen science-policy interfaces using existing mechanisms** (such as the HE Policy Support Facility) mechanism to foster a systemic approach and encourage mutual learning
- Providing technical assistance to Member States wanting to **strengthen the research and innovation value chain** connecting regions with EU priorities
- Supporting food systems actors (particularly amongst Horizon Europe beneficiaries) to **identify and encourage synergies with and between other EU funding instruments** (such as CAP, ERDF, LIFE)
- Helping food systems actors (particularly amongst Horizon Europe beneficiaries) **make better use of the financial instruments provided through the European Innovation Council** within the context of Horizon Europe to help the innovation pipeline and help bring R&I results closer to market take-up.
- **Providing R&I support, in particular for SMEs, in a holistic and systematic manner** (for example via Horizon Europe partnerships, namely the Partnership on Sustainable Food Systems for People, Planet and Climate).

Member States could explore:

- Which elements of the Food 2030 initiative are most relevant to their national context and ensure these are reflected in their food, R&I and/or food R&I strategies.
- Working to **break down traditional policy silos and encourage collaborative R&I** along the food value chain, including exploring options to create interdisciplinary institutions to bring together different ministries and agencies as well as other actors of the food system and exploring options to facilitate an institutional framework which encourages collaboration between different actors (both at policy level and along the food value chain). These actions could also consider how to support start-ups in the food system to collaborate with large corporates, to share risk of R&I activities.
- Working with the European Commission to **collect and share data on food systems R&I** in alignment with the common definitions, categories and metrics agreed at EU level.

The **European Commission and Member States** could furthermore consider:

- Working together to **raise awareness of risk finance instruments** available to companies undertaking R&I in food systems through intermediaries of the EIF, as well as EU level programmes such as the European Innovation Council pilot.
- Investigating the extent to which potential investment gaps (including priority four: innovation and empowerment of communities; and the food systems Africa, the microbiome world and urban food systems transformation pathways) require additional investment to achieve the goals of the Food 2030 initiative, in particular in its ambitions to develop systemic solutions that can deliver co-benefits to sustainability and resilience, environment and climate, nutrition, communities and circularity.

ANNEX A: METHODOLOGY FOR EU MAPPING

FP7 data was downloaded according to the keywords included in the inception report and agreed at the inception meeting¹⁴⁸. For the review of Horizon 2020 projects, analysis is based on the dataset which was extracted and categorised by colleagues at DG RTD as part of the previous work carried out for the European Commission's *2020 Food 2030 Pathways for Action report*. An alternative dataset was created by using a machine learning approach to identify H2020 projects in scope/of interest. This data has been reviewed and compared against the analysis undertaken by the European Commission .

Project information was put into the EU mapping template, which was developed and agreed during the inception phase. The project mapping included several steps:

1. **Determination of relevance:** projects were classified as relevant using specified exclusion criteria¹⁴⁹. The exclusion criteria were iteratively updated throughout based on discussions with the Steering Group. Specifically discussed were the relevance of projects related to drinking water, soil health, and biodiversity, as well as the inclusion of CSA projects.
2. **Mapping to Food 2030 priority:** all relevant projects were assigned to the Food 2030 priority they align with. A weighting system was used in cases when a project aligns with more than one priority.
 - a. Corresponds to more than one priority in equal measures – assign 1/number of relevant priorities assigned to each relevant priority
 - b. Corresponds mainly to one priority but touches upon aspects of other priorities as well – assign a weighting of 0.7 to the main priority, and a rating of 0.3/ number of relevant remaining priorities to the remaining relevant priorities.
 - c. Corresponds in equal measures to two priorities but touches upon aspects of other priorities as well – assign a weighting of 0.4 to the two main priorities, and a rating of 0.2/ number of relevant remaining priorities to the remaining relevant priorities.

¹⁴⁸ The following keywords are proposed for this search: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, Sustainability+", "eco-innovation+", "environmental impact+"".

¹⁴⁹ Projects must be 1. Food related and 2. aimed at making food systems sustainable, resilient and healthy.

- d. Corresponds in equal measures to three priorities but touches upon aspects of the remaining priority as well – assign a weighting of 0.3 to the three main priorities, and a rating of 0.1 to the remaining priority.
3. **Mapping to Food 2030 pathways:** all relevant projects were assigned to the Food 2030 pathway they contributed to. As some projects corresponded to more than one pathway, a main pathway per project was determined. If appropriate, the project was also mapped against other relevant pathways. If a project corresponded to more than one pathway, the total funding amount was divided between the different pathways implicated in order to reflect the cross-cutting nature of the projects and avoid double counting.
4. **Mapping to sectors:** all relevant projects were classified to the sector in which the research and innovation activity took place. These sectors were defined at the inception phase and cover the whole food system. Throughout the mapping process, two additional sectors were added. Given the inclusion of CSA projects in the scope of this project, a new sector “networking and knowledge exchange” was added. Additionally, a category “cross-sector” was added to denominate projects that cover several or all stages of the food value chain.

The initial dataset of potentially relevant projects included 5,662 FP7 projects and 587 Horizon 2020 projects.

For FP7, around 700 of the potentially relevant projects were manually coded into relevant/not relevant, to build a training dataset for a machine learning algorithm which will be used to ensure comparability between the allocation of EU projects and national projects, as well as the allocation of FP7 and Horizon 2020 projects. A logistic regression model (LASSO regression) was subsequently used to identify the most important terms appearing in project summaries determining whether a project was in scope or not. This classification model was then used to classify the remaining database into relevant and not relevant projects. Statistical tests undertaken with this classification model as well as extensive manual spot-checks of model predictions suggest that the model predicted accurately in around 90% of all cases. This model was then applied to the Horizon 2020 dataset, in order to ensure consistency between the two.

ANNEX B: METHODOLOGY FOR NATIONAL RESEARCH

The national research has been carried out using the same inclusion/exclusion criteria, keywords and approach to mapping as for the mapping of EU projects. The data collection has comprised the following steps:

1. Carried out **desk research** to identify:
 - Main providers of food-related R&I funding at national level and other relevant actors
 - Relevant national strategies for funding R&I since 2007
 - Relevant food policies since 2007
 - Relevant national databases of R&I projects, grants etc.
 - Specific food related competitions/funding
 - Relevant contact points at national innovation agency, statistics agency and/or relevant Ministries.
2. Where available, downloaded publicly available data on national innovation funding using agreed keywords¹⁵⁰. This allowed to **identify a list of publicly funded R&I projects in Member States** related to food systems between 2007 and 2020.
3. Contacted **SCAR contact points** to request additional data (and support with identifying data sources) and **conducted interviews** to date to discuss the national R&I landscape in food systems, the national R&I context, historic trends and current expenditure on public and private sector food-related R&I.
4. Contacted **relevant institutions** based on desk research or signposted by interviewees, such as innovation agencies, statistics agencies or relevant ministries,

¹⁵⁰ The following keywords were used for this search: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, Sustainability+ "eco-innovation+" "environmental impact+". The keywords were translated and slightly tweaked to reflect the appropriate wording for the following countries: Austria, Germany, Spain.

to help identify additional data sources. Provided relevant keywords and search terms to facilitate the extraction of relevant projects from internal databases.

5. Collated data in the **data collection template** and exclude irrelevant projects (non-food and/or not related to Food 2030 priorities).
6. **Categorised** each project against Food 2030 priorities, pathways and sectors to understand distribution of projects and spend.
7. Recorded **data gaps and limitations** and identified key variables of interest for synthesis analysis (to be discussed at team level) e.g. type of organisation funded, size of organisation funded etc.

ANNEX C: METHODOLOGY FOR ANALYSIS OF PRIVATE SECTOR INVESTMENT

1. INVESTMENT

1.1 Estimating private R&D from patent data

Introduction

The main purpose of this task was to estimate how much money is invested by the private sector in food-related R&I across the EU and - to the extent possible - map how this spending is distributed across the different priorities, pathways and sectors identified by the Food 2030 strategy.

Data collection on private sector investment is very difficult to achieve, particularly at the EU-level, as there is limited data available in the public realm across Member States. A patent-based approach was therefore undertaken to estimate the level of private sector investment, building on a similar method implemented by Pasimeni et al (2018)¹⁵¹ for estimating R&I investment levels in renewable energy. This approach was felt to be a pragmatic method for understanding the scale and scope of private sector R&I investment within the EU, while remaining proportionate to the overall project scope and budget, in the absence of other suitable methods of estimation.

Context

Companies in the food industry are viewed as belonging to a low-tech sector, as the share of total output attributable to R&D is around 0.3% in the EU (Delvaux et al., 2018). However, there are benefits to be had from more intensive R&D, such as genetically modified crops, which has revolutionised the food industry, whereas other food innovations are replicable and do not need as intense R&D. Thus, the agri-food sector can be thought of as comprising two distinct groups: easily replicable innovations and hard to replicate innovations. The easily replicated innovations reduce the incentive for firms to invest in R&D because it is harder to gain competitive advantage in such circumstances. Furthermore, most companies

¹⁵¹ Pasimeni, F., Fiorini, A., and Georgakaki, A. (2019). Assessing private R&D spending in Europe for climate change mitigation technologies via patent data. *World Patent Information*, 59, 101927. <https://doi.org/10.1016/j.wpi.2019.101927>

in the sector are SMEs, who do not usually have the capacity to invest heavily in research and development (although there are some exceptions if suitable risk capital sources are available).

In the food industry, intellectual property rights (IPRs) can be granted to protect the results of research & innovation efforts into new manufacturing and processing methods, or products. A company might consider it important to protect its IPR on a more cost-effective piece of industrial equipment, or it might consider seeking protection for a product with improved taste, texture, or a product that utilises a non-obvious alternative to a traditional ingredient in a recipe (e.g. a plant-based protein as a substitute for egg in egg-based preparations)¹⁵². There are a number of ways in which IPRs can be secured in the food sector. Trademarks, trade secrets, and patents are among the main ones.

- **Trademarks:** These are non-functional, distinctive words, letters, or symbols associated with a product or its packaging, which might represent a brand; trademarks might also be granted for shapes and colours, although these might be more difficult to obtain because of a tendency to apply the distinctiveness requirement in a narrow sense¹⁵³.
- **Trade secrets:** Being first to the market might be more suitable for time-critical innovation. Trade secrets (also known as 'kitchen secrets') do not require any formal registration act and are often used when the ingredients of a product or its processing methods cannot be easily derived from the final product¹⁵⁴.
- **Patents:** These can be used to protect innovation which is novel, non-obvious, and has an industrial application, although the process of recording patents can take up to four years¹⁵⁵.

There is a wide body of literature that supports the usage of patents as a proxy for research and innovation in the food sector. For instance, the Australian government conducted an investigation into the use of patents as a marker for innovation in the Australian food industry and found that almost half of the Australian inventions occurring in the food

¹⁵² New Food Magazine (2019). Protecting intellectual property in the food and drink industry. Available at: <https://www.newfoodmagazine.com/article/81493/protecting-intellectual-property-in-the-food-and-drink-industry/> (Accessed 18 November 2021).

¹⁵³ Financial Times, 2017. Why you can trademark a Toblerone but not a KitKat. Available at: <https://www.ft.com/content/16351d98-46d9-11e7-8d27-59b4dd6296b8> (Accessed 18 November 2021).

¹⁵⁴ New Food Magazine, 2019. Protecting intellectual property in the food and drink industry. Available at: <https://www.newfoodmagazine.com/article/81493/protecting-intellectual-property-in-the-food-and-drink-industry/> (Accessed 18 November 2021).

¹⁵⁵ Focus group – FoodDrink Europe ETP.

industry from 2000 to 2011 were cited by another inventor (Department of Industry, 2014). A focus group with FoodDrinkEurope members undertaken by the study team suggested that 10% of research & innovation undertaken by EU-based companies is protected through patents.

Approach

The estimation was undertaken in four key steps:

- **Retrieval and clean-up of patent data:** Patent data was retrieved by the European Commission's Joint Research Centre (JRC) covering 10,000 innovative firms in the food sector. The data was downloaded from the European Patent Office's Patstat 2020 – Autumn Version dataset, using the A01-A23, Y02P schemas of the Cooperative Patent Classification (CPC) and the SQL query detailed in Pasimeni (2019)¹⁵⁶. The dataset produced by the JRC aggregated patent families based on CPC codes for each applicant, and provided fractional patent counts for 4-digit CPC codes, as well as priority dates for groups of patent families under the same CPC code.
- **Retrieval and linking of firm data:** Information on patent applicants was linked to company records in the Orbis¹⁵⁷ database. R&D expenditure between 2012¹⁵⁸ and 2018¹⁵⁹ was obtained for 318 companies active in the food sector and a unitary cost of patents by CPC sector was established. Sensitivity tests undertaken suggest that this group was largely representative of the total population of 10,000 innovative firms.
- **Estimated R&I investments into patent-related activity:** Established unitary costs were then multiplied by total inventive activity in each CPC code to estimate the relative amount invested in the technology classes within scope of the present study in a given year and country. A sensitivity analysis was undertaken at this stage in order to understand the extent to which our underlying assumptions may have impacted the final result.

¹⁵⁶ Pasimeni, F. (2019). SQL query to increase data accuracy and completeness in PATSTAT. *World Patent Information*, 57, 1-7. <https://doi.org/10.1016/j.wpi.2019.02.00>

¹⁵⁷ <https://www.bvdinfo.com/en-gb/our-products/data/international/orbis>

¹⁵⁸ Data prior to 2018 was not available in Orbis

¹⁵⁹ Data after 2018 was not available in Patstat

- **Estimating overall R&I investments:** Finally, a 10x multiplier was applied to the investment estimates established for patent-related activity – this was based on a focus group with FoodDrinkEurope members which suggested that 10% of R&I undertaken by companies in the food sector is patented.

Patent data retrieved from the JRC is structured in the form of fractional patent counts (as opposed to whole patent counts), under the assumption that each patent can be equally distributed across all the schemes it is assigned to¹⁶⁰. As patents can be registered by more than one inventor in more than one patent office, using fractional counts allows to assign a ‘share’ of each patent to all the inventors involved and to all the patent registration offices where the patent was registered. Whilst it can be argued that not all inventors may have equally contributed to a patent (e.g., in terms of time, financial resources), fractional counts appear to be particularly suitable for the purpose of measuring inventive activity and avoiding double counting and home bias¹⁶¹.

Given the fact that one application can be lodged across multiple patent offices and at different times, by different applicants, and under different technology schemes, applications that are related to each other were grouped under the same patent family.

Step by step estimation of private sector investment

The output of our analysis includes all companies active in the agri-food sector (and, where relevant, the agricultural sector). For each company i , the residence country c and the food technology area f in which it is active are known, the annual food technology fractional of a company, that is its number of inventions produced and financed in one-year t in food-related fields, is defined in equation (1).

$$(1) F_{i,c,f,t}$$

Not all inventions/patents from companies in the food industry will be directly related to food. Hence, equation (2) represents the company’ total food and non-food related inventing/patenting activity at time t , with r a given non-food technology area.

¹⁶⁰ Fiorini, A., Georgakaki, A., Pasimeni, F., and Tzimas, E., 2016. Monitoring R&I in Low-Carbon Energy Technologies. Methodology for the R&I indicators in the State of the Energy Union 2016 edition. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC105642> (Accessed 18 November 2021).

¹⁶¹ Fiorini, A., Georgakaki, A., Pasimeni, F., and Tzimas, E., 2016. Monitoring R&I in Low-Carbon Energy Technologies. Methodology for the R&I indicators in the State of the Energy Union 2016 edition. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC105642> (Accessed 18 November 2021).

$$(2) F_{(i,c,t)} = \sum_{f=1}^F F_{i,c,f,t} + \sum_{r=1}^R F_{i,c,r,t}$$

The total R&D expenditure of a given company in a given year is then expressed in equation (3)

$$(3) RD_{i,c,t} = RD_{i,c,f,t} + RD_{i,c,r,t}$$

And the R&D expenditure of a given company in a given year and technology is given in equation (4)

$$(4) RD_{i,c,f,t} = RD_{i,c,t} \times \frac{F_{i,c,f,t}}{F_{i,c,t}}$$

With the unitary cost of one invention for a given company, in a given year, country and technology area. This unitary cost for one invention for a given company, for each country and technology area for a given year by equation (5).

$$(5) UC_{i,c,f,t} = \frac{RD_{i,c,f,t}}{F_{i,c,f,t}}$$

Hence starting from the R&D expenditure data available and the fractional patent counts in relevant patent classifications, as well as the overall patent counts, for a given company, unitary costs are established before R&D spending in the given patent classifications is estimated. R&D spending for companies without such data available in Orbis is then estimated using average unit costs in a given food technology/patent classification.

Companies may be operating under a group (with a parent company having the controlling interest). For these companies, we followed the approach set out in Pasimeni, Fiorini, and Georgakaki (2019)¹⁶² without replicating it here.

Assumptions

There are a number of assumptions that underscore the econometric approach outlined above. These are:

- All inventions of subsidiaries of a company group examined are financed by the group's R&D.

¹⁶² Pasimeni, F, Georgakaki, A. and Fiorini, A., Assessing private R&D spending in Europe for climate change mitigation technologies via patent data, World Patent Information, 59, 2019, <https://doi.org/10.1016/j.wpi.2019.101927>

- R&D expenditure is associated with all subsidiaries of a group that are in the same country and the same sector. This assumption is one that may be a potential limitation, as the authors note in their conclusion, as it is not often the case that different technological processes that require a patent for higher intensity R&D will have the same level of expenditure as processes that require low level R&D.
- The approach assumes that the inventive activity is financed by the owners (applicants) of the invention in the year in which the activity itself begins (priority year), and that there is a relationship between patent and R&D, with a time lag between R&D and patent filing.
- For our sector level estimate of R&D spending, we also assume that 10% of all research and innovation spending is reflected in patenting activity. This assumption was informed by a focus group undertaken with members of FoodDrinkEurope.

1.2 Methodology for analysis of equity investment

Data for our analysis of equity finance in the US and Europe is obtained from PitchBook based on a combination of industry, verticals¹⁶³, and keywords described in the ensuing section.

The search includes all completed deals between 1st January 2007 and 30th November 2021 where the beneficiary is a company located in the European Union or the United States.

Types of deals included in the analysis are:

- **Venture capital (VC):** Pre/accelerator/incubator, angel, seed, early stage VC, later stage VC
- **Private equity:** Private equity growth/expansion, private investment in public equity (PIPE)
- **Public investment:** Initial public offerings (IPOs), secondary offerings (2POs)

Manual spot checks have been carried out to ensure data consistency. Deals with no known deal amount are included.

¹⁶³ 'Verticals' is a term that describes a group of companies that focus on a shared niche or specialised market spanning multiple industries.

Query criteria

The following query was run in PitchBook. The combinations of labels were agreed with DG RTD.

(Beverages Industry NOT Healthcare Keyword) OR

(Food Products Industry NOT Healthcare Keyword) OR

(Food Tech Vertical NOT E-Commerce Keyword NOT Ecommerce Keyword NOT Mobility Tech Keyword) OR

(AgTech Vertical AND Crops Keyword AND (Precision Farming Keyword OR Precision Agriculture Keyword) OR

(Restaurant Technology Vertical NOT Payment Systems Keyword) OR

(Restaurant and Bars Industry AND (Food Keyword OR Beverages Keyword OR Drinks Keyword)) OR

(Animal Husbandry Industry NOT Animal Food Keyword NOT Animal Feed Keyword NOT Veterinary Food Keyword) OR

(Aquaculture Industry NOT Feeds Keyword) OR

(Cultivation Industry AND Crops Keyword NOT Horticulture Keyword) OR

(Other Agriculture AND (Crops Keyword AND (Precision Farming Keyword OR Precision Agriculture Keyword OR Waste Keyword))) OR

(Containers and Packaging Industry AND Food Keyword AND Food Packaging Keyword)

Food Waste Recycling Keyword OR

Food Waste Keyword OR

Food Waste Reduction Keyword OR

(Fishing Activities Keyword NOT Fishing Gear Keyword NOT Fishing Clothes Keyword) OR

Food Service Industry Keyword OR

Food Processing Keyword OR

Food Retail Keyword OR

Food Logistics Keyword OR

Food Safety and Quality Keyword OR

Obesity Keyword OR

Dietary Meals Keyword

ANNEX D: BREAKDOWN OF EU R&I FUNDING BY INSTRUMENT AND PROGRAMME

Table 1: EU public funding for food-systems related R&I projects by instrument

FP7	
Funding instrument	Food systems funding identified
Research for the benefit of specific groups (BSG)	EUR 175 million
Collaborative Projects (CS)	EUR 896 million
Coordination and Support activities (CSA)	EUR 117 million
Individual projects funded by the European Research Council (ERC)	EUR 44 million
Marie Curie support actions	EUR 98 million
Network of Excellence (NoE)	EUR 5 million
Horizon 2020	
Funding instrument	Food systems funding identified
European Joint Programme Cofund (EJP Cofund)	EUR 45 million
Coordination and Support activities (CSA)	EUR 209 million
Frontier research grants (ERC)	EUR 197 million
Marie Skłodowska-Curie Actions	EUR 245 million
SME instruments	EUR 242 million
ERA-net Cofund	EUR 84 million
Research and innovation actions (RIA)	EUR 1 million
Innovation actions (IA)	EUR 1 million

Source: Ipsos analysis of CORDIS data.

Table 2: FP7 funding programmes relevant to food-systems related R&I

Programme	Sub-programme	Thematic focus	Amount of EU public funding for food-system related R&I projects
Cooperation	FP7-ENERGY	The Specific Programme “Cooperation”: Energy (FP7-ENERGY) funds actions to find solutions to respond to the challenges facing energy systems, namely the increasing global energy demand, the finite nature of conventional oil and natural gas reserves, and the need to drastically reduce greenhouse gas emissions.	EUR 4 million
	FP7-ENVIRONMENT	The Specific Programme “Cooperation”: Environment (including Climate Change) (FP7-ENVIRONMENT) covers R&I actions in the field of climate change, sustainable resource management, environmental technologies and earth observation and assessment tools, with the overarching aim to ease the man-made negative impacts on the environment and its resources.	EUR 64 million
	FP7-HEALTH	The objective of the specific Programme “Cooperation”: Health (FP7-HEALTH) is to improve citizen’s health of as well as increase and strengthen European health-related industries and businesses.	EUR 25 million
	FP7-ICT	The Specific Programme “Cooperation”: Information and communication technologies” (FP7-ICT) fund projects in the research areas of Network and service infrastructure stability and security; Performance and reliability of electronic systems and components; Personalised ICT systems; and Digital content management.	EUR 24 million

Programme	Sub-programme	Thematic focus	Amount of EU public funding for food-system related R&I projects
	FP7-SSH	The Specific Programme “Cooperation”: Socio-economic Sciences and Humanities (FP7-SSH) has a broad remit and funds R&I that seeks to answer questions related to topics such as demographic change, globalisation, political developments, or cultural diversity and the values.	EUR 13 million
	FP7-SECURITY	The Specific Programme “Cooperation”: Security (FP7-SECURITY) addresses questions of civil and defence security.	EUR 8 million
	FP7-KBBE	The Specific Programme “Cooperation”: Food, Agriculture and Biotechnology (FP7-KBBE) funds research and innovation activities on the safety of food and feed chains, diet-related diseases, consumer food choices and the impact of food and nutrition on health.	EUR 773 million
	FP7-NMP	FP7-NMP denotes the Specific Programme “Cooperation”: Nanosciences, Nanotechnologies, Materials and new Production Technologies, which aimed to improve the competitiveness of European industry and create knowledge to transform it from a resource-intensive to a knowledge intensive one.	EUR 24 million
	FP7-SPACE	The Specific Programme “Cooperation”: Space (FP7-SPACE) funds R&I related to outer space.	EUR 8 million

Programme	Sub-programme	Thematic focus	Amount of EU public funding for food-system related R&I projects
Ideas	FP7-IDEAS-ERC	The Specific programme: “Ideas” (FP7-IDEAS-ERC) does not have a thematic focus. It funds research, technological development and demonstration activities.	EUR 442 million
People	FP7-PEOPLE	The “People” (FP7-PEOPLE) programme does not have a thematic focus but provides funding for individuals to allow them to follow a career in research.	EUR 98 million
Capacities	FP7-INCO	The Specific Programme “Capacities”: International co-operation (FP7-INCO) does not have a thematic focus itself but instead covers the international cooperation actions in the 10 thematic areas of the capacities programme and across themes.	EUR 10 million
	FP7-INFRA-STRUCTURES	The Specific Programme “Capacities”: Research infrastructures” (FP7-INFRASTRUCTURES) does not have a thematic focus. It seeks to improve the use and development of European research infrastructure.	EUR 13 million
	FP7-REGIONS	The Specific Programme “Capacities”: Regions of knowledge and support for regional research-driven clusters (FP7-REGIONS) does not have a thematic focus. It aims to encourage transnational networks of regions and research-driven clusters.	EUR 6 million

Programme	Sub-programme	Thematic focus	Amount of EU public funding for food-system related R&I projects
	FP7-REGPOT	The Specific Programme “Capacities”: Research potential of Convergence Regions (FP7-REGPOT) does not have a thematic focus. It looks to foster research potential in less advanced regions in the EU and facilitate knowledge exchange and development.	EUR 32 million
	FP7-SIS	The Specific Programme “Capacities”: Science in society (FP7-SIS) does not have a thematic focus. It aims to promote science, increase knowledge and trigger curiosity in society.	EUR 6 million
	FP7-SME	FP7-SME - Specific Programme “Capacities”: Research for the benefit of SMEs (FP7-SME) does not have a thematic focus. It provides funding from SMEs and SME associations for research projects to overcome SME specific challenges.	EUR 180 million
	FP7-GA	Coordination of Non-Community Research Programmes (FP7-GA) does not have a thematic focus. Projects are intended to develop and strengthen coordination of national and regional research activities.	EUR 2 million

Source: Ipsos analysis of CORDIS data.

Table 3: Horizon 2020 funding programmes relevant to food-systems related R&I

Programme	Thematic focus	Amount of EU public funding for food-system related R&I projects
Excellent Science	Total for Excellent Science	EUR 553 million
	European Research Council (ERC)	EUR 197 million
	Future and Emerging Technologies (FET)	EUR 47 million
	Marie Skłodowska-Curie Actions	EUR 245 million
	Research infrastructure	EUR 64 million
Industrial Leadership	Total for Industrial Leadership	EUR 645 million
	▪ Leadership in enabling and industrial technologies	EUR 584 million
	▪ Access to risk finance	EUR 0
	▪ Innovation in SMEs	EUR 61 million
Societal Challenges	Total for Societal Challenges	EUR 2 million ¹⁶⁴
	Health, demographic change and wellbeing	EUR 67 million
	Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy	EUR 2 million
	Secure, clean and efficient energy	EUR 43 million
	Smart, green and integrated transport	EUR 23 million
	Climate action, environment, resource efficiency and raw materials.	EUR 265 million
Spreading Excellence and Widening Participation	Total for Spreading Excellence and Widening participation	EUR 57 million

Source: Ipsos analysis of CORDIS data.

¹⁶⁴ Several projects were classified as corresponding to the “Societal challenges’ priority, but without further specification. The total number of funding awarded under this priority therefore does not match the sum of funding awarded for each specific challenge.

Table 4: Overview of food systems funding per funding programme (FP7 and H2020)

Programme	Description	Food systems funding allocated
FP 7¹⁶⁵		
Cooperation	<ul style="list-style-type: none"> ▪ Largest programme under FP7. Funded collaborative research across Europe, carried out in ten key thematic areas (“health”, “food, agriculture and fisheries, and biotechnology”, “ICT”, “nanosciences, nanotechnologies, materials and new production technologies”, “energy”, “environment (including climate change)”, “transport (including aeronautics)”, “socio-economic sciences and the humanities”, “space” and “security”) 	<p>The majority (71%) of food-systems related R&I funding under FP7 came under the Cooperation programme, accounting for a total of approximately EUR 943 million. This is circa 3% of the programmes total budget (EUR 32.413 million).</p> <p>The majority of food-systems R&I projects were funded under the Specific Programme “Cooperation”: Food, Agriculture and Biotechnology (FP7-KBBE), accounting for EUR 773 million (58% of all relevant funding on food systems under FP7). EUR 64 million was provided under FP7-ENVIRONMENT (5% of total relevant funding on food systems under FP7).</p>
Ideas programme	<ul style="list-style-type: none"> ▪ Funded basic (curiosity-driven) research. 	<p>3% (just over EUR 441 million) of food-systems related R&I project funding was distributed under the Ideas programme. This amounts to 5.7% of the overall budget of this sub-programme.</p>
People programme	<ul style="list-style-type: none"> ▪ Supported researcher mobility and career development. 	<p>EUR 97.7 billion of funding was awarded to food-systems related projects under the FP7 programme People, making up 7% of all relevant funding. This accounts for 2% of all funding awarded under this programme.</p> <p>13% of relevant funding (EUR 180 million) was awarded to SMEs (FP7-SME) and 7% (EUR 98 million) of relevant funding was dedicated to individual researchers.</p>

¹⁶⁵ Overview of funding under FP7, available at: https://www.ffq.at/sites/default/files/downloads/page/fp7_final_evaluation_expert_group_report.pdf

Capacities Programme	<ul style="list-style-type: none"> ▪ Focused on seven objectives (“research infrastructures, “research for the benefit of SMEs”, “regions of knowledge”, “research potential”, “science in society”, “support to the coherent development of research policies” and “activities of international cooperation”). 	<p>19% of relevant project funding (approximately EUR 248 million) fell within the Capacities programme. With a total budget of approximately EUR 3.8 billion, this means that food-systems related projects were awarded almost 6.6% of the programme’s overall funding.</p>
<p>A further EUR 2.2 million was allocated the coordination of non-community research programmes (FP7-GA), which includes the ERA-NET scheme as well as the participation of the Community in jointly implemented national research programmes.</p>		
Horizon 2020¹⁶⁶		
Excellent Science Pillar	<p>Aimed to strengthen the EU’s research and innovation system by building human capital and research infrastructure. Included four programmes:</p> <ul style="list-style-type: none"> ▪ The European Research Council (ERC) provided funding to researchers to pursue curiosity-driven research at the frontier of science; ▪ The Future and Emerging Technologies (FET) programme supported collaborative research across disciplines in new areas of science and technology; 	<p>Almost EUR 553 million were awarded to food-systems related projects in total under the Excellent Science Pillar (15.7% of relevant funding on food systems under Horizon 2020).</p> <ul style="list-style-type: none"> ▪ EUR 197 million, a little over 35%, of relevant funding under this pillar was awarded to frontier research project as ERC funding. Food-systems related projects therefore accounted for approximately 1.4% of total ERC funding under Horizon 2020.

¹⁶⁶ Overview of funding under Horizon 2020, available at: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/applying-for-funding/find-a-call/h2020-structure-and-budget_en.htm

	<ul style="list-style-type: none"> ▪ Marie Skłodowska-Curie Actions provided training and career and knowledge-exchange opportunities to researchers; and ▪ The Research infrastructure (including e-infrastructures) programme fostered the innovation potential and human capital of the European R&I infrastructure. 	<ul style="list-style-type: none"> ▪ Almost EUR 47 million (9% of relevant funding under the Excellent Science pillar) was funded within the Future and Emerging Technologies (FET) programme, 1.7% of the programme's overall budget. ▪ Marie Skłodowska-Curie Actions (MSCAs) accounted for 44% (approximately EUR 245 million) of this funding, almost 4% of all funding made available for MSCAs. ▪ The research infrastructure programme accounted for 12% (EUR 63.66 million) of food-systems related projects under the Excellent Science Pillar. Food-systems related projects therefore received 2.5% of all funding under this programme.
<p>Industrial Leadership Pillar</p>	<p>The Industrial Leadership pillar of Horizon 2020 did not have a thematic focus. It aimed to foster the development of technologies and innovations to support businesses, in particular SMEs, in the future. It consisted of three specific objectives:</p> <ul style="list-style-type: none"> ▪ Leadership in enabling and industrial technologies; ▪ Access to risk finance; and ▪ Innovation in SMEs. 	<p>EUR 645 million of funding under the Industrial Leadership pillar went to food-systems related projects, 18% of relevant funding under Horizon 2020.</p> <ul style="list-style-type: none"> ▪ In total, almost EUR 584 million was provided under Leadership in enabling and industrial technologies (4.3% of all funding disbursed under this objective). ▪ No food-systems related projects identified in our research was funded under the 'Access to risk finance' programme ▪ 9% of relevant funding under this pillar was awarded under the 'Innovation in SMEs' programme, totalling a little over EUR 61 million (approximately 1% of overall funding under this programme).

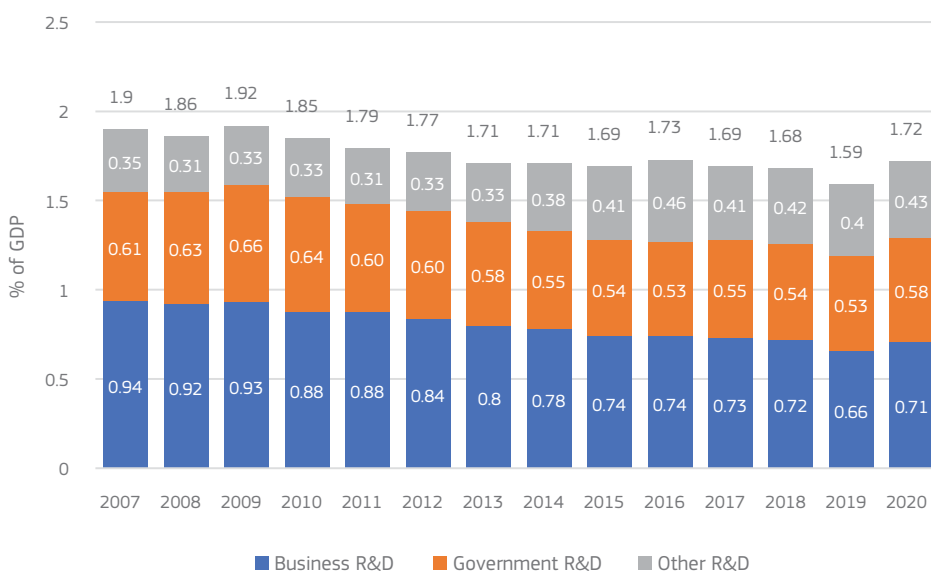
<p>Societal Challenges</p>	<p>Provided R&I funding in key areas that align with the policy priorities of the Europe 2020 strategy. Seven challenges were identified:</p> <ul style="list-style-type: none"> ▪ Health, demographic change & wellbeing; ▪ Food security, sustainable agriculture and forestry, marine/maritime/inland water research and the bioeconomy; ▪ Secure, clean & efficient energy; ▪ Smart, green & integrated transport; ▪ Climate action, environment, resource efficiency & raw materials; ▪ Inclusive, innovative & reflective societies; and ▪ Secure societies. 	<p>In total, EUR 2.25 billion of funding under Societal Challenges was awarded to food-systems related projects. This accounts for 64% of all relevant funding on food systems under Horizon 2020.</p> <p>The majority of funding was provided under 'Food security, sustainable agriculture and forestry, marine/maritime/inland water research and the bioeconomy', accounting for slightly over 44% (just under EUR 1.7 billion) of all funding under this challenge.</p> <p>Food-systems related projects were also funded under the challenge areas 'Climate action, environment, resource efficiency & raw materials' (approximately EUR 265 million, 9% of funding in this challenge area), 'Health, demographic change & wellbeing' (approximately EUR 67 million, a little below 0.9% of total funding under this challenge), 'Secure, clean & efficient energy' (approximately EUR 43 million, 0.7% of funding under this challenge) and 'Smart, green & integrated transport' (approximately 23 million, 4% of the total funding under this challenge).</p>
<p>The Spreading Excellence and Widening participation part of Horizon 2020 addressed disparities in Member States' participation rates of the EU Framework programmes. Just over EUR 57 million of funding was awarded to food-systems related projects under this programme, 2% of the overall relevant funding amount. This accounts for almost 7% of the total funding under this area.</p> <p>No food-systems related projects were funded under the Science with and for society programme.</p>		

ANNEX E: COMPARATOR COUNTRY ANALYSIS

Overview of national R&I food investment landscape: Canada

R&I expenditure as a percentage of Canada’s GDP has slowly been decreasing since 2007, as seen in Figure 1. From 2007 to 2020, Canada went from spending 2% of its GDP to 2%, having reached the lowest percentage in 2019, with 2%. This decline in total R&I expenditure was mainly caused by the decrease of Business R&I, from 0.9% in 2007 to 0.7% in 2020. Government expenditure has remained relatively stable, ranging from 0.6% (2007) to 0.6% (2020). In total, Business R&I corresponds in average to 46% of Canada’s R&I expenditure, while Government funded R&I corresponds to an average of 33%. However, despite the decreasing percentage, the amount of money spent in R&I has actually been increasing, although not at the same rate as the GDP.

Figure 1: R&I expenditure in Canada, as a percentage of GDP



Source: OECD, GERD as a percentage of GDP

There are different funding programs and tax incentives intended to boost R&I in Canada, either at the federal, provincial or regional levels. Although Canada has an overarching federal funding system for R&I, each province is independent regarding the support of institutions and industries in certain thematic areas. Because of this synergy between

federal, provincial and regional levels, seeking R&I funding must take into consideration the opportunities stemming from all three layers while, at the same time, paying attention to federal laws and permits as well as provincial and local legislation¹⁶⁷.

Two major funding initiatives created by the Canadian Government that work at the general level and for all fields of R&I include the **Canada Foundation for Innovation** and the **Scientific Research and Experimental Development Program**:

- **Canada Foundation for Innovation (CFI):** The CFI is a major funding initiative of the Canadian Government, designed to upgrade the research capability and infrastructure of Canada's universities, colleges, research hospitals and non-profit research institutions. Since its creation in 1997, the CFI has supported researchers with the cutting-edge facilities, laboratories and equipment they need to push the frontiers of knowledge in all disciplines, to discover and to innovate¹⁶⁸;
- **Scientific Research and Experimental Development Program (SR&ED):** The SR&ED Program uses tax incentives to encourage Canadian businesses of all sizes and in all sectors to conduct R&D in Canada. These tax incentives come in three forms: an income tax deduction, an investment tax credit and, in certain circumstances, a refund. The SR&ED Program provides more than CAD 3 billion in tax incentives to over 20,000 claimants annually, making it the single largest federal program that supports business R&I in Canada. The program is administered by the Canada Revenue Agency (CRA) ¹⁶⁹.

More specific funding programs, either for specific areas of R&I or at the provincial level, are available in Canada¹⁷⁰.

National R&I Strategy

The **National Research Council Canada (NRC)** is Canada's largest federal R&I organisation and operates within the broad frame of the Government of Canada's **Innovation and Skills Plan**¹⁷¹. This Plan, announced in Budget 2017, is an ambitious

¹⁶⁷ <https://www.stint.se/wp-content/uploads/2020/06/STINT-Public-Research-and-Innovation-Funding-Actors-in-Canada.pdf>

¹⁶⁸ <https://www.innovation.ca/>

¹⁶⁹ <https://www.canada.ca/en/revenue-agency/services/scientific-research-experimental-development-tax-incentive-program.html>

¹⁷⁰ <https://www.ic.gc.ca/eic/site/ito-oti.nsf/eng/O0834.html>

¹⁷¹ <https://www.budget.gc.ca/2017/docs/plan/chap-01-en.html>

effort to make Canada a world-leading centre for innovation, to create well-paying jobs and to help strengthen and grow the middle class, supporting Canadians and the entire innovation continuum.

The NRC has recently been adapting their approach to tackle the world's most pressing challenges, such as climate change, aging populations and economic crises, and to capitalize on the opportunities presented by the digital economy and disruptive technologies. Therefore, in February 2020, they launched the **NRC Strategic Plan 2019-2024**¹⁷², a five-year strategic plan to guide national R&I efforts. This plan builds on the extensive community consultations realized in the NRC Dialogue process in 2016 and the resulting “reimagining” of the NRC as an organisation. Through this process, five overarching areas that will define the NRC's strategic focus for the following five years were identified: enabling a more sustainable economy; supporting a healthier future; innovating the everyday; creating Canadian wealth through innovation; and understanding our world.

The **CFI Strategic Roadmap 2018-2023**¹⁷³ is a five-year strategic roadmap that lays out the directions of the principal mechanism for Canadian R&I funding, guiding the direction that it will take in this period to meet the challenges of today's changing research environment and help enhance Canada's capacity for innovation. It builds on the three specific areas of opportunity identified in the previous strategic roadmap (2012-17)¹⁷⁴: sustain and enhance the world-class capacity of Canada's research institutions; foster collaboration and integration between academic research and the private, public and not-for-profit sectors; and increase the global influence of Canadian research in ways that benefit society.

Previous R&I strategies in Canada also include the **Inclusive Innovation Agenda**¹⁷⁵ (2016). The federal government committed to develop an Innovation Agenda that would reshape how Canada supports innovation and growth, launching a consultation on the development of an Inclusive Innovation Agenda. This engagement focused on six inter-related action areas: promoting an entrepreneurial and creative society; supporting global science excellence; building world-leading clusters and partnerships; growing companies and accelerating clean growth; competing in a digital world; and improving the ease of doing business.

¹⁷² <https://nrc.canada.ca/en/corporate/planning-reporting/nrc-strategic-plan-2019-2024>

¹⁷³ <https://www.innovation.ca/sites/default/files/pdf/strategic-roadmap/cfi-strategicroadmap-2018-2023-en.pdf>

¹⁷⁴ <https://www.innovation.ca/sites/default/files/pdf/2011%20CFI%20Strategic%20Roadmap%20final%20English%202012-04-04.pdf>

¹⁷⁵ https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00009.html

Overview of national food policy

In 2017, the Government of Canada began public consultations with people and organisations to build the first-ever **Food Policy for Canada**. In 2018, Agriculture and Agri-Food Canada (AAFC) released a What We Heard report to outline the priorities of people across the country for the Food Policy for Canada. After this report, the Government announced in 2019 over CAD 134.4 million in initial investments to support the food policy. The **Food Policy for Canada** will help Canada build a healthier and more sustainable food system – one that builds on a robust agenda to support growth for farmers, producers and food businesses in Canada¹⁷⁶.

Six long-term interconnected and mutually-reinforcing outcomes have been identified to support better long-term planning for the Canadian food system. Enhanced coordination of existing, new and future policies and programs across Government will help make progress toward these outcomes and achieve the food policy's vision. These are:

- **Vibrant communities:** Improved community capacity and resilience to food-related challenges;
- **Increased connections within food systems:** Increased governance spaces and partnerships that connect multiple sectors and actors across the food system;
- **Improved food-related health outcomes:** Improved health status of Canadians related to food consumption and reduced burden of diet-related disease, particularly among groups at higher risk of food insecurity;
- **Strong Indigenous food systems:** To be co-developed in partnership with Indigenous communities and organisations;
- **Sustainable food practices:** Improvements in the state of the Canadian environment through the use of practices along the food value chain that reduce environmental impact and improve the climate resilience of the Canadian food system;
- **Inclusive economic growth:** Improved access to opportunities in the agriculture and food sector for all Canadians within a diversified, economically viable and sustainable food system.

¹⁷⁶ <https://agriculture.canada.ca/en/about-our-department/key-departmental-initiatives/food-policy/food-policy-canada>

As part of implementing the **Food Policy for Canada**, the CAD 134.4 million invested by the Government of Canada funded several federal initiatives to address food system priorities for 2019-2024¹⁷⁷:

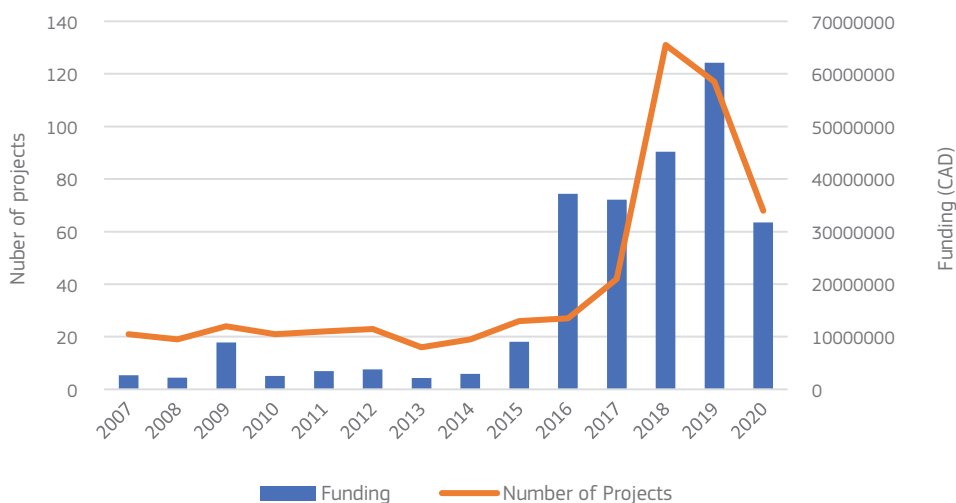
- **Local Food Infrastructure Fund:** To support a wide range of community-led projects that improve access to safe, healthy and culturally diverse food. These could include greenhouses, community kitchens, projects at food banks and farmers' markets.
- **Northern Isolated Community Initiatives Fund:** To support community-led projects like greenhouses, community freezers and skills training to strengthen Indigenous food systems, and combat significant challenges in accessing healthy food in Canada's North;
- **Buy Canadian Promotion Campaign:** To promote Canadian agricultural products thanks to a new Canada Brand, as well as through online and in-store buy Canadian campaigns. Increase consumer pride and confidence in food;
- **Reducing food waste:** To support innovative ways of reducing food loss and waste in Canada. Also, to support leadership by the Government of Canada to encourage food waste reduction across Canada and in federal facilities;
- **Tackling Food Fraud:** To crack down on mislabelling and misrepresentation of food products, helping to protect consumers from deception and companies from unfair competition;
- **National School Food Program:** To create a National School Food Program, to help improve the overall health of children as they learn, leading to better futures for them, and ultimately for the country.
- Public funding available for food R&I

The information provided in the sections below contains data from two different sources: the **Agriculture and Agri-Food Canada (AAFC)** department of the Government of Canada and the **Canada Foundation for Innovation (CFI)**.

¹⁷⁷ <https://agriculture.canada.ca/en/about-our-department/key-departmental-initiatives/food-policy/everyone-table-investing-food-policy-canada>

In total, between 2007 and 2020, 580 R&I food-related projects were funded in Canada, receiving a total of CAD 250.0 million in funds (equivalent to EUR 174.0 million). A review of the number of projects approved during this period shows that 2018 was the year with most projects approved with 131 (CAD 45.2 million, EUR 31.5 million), while 2019 was the year with the most funding with CAD 62.1 million (EUR 43.2 million, 117 projects)

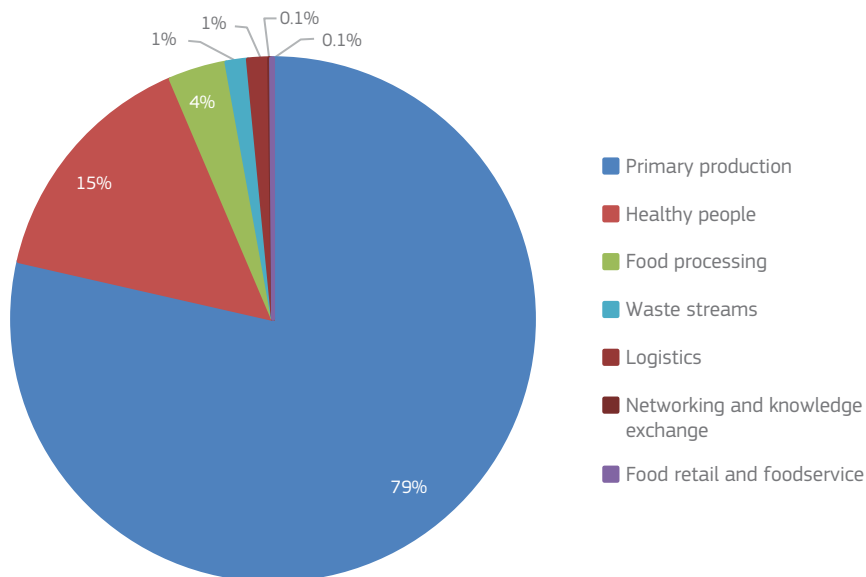
Figure 2: R&I food related projects between 2007 and 2020



Source: Agriculture and Agri-food Canada; Canada Foundation for Innovation.

When sorting the food-related R&I projects into major sectors, the majority of public funding is directed towards projects related to primary production (79%, CAD 196.7 million, equivalent to EUR 137.0 million), with the healthy people sector coming in second (15%, CAD 37.6 million, equivalent to EUR 26.2 million). It is notable that logistics (1%), waste streams (1%) and food retail/service (0.1%) had the lowest level of funding, as observed in Figure 3.

Figure 3: Distribution of the funding by sector



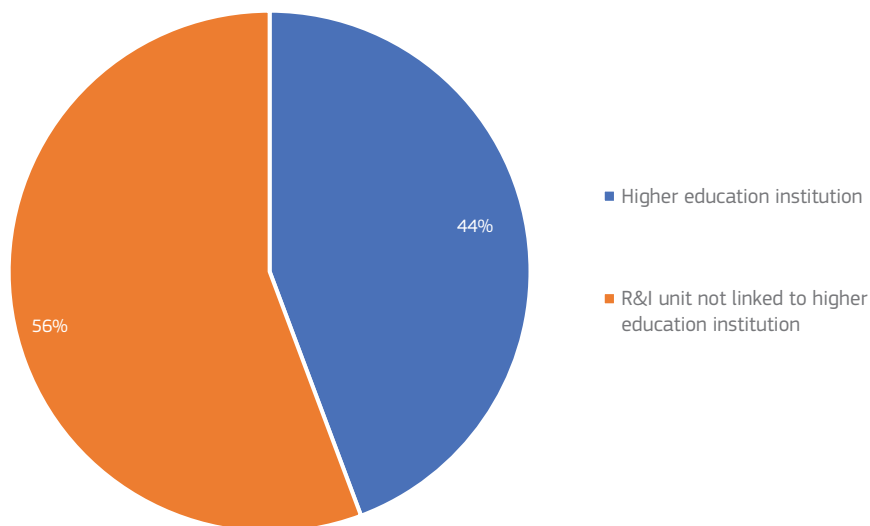
Source: Agriculture and Agri-food Canada; Canada Foundation for Innovation.

Main recipients of public food R&I investment

Canadian public funding for food-related projects had two major recipients: Higher education institutions like universities, colleges, institutes and *cégeps*¹⁷⁸ received 44.% of funding, equivalent to CAD 110.9 million (EUR 77.2 million) and 311 projects. While these institutions had the bigger number of projects, R&I Units not linked to Higher Education Institutions, which correspond to the Research and Development Centers that are part of the Agriculture and Agri-food Canada network, received the most funding despite having fewer projects, CAD 139.1 million (EUR 96.9 million, 56%) for 269 projects.

¹⁷⁸ Acronym from the French term *Collège d'enseignement général et professionnel*, which means General and professional teaching college.

Figure 4: Distribution of the funding by recipient

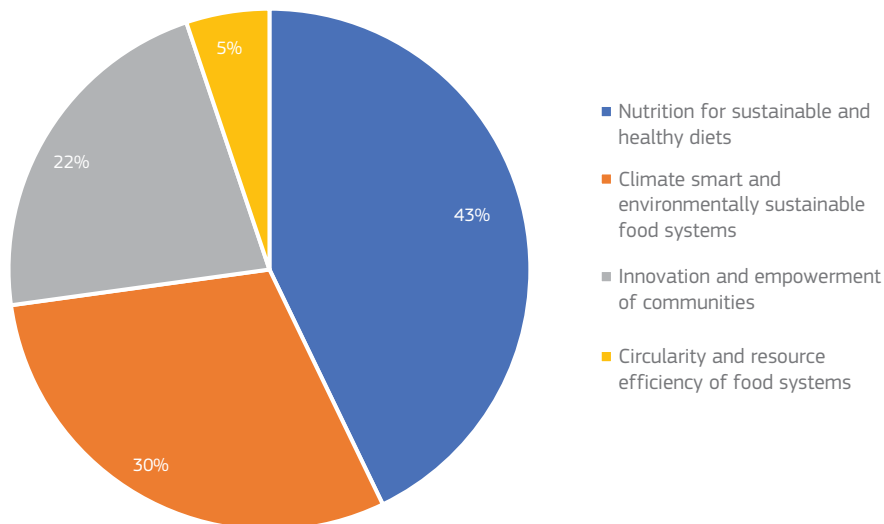


Source: Agriculture and Agri-food Canada; Canada Foundation for Innovation.

Links to Food 2030 priorities and pathways

Taking in consideration the four Food 2030 priorities, the nutrition for sustainable and healthy diets priority comes in first in Canada (43%, CAD 107.1 million, equivalent to EUR 74.6 million), with climate smart and environmentally sustainable food systems and innovation and empowerment of communities coming next, with 30% (CAD 74.9 million, EUR 52.2 million) and 22% (CAD 55.1 million, EUR 38.4 million), respectively. Circularity and resource efficiency of food systems was least prioritised, with only 5% (CAD 12.9 million, equivalent to EUR 9.0 million).

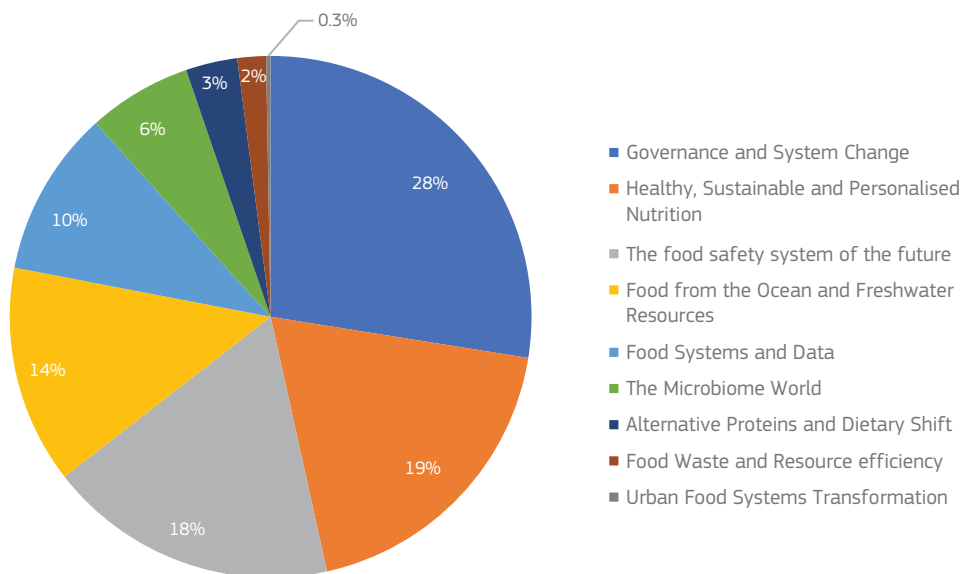
Figure 5: Distribution of the funding by Food 2030 priority



Source: Agriculture and Agri-food Canada; Canada Foundation for Innovation.

Regarding Food 2030 pathways, the governance and system change pathway had the highest share of food-related public R&I funds in Canada, with 28% (CAD 68.8 million, equivalent to EUR 47.9 million). Next, healthy, sustainable and personalised nutrition, and the food safety system of the future come in a close second and third places, respectively, with the former harnessing CAD 47.5 million (EUR 33.1 million, 19%) and the latter CAD 44.9 million (EUR 31.3 million, 18%). The two pathways with the least funding were food waste and resource efficiency (CAD 4.4 million, EUR 3.1 million, 1.8%) and urban food systems transformation (CAD 697,000, EUR 485,251, 0.3%). The food systems Africa pathway had no projects and funds allocated. Further details can be observed in Figure 6.

Figure 6: Distribution of the funding by Food 2030 pathway



Source: Agriculture and Agri-food Canada; Canada Foundation for Innovation.

Data gaps and limitations

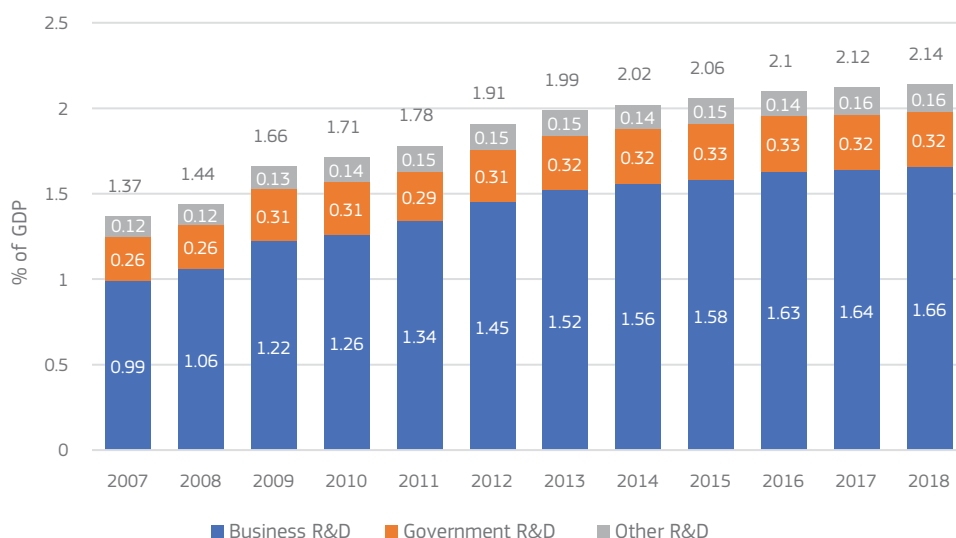
As mentioned, the data was extracted from two databases compiled by the AAFC department of the Government of Canada and the CFI. While the latter featured projects ranging from 2007 to 2020, the first database only had data from 2012 and onwards. There is no detailed information pre-2012 in the first database as around that time the Research Branch and Agri Environment Services Branch merged to form the Science and Technology Branch. Prior to the merger, each Branch kept records in very different ways and in different systems without the details currently available. In 2012, the government began the development of the Science Management System, which is what is used today for the tracking and reporting of projects. The development of the system took several years and this is why the most details can be seen on projects from 2015 to present day.

Moreover, information not available on the databases includes, among others: project description, technology readiness level (TRL), publications and patents.

Overview of national R&I food investment landscape: China

R&I expenditure in China has been consistently increasing since 2007, as seen in Figure 7. From 2007 to 2018¹⁷⁹, R&I expenditure as a percentage of GDP increased from 1% to 2%. This increase was mainly driven by the growth of Business R&I, from 0.99% in 2007 to 2% in 2018. In 2018, this corresponded to nearly 78% of total R&I spending. Government expenditure has remained more stable, representing around 0.3% of GDP across the reference period.

Figure 7: R&I expenditure in China, as a percentage of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

The **Ministry of Science and Technology (MOST)** is the leading entity in establishing a unified national platform for science and technology management and a mechanism for fund allocation, evaluation and supervision of research projects. It works with relevant government departments to develop policy recommendations to optimise the allocation of resources, build a diversified system for science and technology investment, and coordinate, manage and oversee the implementation of science and technology programmes (projects and funds) financed by the central government¹⁸⁰. MOST also leads an inter-ministerial joint

¹⁷⁹ 2018 is the last year for which complete figures are available.

¹⁸⁰ <http://en.most.gov.cn/organization/>

council that coordinates priorities, strategy, directions and budgeting, aiming to prevent overlaps across and within ministries.

The main funding source of the Chinese national innovation strategy is based on five funding pillars for science, technology and innovation. These five pillars are managed under a unified structure by MOST¹⁸¹. The pillars are as follows:

- **National Natural Science Fund:** focusing on basic and applied research in natural sciences, this fund is administered by the **Natural Science Foundation of China (NSFC)**, the largest Chinese research funding agency in natural sciences. The NSFC develops funding schemes, identifies research priorities, organizes peer reviews, makes funding decisions and supervises project implementation. The NSFC is supervised by MOST;
- **National Science and Technology Majorprojects (Megaprojects):** focusing on major key products, technologies and engineering of strategic importance for the country's economy and industrial competitiveness, megaprojects are considered to be the largest and most ambitious R&I investments for China's mid- and long-term development;
- **National Key R&I Programmes (NKPs):** actively supporting well-defined and well-targeted R&I in areas of social welfare and people's livelihood, such as agriculture, energy and resources, environment, health, etc;
- **Technology Innovation Guiding Fund(s):** stimulating the transfer, capitalisation and commercialisation of key results by investing in innovative start-ups and small- and medium- sized enterprises (SMEs) through venture capital funds, private equity and risk compensations;
- **Bases and Talents Programme:** promoting the establishment of a series of internationally competitive bases for scientific research and to foster high-level innovative talents and teams.

The main organisation in the country specifically for agri-food related R&I is the **Ministry of Agriculture and Rural Affairs (MARA)**. This is responsible for implementing the guiding principles and policies related to agriculture, rural areas and farmers.

¹⁸¹ chinainnovationfunding.eu/chinese-national-innovation-funding-programmes/

Other important actors in the Chinese food sector include: Chinese Academy of Agricultural Sciences; China National Food Industry Association; China Safe Food Association; Chinese Academy of Inspection and Quarantine (CAIQ); China National Association of Grain Sector; and China Chamber of Commerce of Import & Export of Foodstuffs, Native Produce & Animal By-Products (CFNA).

National R&I Strategy

In the period 2007–2020, two strategies served as the main guide for science, technology and innovation in China. These are:

- Medium to Long-Term Science and Technology Development Plan 2006–2020¹⁸²;
- National Five-Year Plans for Science and Technology Innovation (11th – 2006 to 2010¹⁸³; 12th – 2011 to 2015¹⁸⁴; 13th – 2016 to 2020¹⁸⁵).

Medium to Long-Term Science and Technology Development Plan 2006–2020

In 2006, the Chinese government issued the eighth Medium to Long-term Plan (MLP) for the Development of Science and Technology (2006–2020), which aimed to transform China into an innovative society by 2020. The eleven key Science and Technology priority sectors identified by this plan were: energy; water and mineral resources; the environment; agriculture; manufacturing industry; transportation sector; information industry and modern service industry; population and health; urbanization and city development; public security; and national defence.

The MLP also highlighted several key objectives for the long-term agenda of Science and Technology - to position China as a world Science and Technology power by 2050. These objectives include: mastering core technologies in manufacturing and IT; leading in agricultural technologies; achieving technological breakthroughs in energy, among others.

¹⁸² https://www.itu.int/en/ITU-D/Cybersecurity/Documents/National_Strategies_Repository/China_2006.pdf

¹⁸³ http://www.gov.cn/english/special/115y_index.htm

¹⁸⁴ <https://policy.asiapacificenergy.org/node/39>

¹⁸⁵ <https://cset.georgetown.edu/publication/state-council-notice-on-the-publication-of-the-national-13th-five-year-plan-for-st-innovation/>

Furthermore, specific quantitative targets for 2020 were established:

- Increase R&I intensity to 3% of GDP;
- Rate of Science and Technology contribution to the economy to reach at least 60%;
- Dependence on imported technology to decline to 30% or below;
- For China to be in the top 5 countries for patents granted and international citations for scientific papers.

National Five-Year Plans for Science and Technology Innovation

Over the 2007-2020 period, the Chinese Government developed three five-year plans for Science and Technology Innovation: the 11th Plan ran from 2006 to 2010, the 12th from 2011 to 2015 and the last one was developed in 2016 and lasted until 2020. This last and most recent plan was formulated on the basis of the 13th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Medium to Long-Term Science and Technology Development Plan 2006-2020. The plan highlighted the synergy between Science and Technology and economic development with the aim of advancing Science and Technology innovation in a holistic, coordinated, farsighted and targeted manner. Strategically, innovation aimed to proceed in tandem with industrial development trends. The roll out of reform measures targeting problems in the innovation chain was a further aim. The plan set 12 targets, including increasing the contribution of scientific and technological progress from 55% to 60% of economic growth and the proportion of output generated by knowledge-intensive services from 16% to 20% of GDP. Despite not being covered by the 2007-2020 period, it is worth mentioning that the 14th Five-Year Plan (2021–2025) for National Economic and Social Development has already been announced.

Overview of national food policy

During the past few decades China has made remarkable steps towards its agricultural development. The poverty alleviation programme led to significantly improved living standards and contributed towards eliminating absolute poverty by the year 2020. Despite this, China's development has still been hindered by malnutrition, chronic diseases, and increasingly evident environmental problems¹⁸⁶.

¹⁸⁶ <http://agfep.cau.edu.cn/module/download/downloadfile.jsp?classid=0&filename=2105141928327359.pdf>

As one of the biggest economies in the world with a population of 1.4 billion, China needs to ensure food security and availability to its population. China's food security policy is based on the principle of ensuring basic self-sufficiency in grains and security of staple foods, while at the same time ensuring the supply of other critical food products such as meat, milk, sugar and oil.

The country has established multiple policies. According to the recently unveiled 14th Five-Year Plan (2021–2025) for National Economic and Social Development, which builds on the achievements of previous plans, and the Long-term 2035 Vision, national priority will be given to developing agriculture and rural areas, promoting rural revitalization on all fronts, and ensuring national food security. The Chinese government has committed to achieve carbon neutrality by 2060, take an active part in global climate governance, and promote green and low-carbon transformation and development. In 2016, the government issued the **Outline of Healthy China 2030 Plan**, incorporating “building a healthy China” into the national development strategy.

To better ensure the supply of agricultural products meet the public need for more nutritious, healthier and safer foods at the new stage of the implementation of the **14th Five-Year Plan**, China is carrying out two different approaches. First, with the intent of slowing down the reduction of cultivated land that has been happening in the country, Chinese organisations and Government should aim to improve agricultural technologies, facilitate the structural adjustment of agriculture, optimize the allocation of domestic agricultural resources, promote the cultivation of high-quality varieties, quality improvement, and branding, and thus increase the effective supply of domestic agricultural products. Second, China must make full use of the two markets (domestic and international) and of resources both at home and abroad through imports and exports, thus increasing the effective global food supply by internationalizing Chinese agriculture. To this end, China should optimize agricultural trade patterns, implement a strategy of diversified agricultural imports, and assist enterprises in participating in the global supply chain of agricultural products.

Analysis of food systems related R&I projects

This analysis focuses on individual projects that could be identified through ScienceNet. The Chinese Academy of Agricultural Sciences (CAAS), as one of the major funders of food system R&I, does not publish details on individual projects. Therefore the analysis above does not take this into account. The analysis in the main body of the report has however taken into account the annual budgets published by the CAAS to provide a more complete overview of public spending on food systems R&I.

According to data made available by ScienceNet (which only includes information from NSFC), a total of 438 R&I food-related projects were developed by Chinese higher education and research institutes between 2007 and 2020, receiving a total of RMB 289.2 million (EUR 38.8 million) in funding. A review of the number of projects approved during this period shows that 2007 was the year with fewest projects approved (10), with most projects approved (48) in 2012. The lowest annual funding for food-related projects was in 2007 (RMB 1.9 million/ EUR 255,991). In 2011, the year with the highest amount, public funding on food-related R&I was RMB 39.7 million (EUR 5.3 million).

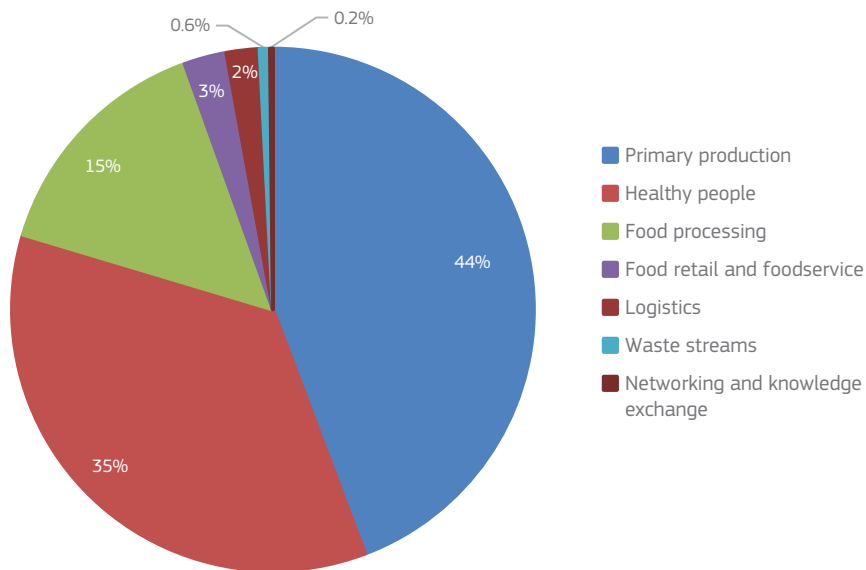
Figure 8: R&I food related projects between 2007 and 2020



Source: ScienceNet

The majority of public funding appears to be directed towards projects and/or actions related to primary production (44%, corresponding to RMB 128.2 million / EUR 17.2 million), with that focused on healthy people in second (35%, corresponding to RMB 102.5 million/ EUR 13.8 million). It is notable that between 2007 and 2020, there was no public investment in packaging-related projects, as observed in Figure 9.

Figure 9: Distribution of the funding by sector

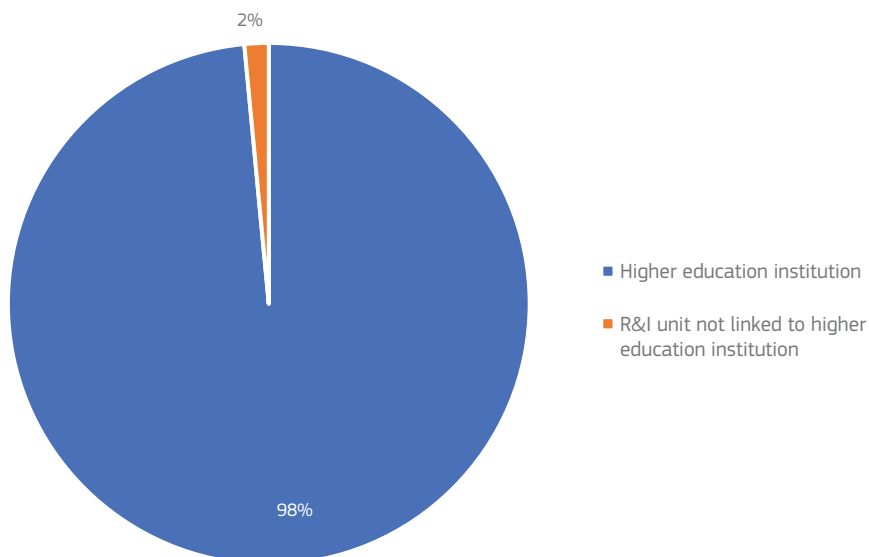


Source: ScienceNet

Main recipients of public food R&I investment

A review of the data shows that Higher Education Institutions received the highest amount of food R&I funding (RMB 284.9 million / EUR 38.3 million, corresponding to 99% of the total funding), followed by R&I Units not linked to higher education institutions (RMB 4.3 million / EUR 579,172, or 2% of the total). Higher Education Institutions coordinated 433 projects between 2007 and 2020, whereas R&I Units not linked to higher education institutions coordinated 5 (Figure 10).

Figure 10: Distribution of the funding by recipient

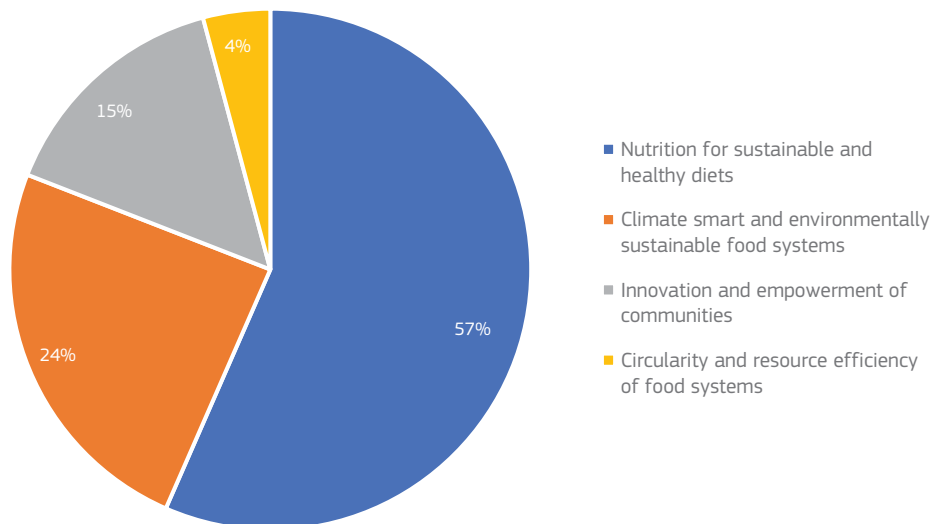


Source: ScienceNet

Links to Food 2030 priorities and pathways

Taking in consideration the four Food 2030 priorities, it is clear that the publicly funded food-related R&I projects in China have heavily prioritised research in nutrition for sustainable and healthy diets (57% of the total, corresponding to RMB 163.6 million / EUR 22.0 million). The second Food 2030 priority in China is the climate smart and environmentally sustainable food systems (24%), with innovation and empowerment of communities coming in third (15%). The circularity and resource efficiency of food systems reflect the least research interest, with only 4% (Figure 11).

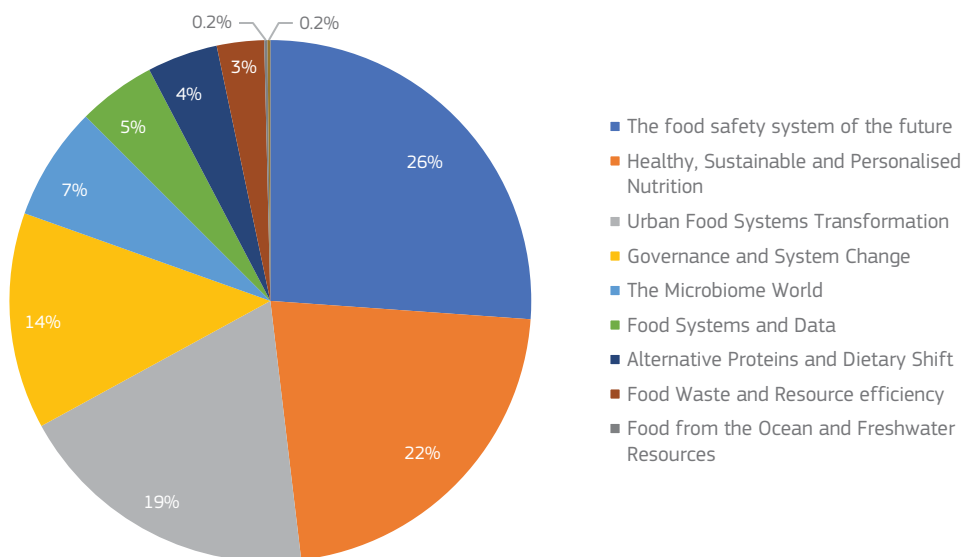
Figure 11: Distribution of the funding by Food 2030 priority



Source: ScienceNet

With regards to Food 2030 pathways, the highest level of publicly funded food-related R&I projects in China was assigned to the food safety system of the future pathway (26% corresponding to RMB 75.5 million / EUR 10.2 million). Next in line, personalised nutrition for sustainable healthy diets was the main pathway of 22% of projects (RMB 63.6 million / EUR 8.6 million), followed by urban food system transformation (19% and RMB 54.7 million / EUR 7.4 million) and governance and systems change (13% and RMB 38.8 million / EUR 5.2 million). Further details can be observed in Figure 12.

Figure 12: Distribution of the funding by Food 2030 pathways.



Source: ScienceNet

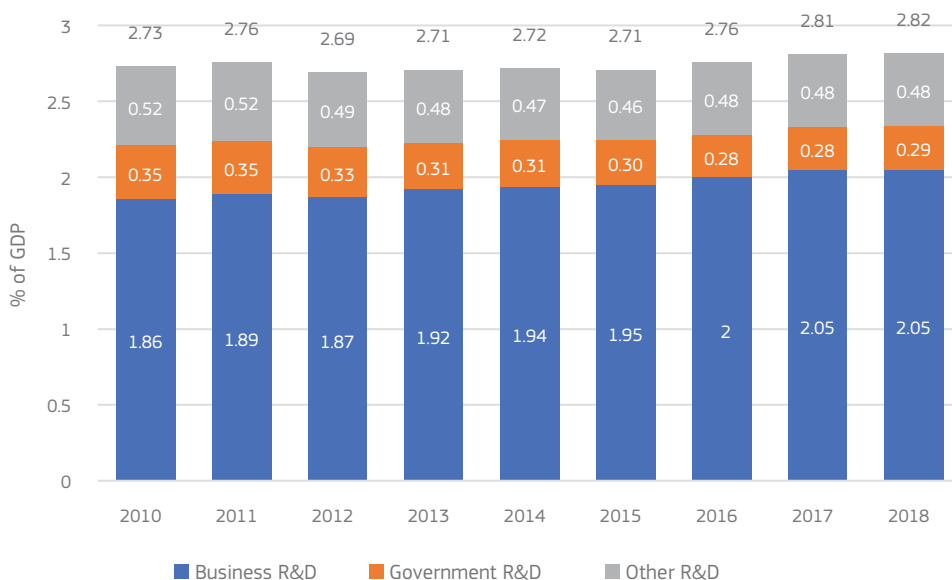
Data gaps and limitations

The results of the analysis are based on data publicly available on ScienceNet. Information not available on the website includes among others: project description, keywords, start and end dates, technology readiness level (TRL), publications and patents. The Chinese Academy of Agricultural Sciences (CAAS), as one of the major funders of food system R&I, does not publish details on individual projects. Therefore the analysis above does not take this into account. The analysis in the main body of the report has however taken into account the annual budgets published by the CAAS.

Overview of national R&I food investment landscape: USA

The USA is the world's top R&I performer¹⁸⁷ investing over 3% of its GDP in R&I activities in 2017 and 2018.

Figure 13: R&I expenditure in the USA, as a percentage of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

In the USA, R&I is funded and performed by a range of different entity types, including the federal and state government, businesses, academia and non-profit organisations¹⁸⁸. The business sector provide the majority of this investment. The business sector also leads most of the R&I output¹⁸⁹, with the majority of the publicly funded investment focusing on fundamental research. Applied research is mainly sourced from private or public-private funds. Universities are key players in technology transfer – for instance through incubators, accelerators, mentoring programmes and entrepreneurship programmes, in addition to the regular curriculum, and the provision of startup funds for students. Examples include UC Berkeley, Stanford, MIT and Harvard. Think-tanks and non-governmental organizations are

¹⁸⁷ <https://nces.nsf.gov/pubs/nsb20203>

¹⁸⁸ <https://fas.org/sqp/crs/misc/R44307.pdf>

¹⁸⁹ Ibid.

also important performers of R&I¹⁹⁰. Additionally, funding can be obtained through non-profit organisations, charities, the business sector and foundations¹⁹¹.

The US R&I system includes a range of highly-rated universities and federal laboratories. The system is very complex. It is highly decentralized across government departments and the private sector. There are also many venture capital firms, banks, private investors and business angels. Funding is thus available from a wide range of sources. At the federal level, this includes but is not limited to the National Endowment for the Humanities, the Smithsonian Institutes, the US Government Grants Database, the National Science Foundation, the National Institutes of Health, the Department of Health and Human Services, the Department of Energy and the Center for Disease Control and Prevention. Silicon Valley, North Carolina's Research Triangle Park (RTP), Boston and New York City stand out as renowned innovation clusters and hubs¹⁹².

National R&I Strategy

The USA does not have an overall national R&I strategy. Indeed, R&I policy is determined at both the state and the federal levels. Innovation is often left to the market and thus the role of the government is to support knowledge and education¹⁹³. In this context the **2018-2020 Strategic Plan from the Agricultural Research Service (ARS)** is noteworthy. This outlines four strategic research areas: **Nutrition, Food Safety and Quality; Natural Resources and Sustainable Agricultural Systems; Crop Production and Protection;** and **Animal Production and Protection**. Additionally, the Strategic Plan integrates synergies between aspects such as antimicrobial resistance, climate change and the microbiome as priorities across multiple national programmes. The main focus of these **synergies** is to tackle the spread of pathogens that might pose a threat to US agriculture, develop the use of genetic material in order to increase productivity, quality and resilience, whilst limiting environmental impacts and ensuring resource efficiency. The key area of **antimicrobial resistance** aims to protect animal agriculture and public health, focusing on R&I to prevent the spread of infections, whereas the focus on **climate change** foresees the empowerment of agricultural stakeholders through science-based knowledge that will allow for better risk management and exploitation of agricultural opportunities. Finally, the **microbiome focus**, which includes the National Microbiome Initiative, strives for a better understanding of the microbiome, and its benefits for healthcare, food and the environment.

¹⁹⁰ <https://nces.nsf.gov/pubs/nsb20203>

¹⁹¹ <https://www.dwih-newyork.org/en/research-innovation/the-research-and-innovation-landscape-in-the-usa/general-overview/>

¹⁹² https://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.532164.de/research_innovation_policy.pdf

¹⁹³ <https://itif.org/publications/2020/11/02/understanding-us-national-innovation-system-2020>

The main goals of the **Nutrition, Food Safety and Quality** research area include the definition of the role of food in optimizing health and food safety, controlling the spread of toxins in agriculture and enhancing competitiveness and agricultural quality. The Strategic Plan's focus on **Natural Resources and Sustainable Agricultural Systems** aims at contributing towards better management of agricultural systems in order to enhance sustainable production, as well as to reduce environmental impacts, and the optimisation of agricultural products as renewable inputs for manufacturing and energy creation. In terms of **Crop Production and Protection**, the ARS will use applied science and technology to guarantee crop productivity, protection from pests, environmental protection and food security, especially through research on genetic resources, genomics, plant disease prevention, crop management, and methyl bromide alternatives. Finally, the research area **Animal Production and Protection** uses scientific innovation and technology to optimize production and animal health, and to support agencies involved in trade, biodefense and food security by focusing especially in genetic improvements, disease resistance and threats to public health, and sustainable systems of production of meat, fish, milk and eggs¹⁹⁴.

A further relevant document is the **National Science Foundation Strategic Plan for Fiscal Years 2018-2022**. This identifies two relevant goals: **Strategic Goal 1. Expand knowledge in science, engineering and learning** envisions supporting basic science and engineering research, as well as the development of advanced instruments, data analysis, computation and novel facilities; **Strategic Goal 2. Advance the capability of the Nation to meet current and future challenges** focuses on addressing high priority national challenges, by funding research on urgent societal issues and promoting innovation for technological and economic competitiveness. This also envisions the creation of partnerships with industry, agencies and international sponsors in order to build capacity and increase innovation. Overall, the National Science Foundation foresees the development of partnerships with industry, foundations, international organizations and other USA federal agencies in order to facilitate innovation, enhance research capacity and fasten the process of implementation of innovations¹⁹⁵.

National Food Strategy

The Farm Bill is the cornerstone document of food policy in the US. This contains the policy guidelines for the following 5 years, and allocates funds to food distribution programmes, and to farmers by means of crop insurance, subsidies and grants. The bill targets a broad set of agriculture and nutrition assistance concerns. The latest Farm Bill was signed

¹⁹⁴ <https://www.ars.usda.gov/ARSUserFiles/00000000/Plans/2018-2020%20ARS%20Strategic%20Plan.pdf>

¹⁹⁵ <https://www.nsf.gov/pubs/2018/nsf18045/nsf18045.pdf>

into law in 2018. It allocates mandatory spending targets to nutrition programmes, commodity support programmes, conservation programmes and crop insurance. The main developments stemming from the latest bill are the extension of agricultural commodity support programmes, the modification of Agricultural Risk Coverage revenue support programmes, and the increase of marketing assistance loan rates for a number of crops. Additionally, the 2018 Farm Bill addresses issues related to rural communities, such as substance abuse, increasing broadband access in rural areas, increasing credit and safeguarding livestock from disease outbreaks. In terms of R&I, the enacted Farm Bill promotes education and use of biotechnology through the removal of tariffs, foresees the application of technology to food distribution programmes, reauthorizes the Rural Revitalization Technology programme, and establishes a task force for identifying gaps in broadband precision farm connectivity. The use of technology is also promoted in the area of monitoring organic imports, and the funding is allocated towards the maintenance of information technology monitoring and evaluation systems. Funding for agricultural research is also reauthorized until 2023, and high priority areas include plant and animal health, fertilizer management, organic agriculture and speciality crops. Additionally, the Farm Bill provides support for urban and indoor agricultural production, industrial hemp research and advanced agricultural research¹⁹⁶.

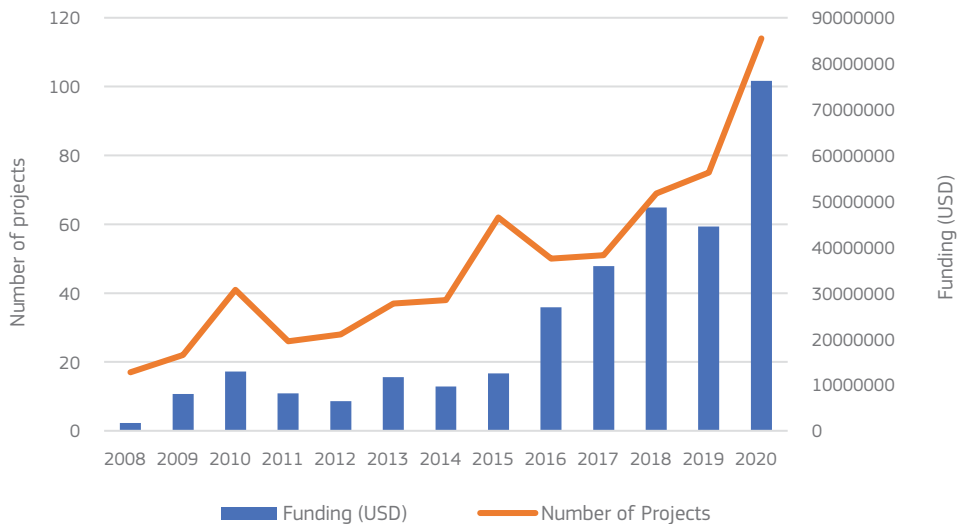
Analysis of food systems R&I projects

According to data made available by the US Department of Agriculture (USDA), a total of 639 R&I food-related projects were developed by US organisations between 2008 and 2020, receiving a total of USD 303.3 million / EUR 260.5 million in funding. A review of the number of projects approved during this period shows that 2020 was the year with most projects approved (113). The highest annual funding amount was also in 2020, when publicly funded expenditure on food-related R&I was USD 76.2 million / EUR 65.7.

Many important programmes, such as the National Institute for Food and Agriculture (NIFA) only publish aggregate annual budgets and no complete detail of individual projects funded. This analysis therefore considers a selection of individual projects that could be identified. The main body of the report provides estimates of overall public investment into food systems R&I by including annual budgets of key research funders such as NIFA.

¹⁹⁶ <https://crsreports.congress.gov/product/pdf/R/R45525>

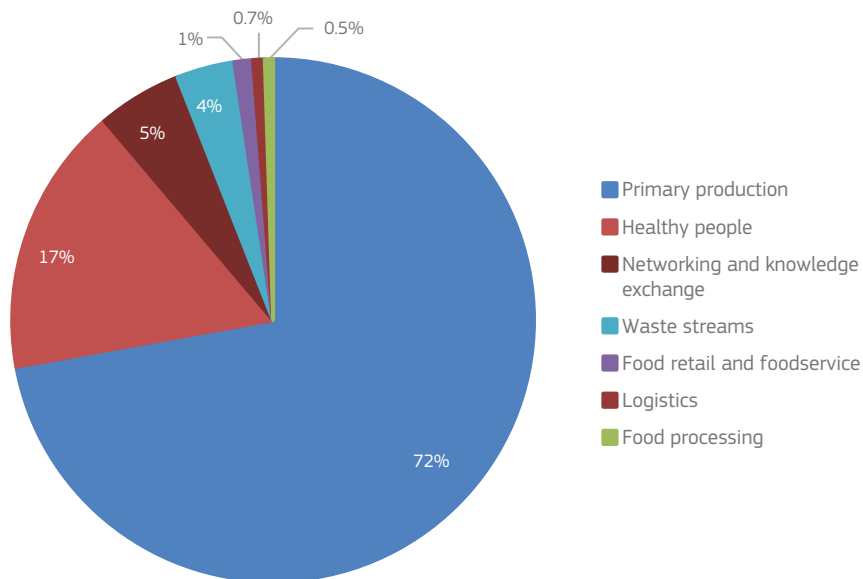
Figure 14: R&I food related projects between 2008 and 2020



Source: USDA

The majority of public funding appears to be directed towards projects and/or actions related to primary production (76%, USD 230.8 million / EUR 199.0 million) (Figure 15).

Figure 15: Distribution of the funding by sector

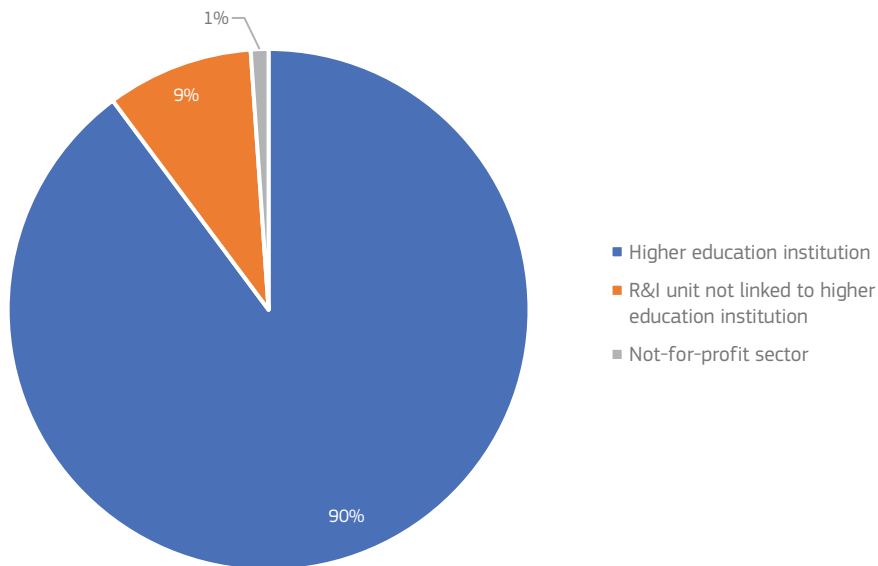


Source: USDA

Main recipients of public food R&I investment

A review of the data shows that Higher Education Institutions received the highest amount of food R&I funding (USD 272.5 million/ EUR 233.0 million, corresponding to 90% of the total funding), followed by R&I Units not linked to Higher Education Institutions (USD 27.5 million / EUR 23.0 million, or 9% of the total). According to the available data, Higher Education Institutions coordinated 540 projects between 2008 and 2020, whereas R&I Units not linked to Higher Education Institutions coordinated 83. Organisations from the not-for-profit sector coordinated 16 projects during the same period.

Figure 16: Distribution of the funding by recipient

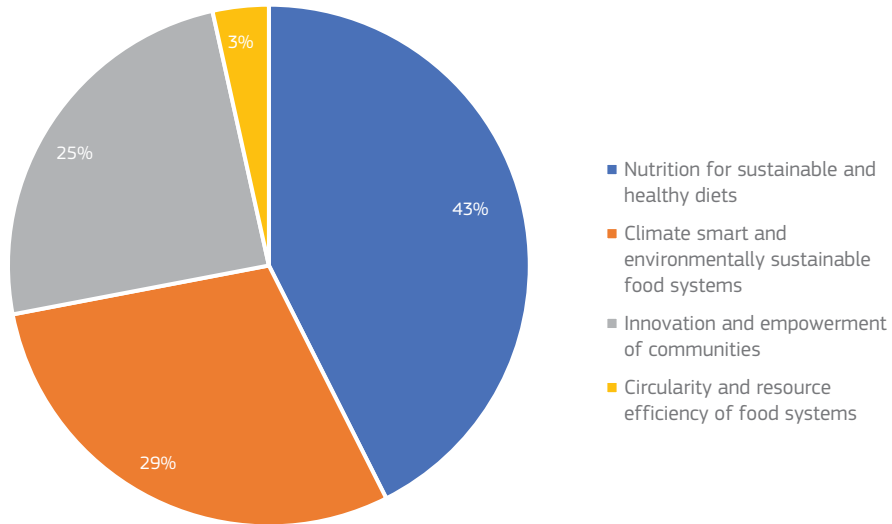


Source: USDA

Links to Food 2030 priorities and pathways

According to an internal analysis of the funding data, publicly funded food-related R&I in the USA has prioritised research in nutrition for sustainable and healthy diets (43% of the total, corresponding to USD 129.1 million / EUR 110.9 million). The second Food 2030 priority in American research is climate smart and environmentally sustainable food systems (29% and USD 89.3 million / EUR 77.0 million). Innovation and empowerment of communities and circularity and resource efficiency of food systems reflect the lowest research interest (25% and 4% respectively) (Figure 17).

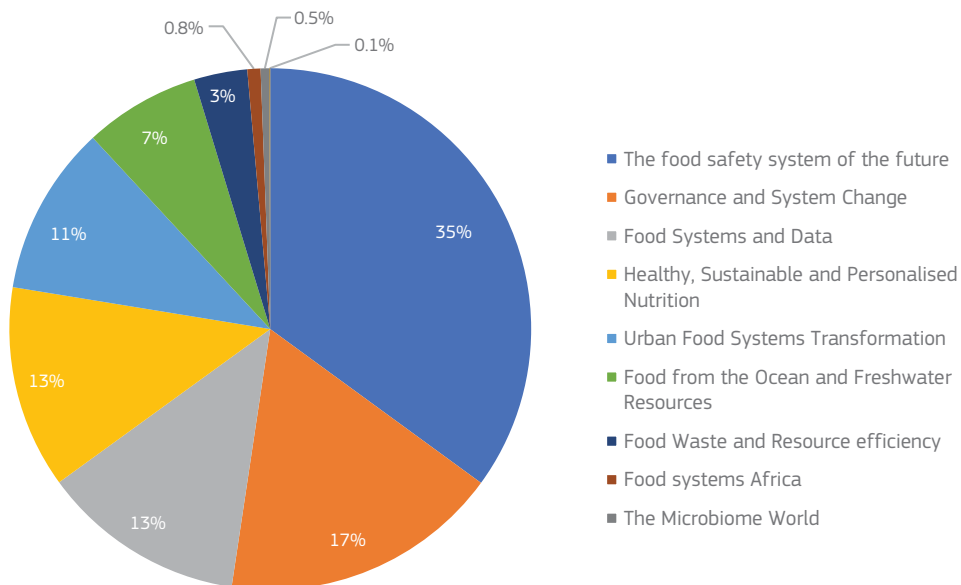
Figure 17: Distribution of the funding by Food 2030 priority



Source: USDA

With regards to Food 2030 pathways, publicly funded food R&I in the USA assigns a large share to food safety systems of the future (35%, corresponding to USD 106.3 million / EUR 91.7 million), followed by governance and system change (17% and USD 52.5 million / EUR 44.1 million). Further details can be observed in Figure 18.

Figure 18: Distribution of the funding by Food 2030 pathway



Source: USDA

Data gaps and limitations

The results of the analysis are based on information provided by the USDA website. Information not available includes project descriptions, technology readiness level (TRL), organization types, publications and patents. The database contained a large number of results that was filtered according to selected keywords.

ANNEX F: COUNTRY REPORTS (OVERVIEW OF NATIONAL R&I FOOD INVESTMENT LANDSCAPE)

INTRODUCTION

This annex presents the individual country reports for the 27 EU Member States which informed the national analysis of the comparative study related to the research and innovation investment level in food systems. The reports include an overview of the R&I landscape in the country, the main actors, strategies and policies related to food R&I, and their alignment with the FOOD2030 priorities and pathways.

The national research builds on a mapping of public sector expenditure on food systems R&I against Food 2030 priorities in 11 EU Member States between 2013 and 2018, which was carried out by the SCAR Food Systems Working Group and published in 2018. This was complemented by researching publicly available data on national innovation funding using agreed keywords¹⁹⁷ to identify a list of publicly funded R&I projects in Member States related to food systems between 2007 and 2020, and consultations with relevant institutions to collect further project data.

The collated data for each country were categorised against the Food 2030 priorities, pathways and sectors to understand distribution of projects and spend. Important to highlight is in particular the definition used for the classification of project against the pathway “Food Systems and Data”: under this category, we have also included aspects interlinked with primary production (such as precision farming) as well, taking a broader definition than strictly outlined within the “Food 2030 Pathways for action: Food Systems and data” factsheet.¹⁹⁸

¹⁹⁷ The following keywords were used for this search: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, Sustainability+” “eco-innovation+” “environmental impact+””. The keywords were translated and slightly tweaked to reflect the appropriate wording for the following countries: Austria, Germany, Spain

¹⁹⁸ European Commission, Directorate-General for Research and Innovation, *Food 2030 pathways for action : food systems and data*, Publications Office, 2020, <https://data.europa.eu/doi/10.2777/38224>

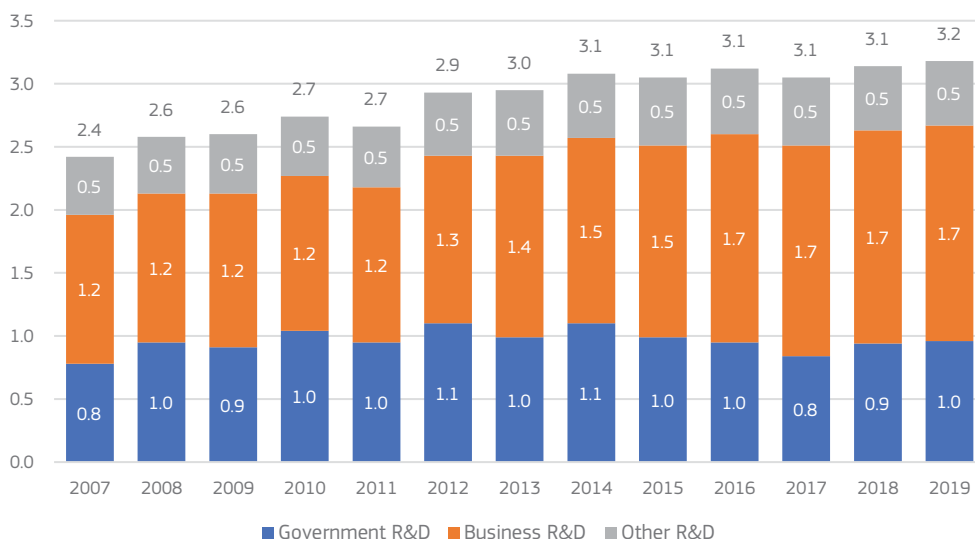
AUSTRIA

1 Overview of national R&I landscape

As demonstrated in Figure 1, overall expenditure for R&I in Austria has increased significantly between 2007 and 2019 with minor fluctuation year on year. In 2019, an estimated EUR 12.69 billion was invested in research and innovation, equivalent to 3.2% of GDP. The largest source of R&I funding in Austria is the private sector, which accounted for almost half (48%) of all R&I expenditure in 2019. The public sector accounts for a little over a quarter of total R&I expenditure, with funding from abroad (ca. 15%) and from the federal states (at between 4-5%) making up the rest.

The country does not have a specific food R&I strategy, but food and R&I are embedded in the R&I strategy and food policies.

Figure 1: R&I expenditure in Austria, as % of GDP¹⁹⁹



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

¹⁹⁹ Statistik Austria (2021). Global estimate/ R&D intensity (annual). Available at: https://www.statistik.at/web_en/statistics/EnergyEnvironmentInnovationMobility/research_and_development_r_d_innovation/global_estimate_r_d_intensity_annual/index.html

Main Providers of Food R&I funding at national level

Within the public sector, three government ministries share responsibility for R&I funding, with separate agencies responsible for the award, distribution and monitoring of grant programmes for each of them:

- The Ministry of Education, Science and Research (BMBWF) is responsible for basic scientific research.
- The Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)²⁰⁰ is responsible for industrial research and development.
- The Ministry for Digitalisation and Economic Affairs (BMDW) is responsible for promoting R&I in enterprises. The Austria Wirtschaftsservice (AWS), the promotional bank of the Austrian federal government, acts as the implementation agency for the BMDW and provides soft loans, grants and guarantees.

Other government departments, such as the Ministry for Agriculture, Regions and Tourism and the Ministry for Social Affairs, Health, Care and Consumer protection, can commission departmental research as well. However, the budget for this is small in comparison to the three programmes mentioned previously.

Other relevant actors

Funding for applied research and innovation is managed by the Austrian Research Promotion Agency (FFG). Funding for basic research is managed by the Austrian Science Fund (FWF).

2 National R&I Strategy

Austria first introduced an overarching national R&I strategy in 2011. The **National Strategy for Research, Technology and Innovation**²⁰¹ (*Strategie der Bundesregierung für Forschung, Technologie und Innovation*²⁰¹) covered the years **2011-2020** and mapped out Austria's path to becoming a leader in innovation. It aimed to achieve this through developing the competitiveness of Austria's R&I environment and infrastructure, promoting

²⁰⁰ Prior to January 2020 named the Federal Ministry for Transport, Innovation and Technology

²⁰¹ Austrian Federal Government (2011), 'National Strategy for Research, Technology and Development 2011-2020', available at: <https://www.genderportal.eu/resources/strategie-der-bundesregierung-fur-forschung-technologie-und-innovation-national-strategy>

capacity building, strengthening private sector R&I and improve the efficiency of national R&I policy. The strategy called for national R&I funding to be targeted towards thematic focal areas to address several Grand Challenges facing the country (including climate change, scarce natural resources and demographic change).

In 2020, the follow-on **Research, Technology and Innovation Strategy 2030** (FTI-Strategie 2030 - Strategie der Bundesregierung für Forschung, Technologie und Innovation²⁰²) was published. Its three main objectives are to:

1. Strengthen Austria's R&I environment in order to catch up with world leaders in innovation;
2. focus on effectiveness and excellence; and
3. promote knowledge, talent and skills.

Although under its second objective the strategy highlights the need to use R&I to achieve national climate goals, the strategy itself does not set thematic priorities to achieve this.

In addition, the Federal Ministry for Agriculture, Regions and Tourism (BMLRT) has its own **programme for research and development** (Das Programm für Forschung und Entwicklung im BMLRT, 2020-2025²⁰³). This includes the thematic R&I priorities the BMLRT wants to focus on in its departmental research, namely futureproofing nature and cultivated areas, renewable resources and climate change, resource management and circular economy, food security, digitalisation, and policy impact assessment.

²⁰² Austrian Federal Government (2020), 'FTI-Strategie 2030 – Strategie der Bundesregierung für Forschung, Technologie und Innovation', https://www.bundestkanzleramt.gv.at/dam/jcr:1683d201-f973-4405-8b40-39dded2c8be3/FTI_strategie.pdf

²⁰³ Federal Ministry for Agriculture, Regions and Tourism (2020). Das Programm für Forschung und Entwicklung im BMLRT, 2020-2025. Available at: <https://www.bmlrt.gv.at/land/land-bbf/Forschung/programm-fuer-forschung-und-entwicklung-adaptiert.html>

3 Overview of national food policy

In terms of building climate smart and sustainable food systems, Austria has several strategies that look to minimise the impact of human activity, in particular agriculture, on the environment in general (and biodiversity in particular):

- The country's **biodiversity strategy** (Biodiversitäts-Strategie Österreich 2020+²⁰⁴), published in 2014, looks to protect biodiversity and minimise the impact of human activity, including through food production, on biodiversity. Objective 2 of the strategy is to expand biodiversity research and monitoring.
- The **national strategy for fruit and vegetables** (Nationale Strategie Obst und Gemüse²⁰⁵) from 2018 accompanies the European Structural and Investment Funds (ESIF) operational programme and outlines support mechanisms for the production of fruit and vegetables. Environmental considerations play an important role, specifically in reducing residue from pesticides and other substances, protecting natural resources (especially water and soil), reducing waste and reducing the negative impact of fruit and vegetable production on biodiversity and climate change.
- In 2019, the Ministry for Sustainability and Tourism, the Ministry for Education, Science and Research and the Ministry for Traffic, Innovation and Technology (now the BMK) jointly published the **Bioeconomy Strategy for Austria**²⁰⁶. Amongst other objectives, this sets out a holistic approach to supporting the country in achieving its climate goals and promoting the transition towards a sustainable society. Another key objective is the promotion of innovation, with specific targets for increasing the number of scientific publications, transdisciplinary projects and patents related to the bioeconomy. Thematic priorities include food security and safety, circularity and climate smart and sustainable food production (including aquaculture). The strategy includes explicit links to the EU Bioeconomy Strategy²⁰⁷ and to the Agenda 2030²⁰⁸.

²⁰⁴ Federal Ministry for Agriculture, Forestry, Environment and Water (2014), BIODIVERSITÄTS-STRATEGIE ÖSTERREICH 2020+, Available at: https://www.bmk.gv.at/themen/klima_umwelt/naturschutz/biol_vielfalt/biodiversitaets_strategie_oe2020.html#:~:text=Die%20Biodiversit%C3%A4ts%2DStrategie%20%C3%96sterreich%202020,und%20die%20Gef%C3%A4hrdungsursachen%20zu%20minimieren.

²⁰⁵ Federal Ministry for Agriculture, Forestry, Environment and Water (2014), NATIONALE STRATEGIE OBST UND GEMÜSE, Available at: https://www.ama.at/getattachment/e5d02964-acf8-4f37-a2be-57d2d525422e/AT_Nationale_Strategie_Obst_Gemuse_2018.pdf

²⁰⁶ Austria Federal Government (2019), Bioeconomy – A strategy for Austria. Available at: <https://www.bmk.gv.at/themen/innovation/publikationen/energieumwelttechnologie/biooekonomiestrategie.html>

²⁰⁷ European Commission (2018), A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0673>

²⁰⁸ United Nations (2015), Transforming our world: the 2030 Agenda for Sustainable Development. Available at: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

To boost the transition towards a circular economy, Austria's Research, Technology and Innovation (RTI) strategy has defined a 'circular economy initiative', marking the area as one of key strategic priority.

Austria also promotes the importance of a healthy and sustainable diet. The **national action plan for nutrition** (Nationaler Aktionsplan Ernährung (NAP.e)²⁰⁹) channels the Ministry of Social Affairs, Health, Care and Consumer protection's efforts to combat malnutrition and inform and empower communities to consume a healthy diet. It includes a particular focus on pregnant women and breastfeeding women, as well as children and teenagers.

Two key priorities evident in Austria's national policies when discussing food systems relate to the issue of food security, both in terms of ensuring security of supply as well as ensuring food safety. Food safety considerations are apparent both within the focus on ensuring quality food products and removing pollutants from soil and water, as well as animal and plant production.

4 Public funding available for food R&I

R&I project funding

A search of the federal research database Bfdat, which contains all research projects funded by federal ministries since 2008, using keywords and filtering by relevant disciplines of science, showed that over EUR 20.4 million had been awarded to research projects falling within the remit of food systems.

Looking at the source of funding yielded the following picture: more than half (60%) of these projects had been funded by the BMLRT (sometimes with co-funding from other ministries or institutions). Of the three funding ministries, the Federal Ministry of Education, Science and Research (BMBWF) funded 12% of all food systems related research projects, while the Ministry for Digitalisation and Economic Affairs (BMDW) and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology (BMK) only funded 1 and 2 projects respectively each (1% of the total). Of the total amount funded for such projects by federal ministries since 2008, 70% came from the BMLRT, far ahead of

²⁰⁹ Federal Ministry for Social Affairs, Health, Care and Consumer Protection (2021), "Nationaler Aktionsplan Ernährung (NAP.e), Available at: [https://www.sozialministerium.at/Themen/Gesundheit/Lebensmittel-Ernaehrung/Ernaehrungsstrategien-und-Gremien/Nationaler-Aktionsplan-Ernaehrung-\(NAP.e\).html#:~:text=Aktionsplan%20Ern%C3%A4hrung%20\(NAP.-,e\),%C3%9Cbergewichts%2D%20und%20Adipositaszahlen%20bis%202020.](https://www.sozialministerium.at/Themen/Gesundheit/Lebensmittel-Ernaehrung/Ernaehrungsstrategien-und-Gremien/Nationaler-Aktionsplan-Ernaehrung-(NAP.e).html#:~:text=Aktionsplan%20Ern%C3%A4hrung%20(NAP.-,e),%C3%9Cbergewichts%2D%20und%20Adipositaszahlen%20bis%202020.)

the next biggest funder, the Federal Ministry for European and International Affairs (BMEIA), which was responsible for 14% of the total funding amount.

The BMK distributes funding via the “Green Frontrunner” instrument. The focus of the green frontrunner funding instrument is to support research that helps to establish new, offensive business field strategies in connection with and as a positive impact on environmental or climate protection. Projects can also be funded under the BRA.IN packaging initiative (Verpackungsinitiative). The initiative, launched in 2018 and running till 2021, bundles together all funding programmes that target the packaging industry. Being a multiannual initiative focused on a specific industry, there is no thematic focus and projects can apply through the various existing funding instruments (such as the Green Frontrunner scheme).

The lack of a strong thematic focus in most national funding calls (disregarding those launched by or in partnership with the European Commission) helps explain the low number of food systems projects funded since 2008. While Austria’s national R&I strategy calls for funding to be structured around several societal challenges, this seems to have happened only in a few specific areas, such as digital innovation or lowering emissions in key sectors such as transport or building. An OECD review of Austria’s innovation policy, conducted in 2018, assessed that R&I has not been sufficiently framed around societal challenges and called for more mission-oriented funding.²¹⁰

As described above, the majority of funding in the area of food systems comes from the Federal Ministry for Agriculture, Regions and Tourism (BMLRT). The BMLRT provides financial resources for the awarding of research contracts in addition to the public research funding from the three funding ministries BMK, BMBWF and BMDW. Unlike traditional funding calls there is no specific budget for these, but rather funding is open to projects and assessed based on the BMLRT’s need as well as relevance to the BMLRT’s strategic priorities.

Institutional Funding

Research and Innovation in Austria is also funded indirectly by the Federal Government through its institutional funding activities. Since 2007, the BMBWF funds the 22 public universities through a service agreement (Leistungsvereinbarungen) for periods of three years each. This enables the universities and their associated research entities (of which there are 1,259) to conduct and promote research largely independently. The BMBWF does stipulate that investments should be funnelled into promising areas of research such as

²¹⁰ OECD (2018). OECD Reviews of Innovation Policy: Austria 2018. OECD Reviews of Innovation Policy, OECD Publishing Paris. Available at: <https://doi.org/10.1787/9789264309470-en>

digitalisation or sustainability, but universities are otherwise independent in conducting research according to their expertise. For the period of 2019–2021, public universities received approximately EUR 11 billion in funding through these service agreements. For the period of 2016–2018, funding support amounted to approximately EUR 9.7 billion.²¹¹

In addition to providing institutional funding to public universities, Austria also funds research institutions which are owned by the state. These generally do not follow a narrow specific thematic focus but rather conduct and promote R&I in broader fields of science. Research institutions, such as the Austrian Agency for Health and Food Safety (AGES) which is owned by the Austrian Federal Ministry of Labour, Social Affairs, Health and Consumer Protection and the Austrian Federal Ministry for Sustainability and Tourism or the Agricultural Research and Education Centre Raumberg-Gumpenstein, an institution of the Austrian Federal Ministry of Agriculture, Regions and Tourism have a narrower topic focus and are also supported by federal funding.

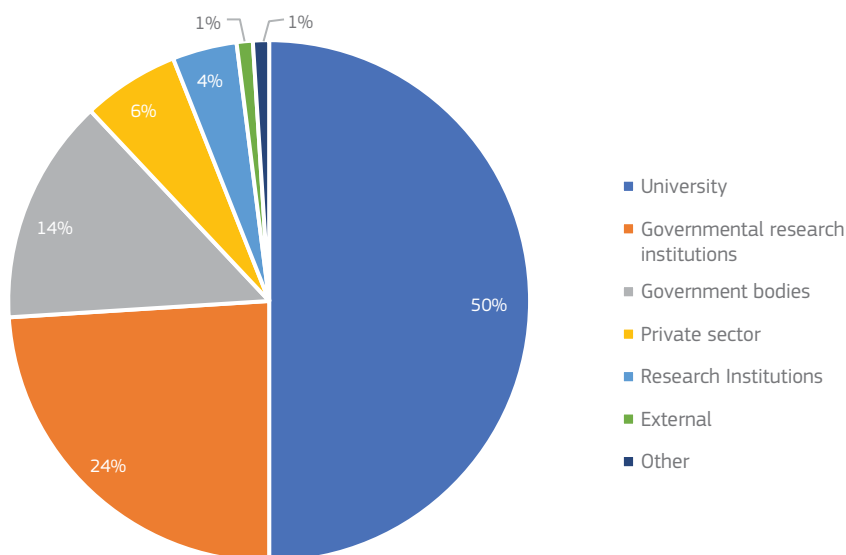
One issue identified by desk research, and corroborated by national stakeholders during interviews, is the difficulty posed by the cross-sectoral nature of food systems to fostering R&I in this field. Food does not directly fall under the responsibility of one ministry. Instead, aspects of the food system are dealt with by different federal entities. For example, food security and nutrition are within the remit of the Federal Ministry for Social Affairs, Health, Care and Consumer protection, while agricultural questions are addressed by the remit of the Federal Ministry for Agriculture, Regions and Tourism (BMLRT).

5 Main recipients of public food R&I investment

The primary recipients of public food R&I investments are universities and research institutions. As shown in Figure 2 below, half of all funding granted to food systems related R&I projects was distributed to projects carried out by universities. Governmental research institutions (in particular the Austrian Agency for Health and Food Safety AGES) received almost a quarter of food systems related R&I project funding.

²¹¹ Federal Ministry of Education, Science and Research (2021). Leistungsvereinbarungen. Available at: <https://www.bmbwf.gv.at/Themen/HS-Uni/Hochschulgovernance/Steuerungsinstrumente/Leistungsvereinbarungen.html>

Figure 2: Public funding for food systems related R&I projects, by recipient cate²¹²



Source: Bundesforschungsdatenbank Bfdat

Not depicted in Figure 2 (due to a lack of financial information available) are the projects funded by the BLMRT directly through its departmental research. There, a slightly different picture presents itself, with the majority of projects related to food systems²¹³ (54%) being carried out by governmental research institutions such as the Agricultural Research and Education Centre Raumberg-Gumpenstein, followed by universities (which conducted 24% of all funded projects).

In addition, over 3,000 businesses, often SMEs as well as a number of big enterprises and multinational enterprises, are actively conducting R&I²¹⁴. Stakeholders familiar with the landscape of food R&I have stated that these companies play an important role in

²¹² Bundesforschungsdatenbank Bfdat, available at: <https://extapp.noc-science.at/apex/?p=115:1> Projects were selected based on a keyword search as well as by branch of science. Keywords used were: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, sustainability, eco-innovation, environmental impact. Branches of science included were: Agriculture, Forestry, Fisheries, Animal Breeding, Animal Production, Agricultural Biotechnology, Food Biotech, Other Agricultural Sciences, Health Sciences

²¹³ BMLRTs project database DaFNE, available at: https://www.dafne.at/dafne_plus_homepage/index.php Projects were selected based on a keyword search. Keywords used were: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, sustainability, eco-innovation, environmental impact.

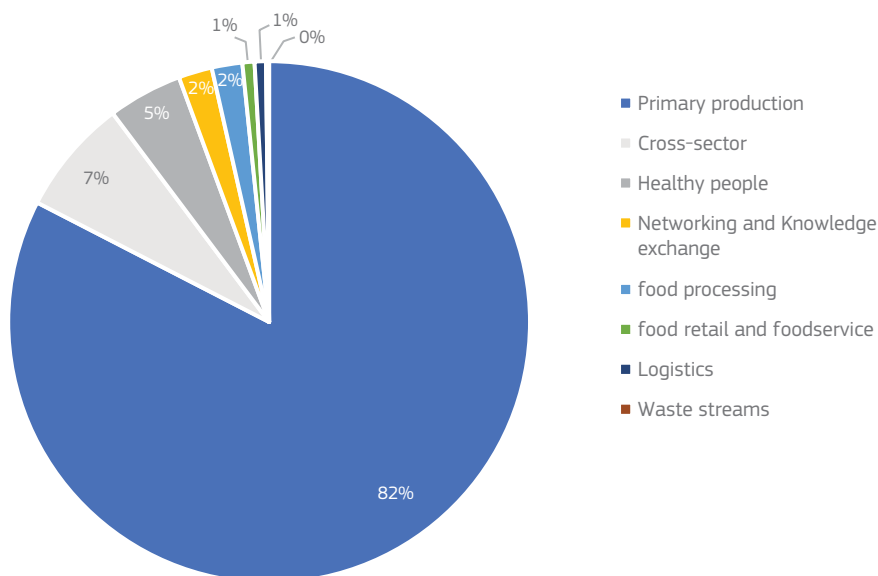
²¹⁴ BMBWF (2021). "Forschung in Österreich". Available at: <https://www.bmbwf.gv.at/Themen/Forschung/Forschung-in-%C3%96sterreich.html>

furthering innovation and are being supported through various incentives such as tax cuts or grants.

Funding by sector

The vast majority of food systems R&I projects funded between 2008 and 2021 were addressed to the primary production sector. This can be understood as a natural conclusion of the fact that the BMLRT is the biggest funder of food systems related R&I project, and mostly funds projects related to its remit of agriculture.

Figure 3: Public funding for food systems related R&I projects, by sector, 2008-2021²¹⁵



Source: Bundesforschungsdatenbank Bfdat

²¹⁵ Bundesforschungsdatenbank Bfdat, available at: <https://extapp.noc-science.at/apex/f?p=115:1> Projects were selected based on a keyword search as well as by branch of science. Keywords used were: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, sustainability, eco-innovation, environmental impact. Branches of science included were: Agriculture, Forestry, Fisheries, Animal Breeding, Animal Production, Agricultural Biotechnology, Food Biotech, Other Agricultural Sciences, Health Sciences

6 Structural Funds available for Food R&I

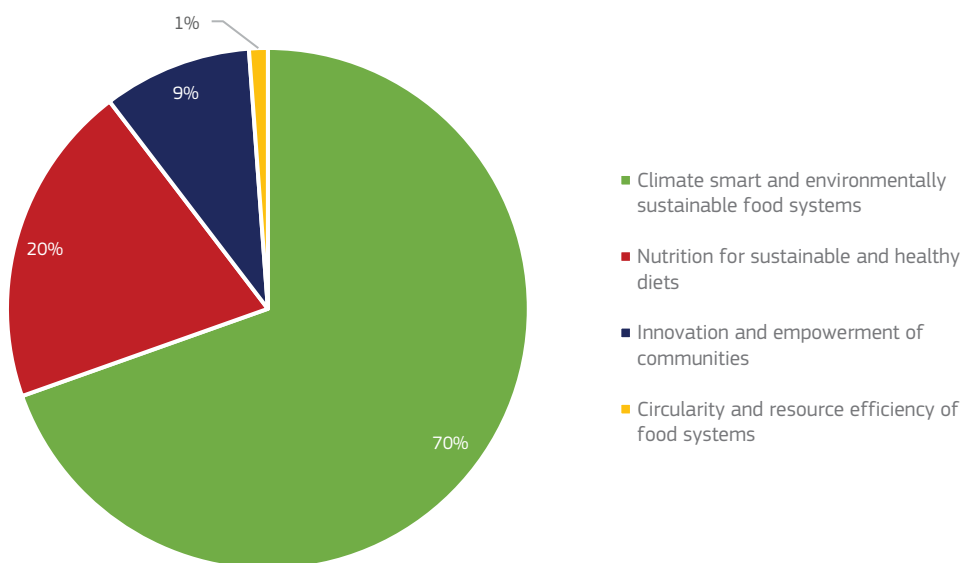
EU Structural Funds contribute to R&I in Austria. The European Fund for Regional Development (EFRD) is particularly relevant here. In the period 2014-2020, EUR 203.68 million of R&I co-funding was made available to Austria to boost regional economic growth and employment, and EUR 257 million was made available for European territorial cooperation projects.²¹⁶

7 Links to FOOD2030 priorities and pathways

As can be seen in Figure 4 below, the vast majority (70%, corresponding to EUR 14.1 million) of public R&I funding in food system was allocated to projects that addressed the priority of Climate smart and environmentally sustainable food systems. This encompasses mostly projects that aim to strengthen ecological agriculture and bio-farming, projects dealing with the contamination of pollutants in soil or water, or addressing invasive species and pests. A little over one fifth of food systems related funding for R&I projects (20%, corresponding to EUR 4.2 million) related to the Food 2030 priority of Nutrition for sustainable and healthy diets, followed by Innovation and empowerment of communities (9%, corresponding to EUR 1.9 million). Circularity and resource efficiency of food systems received the lowest share of public expenditure at 1%, corresponding to EUR 0.24 million.

²¹⁶ Federal Ministry for Education, Science and Research (2021), "Wissenschaft, Forschung & EU-Struktur- und Investitionsfonds", Available at: <https://www.bmbwf.gv.at/Themen/Forschung/Forschung-in-%C3%96sterreich/Strategische-Ausrichtung-und-beratende-Gremien/Leitthemen/Standortpolitik/Wissenschaft-Forschung--EU-Struktur--und-Investitionsfonds.html>

Figure 4: Public R&I expenditure on food systems related projects, by Food 2030 priority, 2008-2021²¹⁷



Source: Bundesforschungsdatenbank Bfdat

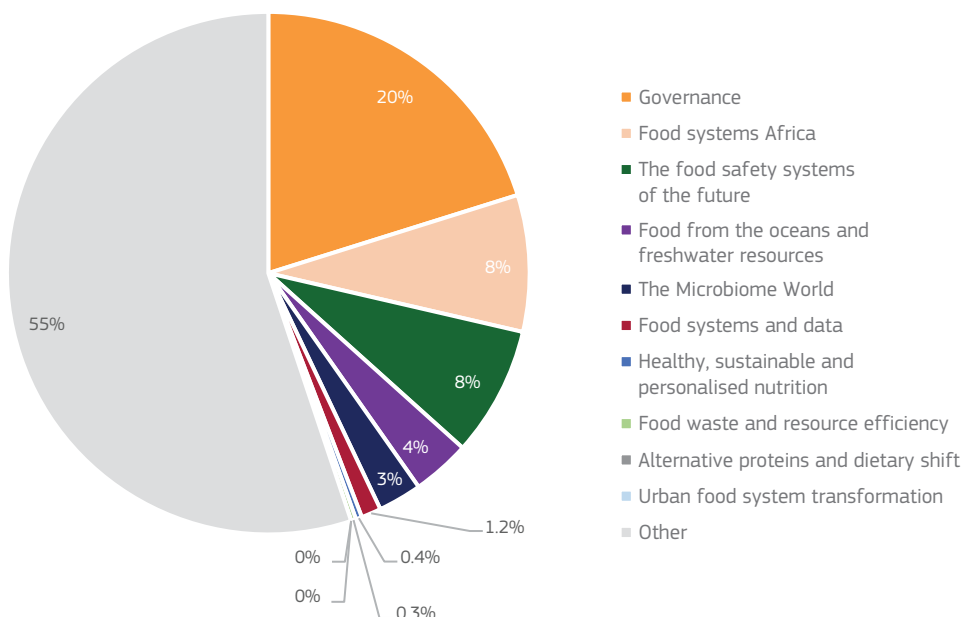
These projects do not, however, encompass departmental research carried out by the BMLRT or the Federal Ministry for Social Affairs, Health, Care and Consumer Protection. Amounts funded for these are not always available. Notwithstanding, an analysis of projects supported by the BMLRT related to food systems shows that most projects (75%) relate to the priority of ensuring climate smart and environmentally sustainable food systems²¹⁸, with a focus on dealing with the contamination of pollutants in soil or water, or addressing invasive species and pests, as well as dealing with the switch towards a more sustainable, eco-friendly agriculture and the impacts of this on land and people.

²¹⁷ Bundesforschungsdatenbank Bfdat, available at: <https://extapp.noc-science.at/apex/f?p=115:1> Projects were selected based on a keyword search as well as by branch of science. Keywords used were: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, sustainability, eco-innovation, environmental impact. Branches of science included were: Agriculture, Forestry, Fisheries, Animal Breeding, Animal Production, Agricultural Biotechnology, Food Biotech, Other Agricultural Sciences, Health Sciences

²¹⁸ BMLRTs project database DaFNE, available at: https://www.dafne.at/dafne_plus_homepage/index.php Projects were selected based on a keyword search. Keywords used were: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, sustainability, eco-innovation, environmental impact.

In terms of the alignment of Austria's food systems R&I projects funded between 2008 and 2021 with the pathways of the Food 2030 initiative, 55% (corresponding to EUR 11.2 million) does not fit any of the Food 2030 pathways (categorised as 'other'). While this covers a variety of projects, most are centred around research and innovation in agriculture, to find ways to make primary production more climate friendly. This includes, for example, a project researching the impacts of organic farming or a project developing climate-resistant rye crops. Of the FOOD2030 pathways, Governance and system change has the highest proportion of public contribution (20%, corresponding to EUR 4.1 million), followed by Food systems Africa (just over 8%, corresponding to EUR 1.7 million) and the Food safety systems of the future (8%, corresponding to EUR 1.6 million). The rest of public contribution in Austria is divided in low proportion amongst the other FOOD2030 pathways, with Food waste and resource efficiency receiving the lowest proportion, at 0.3% (corresponding to EUR 0.06 million). This is expressed in Figure 5.

Figure 5: Public R&I expenditure on food systems related projects, by Food 2030 pathway, 2008-2021²¹⁹



Source: Bundesforschungsdatenbank Bfdat

8 Data gaps and limitations

The results of the analysis are based on interviews with relevant officials and publicly available information extracted from the federal research database Bfdat, which contains all research projects funded by federal ministries since 2008. Data from 2007 was therefore not available. Another data gap was the lack of funding information for departmental research. The Bfdat did not include projects funded through departmental research. Several disparate databases of departmental research for individual ministries, such as the BLMRT, exist, but these did not include financial information.

²¹⁹ Bundesforschungsdatenbank Bfdat, available at: <https://extapp.noc-science.at/apex/f?p=115:1> Projects were selected based on a keyword search as well as by branch of science. Keywords used were: Food, agriculture, fisheries, agri-tech, agri tech, precision farming, soil, food production, food processing, packaging, nutrition, food waste, foodwaste, water, food safety, food systems, supply chains, sustainability, eco-innovation, environmental impact. Branches of science included were: Agriculture, Forestry, Fisheries, Animal Breeding, Animal Production, Agricultural Biotechnology, Food Biotech, Other Agricultural Sciences, Health Sciences

Summary of data sources: Austria

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	The Ministry of Education, Science and Research (BMBWF) is responsible for basic scientific research.	https://www.bmbwf.gv.at/public.html
	The Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) is responsible for industrial research and development.	https://www.bmk.gv.at/
	The Ministry for Digitalisation and Economic Affairs (BMDW) is responsible for promoting R&I in enterprises.	https://www.bmdw.gv.at/
	Other government departments, such as the Ministry for Agriculture, Regions and Tourism and the Ministry for Social Affairs, Health, Care and Consumer protection, can commission departmental research as well.	
	The Austria Wirtschaftsservice (AWS), the promotional bank of the Austrian federal government, acts as implementation agency for the BMDW and provides soft loans, grants and guarantees. Funding for applied research and innovation is being managed by the Austrian Research Promotion Agency (FFG). Funding for basic research is managed by the Austrian Science Fund (FWF).	https://www.fwf.ac.at/de/

Food innovation related policies	Austria Federal Government (2019), Bioeconomy – A strategy for Austria.	https://www.bmk.gv.at/themen/innovation/publikationen/energieumwelttechnologie/biooekonomiestrategie.html
	Federal Ministry for Agriculture, Forestry, Environment and Water (2014), BIODIVERSITÄTS-STRATEGIE ÖSTERREICH 2020+	https://www.bmk.gv.at/themen/klima_umwelt/naturschutz/biol_vielfalt/biodiversitaets_strategie_oe2020.html#:~:text=Die%20Biodiversit%C3%A4ts%2DStrategie%20%20%C3%96sterreich%202020,und%20die%20Gef%C3%A4hrdungsursachen%20zu%20minimieren
	Federal Ministry for Agriculture, Forestry, Environment and Water (2014), NATIONALE STRATEGIE OBST UND GEMÜSE	https://www.ama.at/getattachment/e5d02964-acf8-4f37-a2be-57d2d525422e/AT_Nationale_Strategie_Obst_Gemuse_2018.pdf
National R&I Strategies	Austrian Federal Government (2011), 'National Strategy for Research, Technology and Development 2011-2020'.	https://www.genderportal.eu/resources/strategie-der-bundesregierung-fur-forschung-technologie-und-innovation-national-strategy
	Austrian Federal Government (2020), 'FTI-Strategie 2030 – Strategie der Bundesregierung für Forschung, Technologie und Innovation'	https://www.bundestkanzleramt.gv.at/dam/jcr:1683d201-f973-4405-8b40-39dded2c8be3/FTI_strategie.pdf
	Federal Ministry for Agriculture, Regions and Tourism (2020). Das Programm für Forschung und Entwicklung im BMLRT, 2020-2025. (RTI Strategy of the BMLRT)	https://info.bml.gv.at/en/

	Federal Ministry for Social Affairs, Health, Care and Consumer Protection (2021), "Nationaler Aktionsplan Ernährung (NAP.e)	https://www.sozialministerium.at/Themen/Gesundheit/Lebensmittel-Ernaehrung/Ernaehrungsstrategien-und-Gremien/Nationaler-Aktionsplan-Ernaehrung-(NAP.e).html#:~:text=Aktionsplan%20Ern%C3%A4hrung%20(NAP.-e),%C3%9Cberge-wichts%2D%20und%20Adipositaszahlen%20bis%202020
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Federal Ministry for Education, Science and Research (2021), "Wissenschaft, Forschung & EU-Struktur- und Investitionsfonds"	https://www.bmbwf.gv.at/
Food innovation funding		
	Name and description	Link
Specific food innovation related R&I competitions/funding	National funding data base Bfdat. Lists all projects from 2008 onwards that received federal funding.	Bundesforschungsdatenbank Bfdat: https://extapp.noc-science.at/apex/f?p=115:1
	Project database of the Federal Ministry of Agriculture, Regions and Tourism DaFNE. Lists all projects funded by the BMLRT. Some overlap with projects included in the Bfdat, but also lists departmental research projects, however without amounts funded.	https://info.bml.gv.at/en/in-focus/research/research-platform-dafne.html

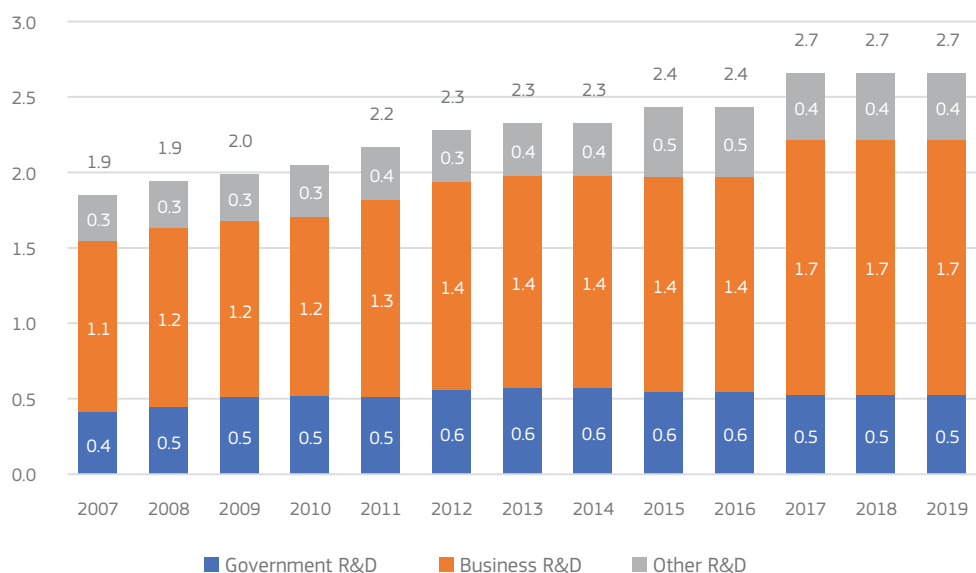
BELGIUM

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Belgium from 2007 to 2019.²²⁰ While overall R&I expenditure has increased steadily over this period, this has been driven primarily by increases in private sector expenditure. Government funding has remained relatively steady at approximately 0.5% of GDP.

Belgium has regional R&I strategies in all regions as well as a food policy in the Brussels²-Capital region, but no specific food R&I policy at regional or federal level. A Flemish food strategy is currently under development, expected by the end of 2022.

Figure 1: R&I Expenditure in Belgium, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

²²⁰ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Main Providers of Food R&I funding at national level

In Belgium, there are numerous entities that provide R&I funding related with food systems. At the federal level, which covers all three regions of Belgium (Brussels-Capital Region, Flanders and Wallonia), food R&I funding is mainly provided by the **Federal Public Service (FPS) Health, Food Chain Safety and Environment**, that combines competences from the former Ministry of Social Affairs, Health and Environment, and the regionalised Ministry of Agriculture. Other relevant funding sources at the federal level include the **National Fund for Scientific Research (FNRS)** and the **Belgian Science Policy Office (BELSPO)**.

At the regional level, food R&I funding is particularly relevant in the Region of Flanders, where the main provider of food R&I funding is the **Agency for Innovation and Entrepreneurship (VLAIO)**, which is a governmental organisation of the Flemish government that provides support to entrepreneurs. In fact, VLAIO is the biggest source of investment in food R&I in the whole country, even surpassing FPS, which acts at the federal level. Next in the region, VLAIO is followed by the **Department of Agriculture and Fisheries of the Flemish public authority**, which is also a leading entity in the context of the Belgium's food R&I funding. This entity deals with the development, implementation, control and evaluation of all matters in the fields of agriculture, horticulture, fisheries and the countryside. Other relevant funding sources in the Flanders Region include the **Research Foundation – Flanders (FWO)** and the **Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)**. ILVO is an independent scientific research institute of the Flanders Government. ILVO's assignment from the government is to work on the sustainability of agriculture, fisheries and agri-food sector. To perform this mission, ILVO performs multidisciplinary, ground-breaking and independent research.

Lastly, in the Wallonia Region, the two main sources of food-related R&I funding are the **Service Public de Wallonie: Agriculture, Ressources naturelles et Environnement (SPW DGO3)** and **Wagralim**, the Agri-Food Innovation Cluster of Wallonia.

2 National R&I Strategy

R&I in Belgium is decentralised to the three regions: Brussels-Capital Region, Flanders and Wallonia. Therefore, in Belgium, R&I competences and mandates span across all these government levels. In the reference period for this report (2007-2020), the main regional R&I plans in Belgium included the **Brussels-Capital Region's Regional Innovation**

Plan (2016-2020) on improving innovation chain and typologies, the **Flemish Reform Programme 2020**, and **Digital Wallonia**, including measures from previous strategies²²¹.

In July 2016, the Government of the Brussels-Capital Region approved the new **Regional Innovation Plan 2016-2020**. With this plan, Brussels aimed at becoming the capital of innovation. The plan aimed to be the framework of reference for the R&I policy and a catalyst for socioeconomic development. The plan pays particular attention to three strategic priority areas that reflect the Region's strengths, namely:

- Health - Personalised medicine;
- Environment - Green economy; and
- ICT – Digital economy.

Currently, the Government of the Brussels-Capital Region has already approved the next and most recent version of the Regional Innovation Plan, which will cover the 2021-2027 period²²².

In the Flanders Region, the **Flemish Reform Programme 2020**, which corresponds to the tenth reform programme drawn up by the Government of Flanders, offers a bespoke response to the country-specific recommendations 2019-2020 and the Europe 2020 targets. This Reform Programme builds upon former Flemish programmes, like the Flemish Reform Programme 2016 and other previous editions. In the context of the 2020 programme, the country-specific recommendation 3 highlights the need to continue investing in R&I in the Flanders Region. In this sense, one third of the new recurrent funds is used for new R&I policy initiatives. The most important of these new policy initiatives are the Artificial Intelligence (AI) Policy Plan, the Cybersecurity (CS) Policy Plan, and the Moonshot CO2²²³.

In December 2018, the Walloon government updated the **“Digital Wallonia”** strategy for 2019-2024. The strategy details the framework defining the guidelines to seize the socio-economic opportunities of the digital transformation for the next five years. In addition, Wallonia has adopted an investment plan that aims to increase investment expenditure by EUR 5 billion between 2019 and 2024 in order to meet regional infrastructure needs, particularly in the areas of mobility, energy, and R&I. The regional government has also

²²¹ www.innovationpolicyplatform.org/www.innovationpolicyplatform.org/content/belgium/index.html

²²² <https://innoviris.brussels/regional-innovation-plan>

²²³ https://www.flandersineu.be/sites/default/files/atoms/files/Flemish%20Reform%20Programme%202020_0.pdf

decided to maintain or renew existing policies through investments under the Marshall Plan 4.0 (2015-2019) and the Infrastructure Plan (2016-2019)²²⁴, which renew previous policies like the Marshall Plan 2.Green (2009-2014) and the original Marshall Plan (2006-2009).

3 Overview of national food policy

In Belgium there is no national food policy due to the government's structure and distribution of competences across the three regions. Therefore, food health issues and consumer policies are managed at the federal level by FPS Health, Food Chain Safety and Environment; while agriculture, food, environment and food-related health are competences of the regional authorities and are shared by different ministers²²⁵.

In 2016, the Brussels-Capital Region launched its own food strategy titled “**Good Food Strategy – towards a sustainable food system in the Brussels Capital Region**”.²²⁶ This strategy includes ambitious objectives, amongst which to increase local production to provide 30% of fruits and vegetables by 2035 and to achieve a 30% reduction in food waste by 2020. These objectives are to be accomplished through several actions according to 7 key axes: production, supply, demand, good food culture, food waste, innovation and governance.

Overall, the Good Food Strategy aims to advertise the possibility of good food without a high budget, advocating for accessibility to good food for all and reducing food waste. Thus, this strategy is deeply grounded on innovation and governance²²⁷.

Regarding the regions of Flanders and Wallonia there are no specific food policies, but a food strategy for Flanders is under development and is expected to be published by the end of 2022. However, the Region of Flanders has its own initiatives focused on food systems, such as **Flanders' FOOD**. This is a strategy-driven platform for innovation, which contributes to a more competitive, innovative and sustainable agri-food industry in the Region of Flanders. Flanders' FOOD levers the innovation capacity of the agri-food companies by

²²⁴ <https://www.oecd.org/cfe/Belgium.pdf>

²²⁵ https://scar-europe.org/images/FOOD/Deliverables/Qualitative_mapping_RESULTS/BE_Feedback_Dec2017.pdf

²²⁶ No previous strategy was found for the Brussels-Capital region. It is therefore assumed that no specific regional food policy existed in the Brussels-Capital region prior to 2016

²²⁷ <https://acrplus.org/en/news/news-from-our-members/611-brussels-environment-a-good-food-strategy-for-brussels>

enhancing their scientific and technological knowledge by means of an integrated approach of knowledge creation, knowledge dissemination and partner matching²²⁸.

Currently, there is little coordination between federal and regional authorities regarding food systems²²⁹. Therefore, all the information and opportunities related with food systems are highly decentralised.

4 Public funding available for food R&I

As mentioned above, the Belgium funding system is highly decentralised. Therefore, there are several national and regional entities that provide funding opportunities for food-related research and innovation projects. In this sense, the data provided in the sections below results from a data collection process that includes the following funding providers: VLAIO; FPS Health, Food Chain Safety and Environment; the Department of Agriculture and Fisheries of the Flemish public authority; FNRS; FWO; ILVO; SPW DGO3; Wagralim; and BELSPO.

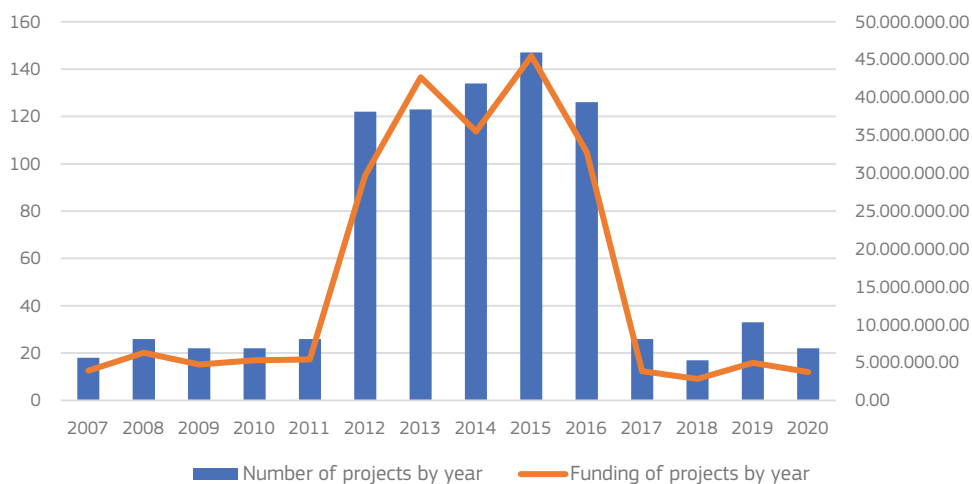
According to data made available by these funding providers²³⁰, a total of 864 R&I food-related projects were developed by Belgium organisations between 2007 and 2020, receiving a total of EUR 227.4 million in funding. A review of the number of projects approved during this period shows that 2012 through 2016 were the years with the highest number of projects approved (with the highest in this period being 2015 with 147 projects) and 2018 was the year with the lowest number of projects approved (17). In addition, 2015 and 2018 were both, respectively, the years with the most and least funding granted to Belgium organisations for food-related projects (EUR 45.5 million in 2015 and EUR 2.8 million in 2018) (Figure 1).

²²⁸ www.flandersfood.com

²²⁹ https://scar-europe.org/images/FOOD/Deliverables/Qualitative_mapping_RESULTS/BE_Feedback_Dec2017.pdf

²³⁰ Between 2007 and 2011, as well as 2017 and 2020, data were provided by fewer funding providers than in the period between 2012 and 2016.

Figure 2: R&I food related projects between 2007 and 2020.



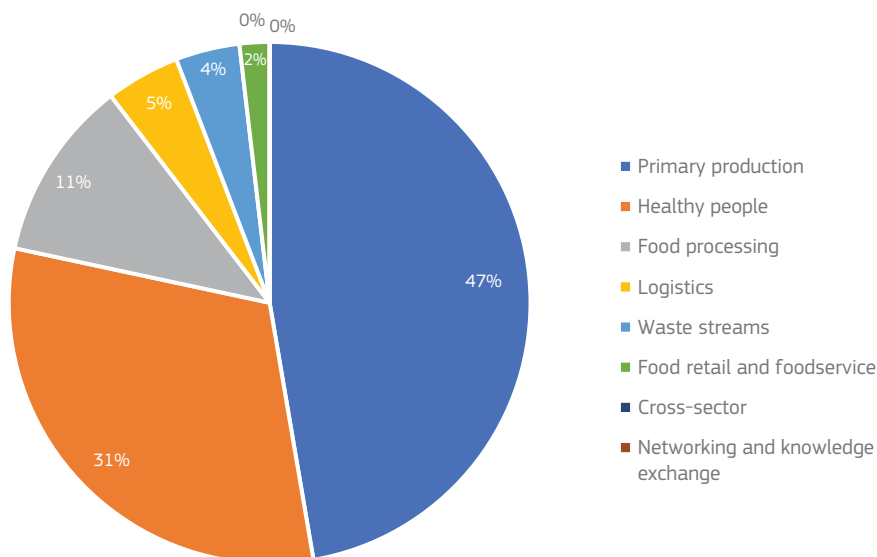
Source: VLAIO; FPS Health, Food Chain Safety and Environment; the Department of Agriculture and Fisheries of the Flemish public authority; FNRS; FWO; ILVO; SPW DGO3; Wagralim; and BELSPO

Although the data available showed 864 R&I food-related projects in total, 106 of them had confidential information that could not be shared publicly, with their funding being the only information available to the public. Therefore, these 106 projects were counted for the analysis of funding distribution by year, but will not be counted in the analysis of the sectors and FOOD2030 priorities and pathways, since the title and description of the projects were not available.

Funding by sector

When analysing the sectors of the 758 non-confidential projects that received funding for food-related R&I actions, the majority of public funding appears to be directed towards projects related to primary production (47%, EUR 91.9 million), with the healthy people sector coming in second (31%, EUR 60.3 million). It is notable that between 2007 and 2020, there was no public investment in packaging-related projects, as observed in Figure 3.

Figure 3: Distribution of funding by sector

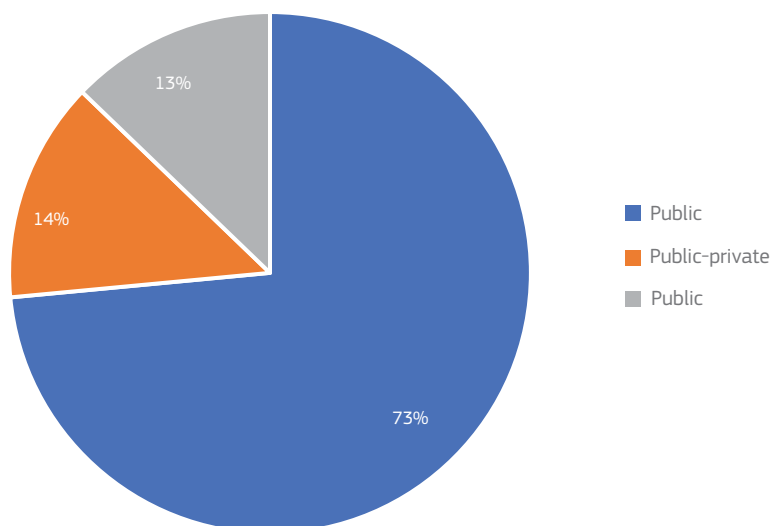


Source: VLAIO; FPS Health, Food Chain Safety and Environment; the Department of Agriculture and Fisheries of the Flemish public authority; FNRS; FWO; ILVO; SPW DGO3; Wagralim; and BELSPO

5 Main recipients of public food R&I investment

Figure 4 shows a review of the data which indicates that public institutions received the highest amount of food R&I funding in a total of 640 projects (EUR 164.4 million, corresponding to 74% of the total funding). Private institutions (EUR 28.7 million, or 13% of the total) and public-private institutions (EUR 30.8 million, or 14% of the total) had similar shares of funding, despite more projects being coordinated by private institutions (100 projects coordinated by private institutions vs. 42 projects coordinated by public-private institutions).

Figure 4: Distribution of the funding by recipient



Source: VLAIO; FPS Health, Food Chain Safety and Environment; the Department of Agriculture and Fisheries of the Flemish public authority; FNRS; FWO; ILVO; SPW DG03; Wagralim; and BELSPO

6 Structural Funds available for Food R&I

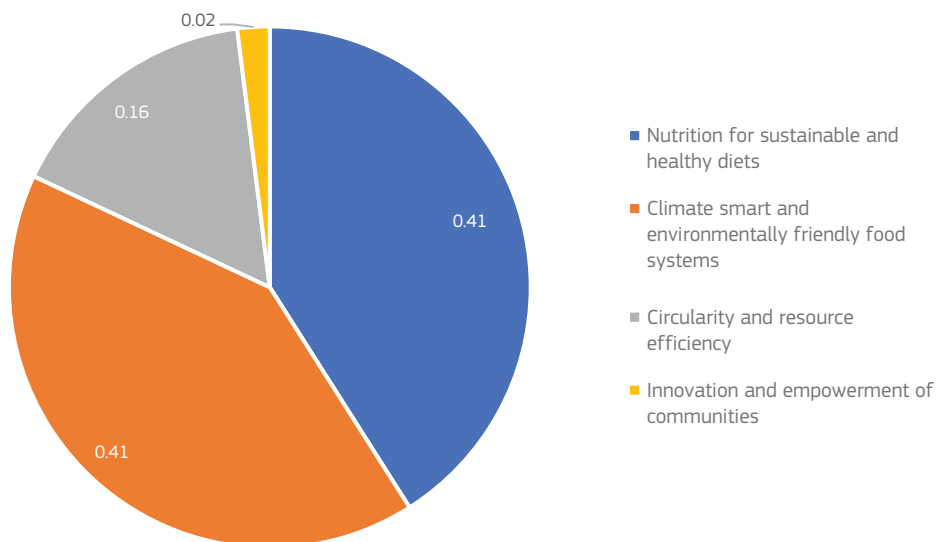
For the purposes of this report, the total amount of structural funds used for R&I projects for the reference period was not found in any publicly-available report or from consultations with relevant contacts.

7 Links to FOOD2030 priorities and pathways²³¹

Taking in consideration the four FOOD2030 priorities, it is clear that the publicly funded food-related R&I projects in Belgium have heavily prioritised research in Nutrition for sustainable and healthy diets (41%) and Climate smart and environmentally sustainable food systems. Circularity and resource efficiency of food systems receives approximately 11% of funding, with Innovation and empowerment of communities receiving the least (2%).

²³¹ In seven of the projects analysed it was not possible to find a correspondence between the themes of research and the FOOD2030 priorities and pathways. The total funding associated to these projects is 1.1 million euros.

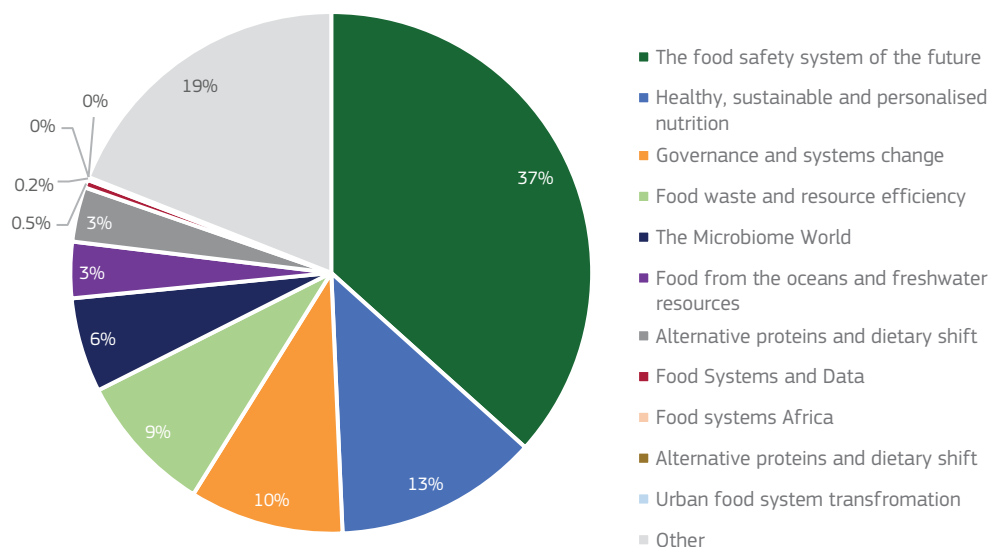
Figure 5: Distribution of the funding by FOOD2030 priority



Source: VLAIO; FPS Health, Food Chain Safety and Environment; the Department of Agriculture and Fisheries of the Flemish public authority; FNRS; FWO; ILVO; SPW DG03; Wagralim; and BELSPO

With regards to FOOD2030 pathways, publicly funded food-related R&I projects in Belgium were mostly assigned to the food safety systems of the future pathway (37%, corresponding to EUR 83.3 million). Next in line, Healthy, sustainable and personalised nutrition was the main pathway of 13% of funding (EUR 28.7 million), followed by Governance and system change (10% or EUR 21.7 million). The two pathways with the least funding were Urban food systems transformation and Food systems Africa, both with less than 1% of funding (which corresponds to less than EUR 2 million). Further details can be observed in Figure 6.

Figure 6: Distribution of the funding by FOOD2030 pathway



Source: VLAIO; FPS Health, Food Chain Safety and Environment; the Department of Agriculture and Fisheries of the Flemish public authority; FNRS; FWO; ILVO; SPW DGO3; Wagralim; and BELSPO

8 Data gaps and limitations

The information required for the development of the Belgium analysis is not publicly available on the websites of the national and regional funding entities. Therefore, the results of the analysis are based on data provided by these funding entities. Information not provided by the mentioned entities includes among others: project description, keywords, technology readiness level (TRL), publications and patents.

Summary of data sources: Belgium

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	VLAIO - Agency for Innovation and Entrepreneurship	www.vlaio.be/nl
Food innovation related policies	Good Food Strategy	acrplus.org/en/news/news-from-our-members/611-brussels-environment-a-good-food-strategy-for-brussels
	Flanders' FOOD	www.flandersfood.com/nl
National R&I Strategies	Regional Innovation Plan 2016-2020	innoviris.brussels/regional-innovation-plan
	Flemish Reform Programme 2020	www.flandersineu.be/en/flemish-reform-programme-2020
	Digital Wallonia	www.oecd.org/cfe/ Belgium.pdf

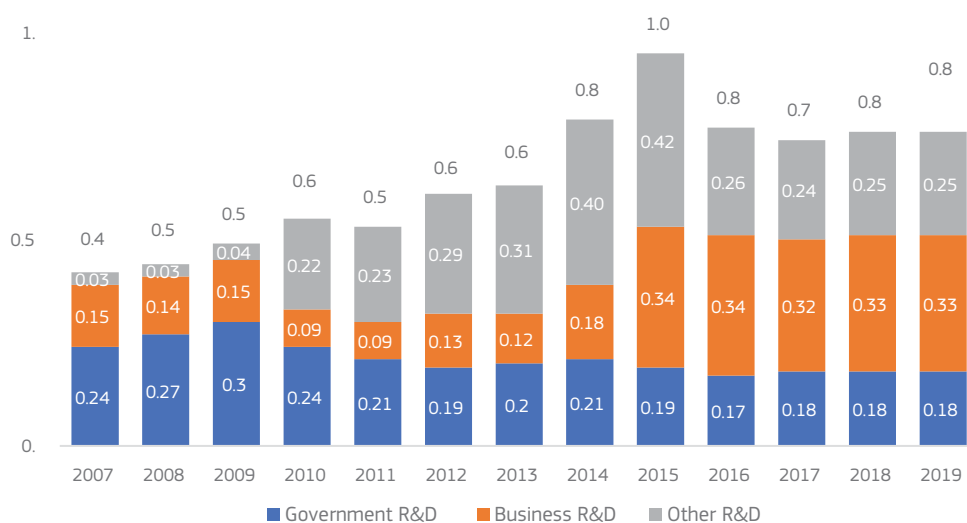
BULGARIA

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Bulgaria from 2007 to 2019.²³² Although overall expenditure on R&I has increased as a proportion of GDP over the period in question (with a peak of 1.0% in 2015), total R&I expenditure has never exceeded one percent of national GDP. Additionally, government expenditure has decreased significantly over this period from a peak of 0.3% in 2008 to 0.2% in 2019.

The country does not have a specific food R&I strategy, but food and R&I are embedded in the R&I strategy and food policies.

Figure 1: R&I expenditure in Bulgaria, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

²³² Figures for 2019 have been inferred from 2018 data

2 Main Providers of Food R&I funding at national level

Until 2020, the R&I funding at national level in Bulgaria, including Food R&I funding, was provided by three public authorities: the Ministry of Education and Science (MES), through the Scientific Research Fund (SRF) and through the annual budgets of the state universities and scientific organisations (institutes at the Bulgarian Academy of Science); the Small and Medium Enterprises Promotion Executive Agency with the Minister of Economy (SMEPEA), through the National Innovation Fund (NIF); and by the Ministry of Agriculture, Food and Forests (MAFF) through the annual budgets of the Agricultural Academy (AA). The MES is responsible for scientific research policy, while the remit of the Ministry of Economics (ME) is innovation policy.

In 2020, the State Agency for Scientific Research and Innovation (SASRI) was established with the Council of Ministers whose primary function is to “*coordinate and control the state policy on interaction between the scientific research, the innovation and the technologies*”²³³. Since July 1, 2021, SARI administers the activities of NIF²³⁴. The first Chairman of SARI was appointed in March 6, 2021 and currently the establishment of the Agency is not fully completed.

Other relevant actors

The Agricultural Academy (AA) with the Minister of Agriculture, Food and Forests is an organisation for research, applied service and support activities in the field of agriculture, animal husbandry and food industry whose history dates back to the 1970-ies. Within the structure of AA there are 25 institutes, 4 Scientific centres and the State enterprise “Scientific-Applied Centre”, with 13 Experimental centres spread in the whole territory of the country. It is financed by the national budget, by EU projects and by sale of services.

The Agricultural University in Plovdiv was established in 1945 and has four faculties - in Agronomy, Viticulture, Plant Protection and Agroecology, and Economics. The state University of Food Technologies (UFT) in Plovdiv was established as independent high school in 1953 with the name Higher Institute of Food and Flavour Industry. The Faculty of Veterinary Medicine (FVM) exists since 1921, when it was established as a part of the Sofia University. After long periods of “moving” into different universities, institutes and associations, since 1995 FVM is a part of the Trakia University in Stara Zagora.

²³³ Organisational Regulations of the State Agency for Scientific Research and Innovation, art. 3(1), <https://www.mon.bg/bg/60> - last seen in June 21, 2021

²³⁴ Ordinance 70 of March 2, 2020 for Adoption of Organisational Regulations of the State Agency for Scientific Research and Innovation, Transitional and Final Provisions, para 15, <https://www.lex.bg/bg/laws/ldoc/2137210397> - last seen in June 21, 2021

Three institutes of the Bulgarian Academy of Science work in the field of food-related topics: the Institute of Biodiversity and Ecosystem Research (IBER), the Institute of Biology and Immunology of Reproduction (IBIR) and the Institute of Plant Physiology and Genetics (IPPB). IBER was established on 1 July 2010 after merging of Institute of Zoology, Institute of Botany and Central Laboratory of General Ecology on the basis of resolution of General Assembly of Bulgarian Academy of Sciences. IBIR was established in 1938 with the name Institute for Artificial Insemination and Breeding Diseases. In 1961 the Institute was renamed to Institute of Biology and Pathology of Reproduction and joined the Bulgarian Academy of Sciences. IPPB was established within the Structural Reconstruction in the Bulgarian Academy of Sciences (BAS) in 2010, as a successor of the former Institute of Plant Physiology „Acad. Metodi Popov” and the Institute of Genetics „Acad. Doncho Kostoff”.

The National Roadmap for Scientific Infrastructure (NRSI) 2020-2027 encompasses 5 entities in the field Industry for Healthy Life and Biotechnologies:

- Centre of Plant Systems Biology and Biotechnology (CPSBB);
- National infrastructure in agriculture and food (RINA);
- Research infrastructure in the field of food, nutrition and health, linked to Bulgaria’s participation in pan-European infrastructure FNH-RI (FNH-RI BUL);
- Competence Center „Sustainable utilisation of bioresources and waste from medicinal and aromatic plants for innovative and bioactive products“;
- Center for Diagnostics and Technologies for Plant Health (PLANTHEALTH).

3 National R&I Strategy

The main policy document concerning scientific research in Bulgaria is the Updated National Strategy for Development of Scientific Research in the Republic of Bulgaria (UNSDSR) 2017-2030. Its primary goal is sustainable economic growth and a substantial increase in the quality of research²³⁵. The previous document in this field was the National Strategy for Development of Scientific Research (NSDSR) 2020.

²³⁵ Updated National Strategy for Development of Scientific Research in the Republic of Bulgaria 2017-2030, p. 23, <https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=1231> - last seen in June 23, 2021

The NSDSR 2020 formulated five priority scientific areas, the second of which covered health and quality of life, biotechnology and organic food. The UNSDSR 2017-2030 does not cite any specific scientific fields, but stipulates that the activities under priority 2 (Scientific infrastructure) should be developed according to the priority areas of the Innovation Strategy for Intelligent Specialisation of the Republic of Bulgaria (ISIS) 2014-2020, one of which is the food industry²³⁶.

4 Overview of national food policy

Bulgarian Food policy is divided between the Ministry of Agriculture, Foods and Forests (MAFF), on the one hand, and the Ministry of Economics, on the other. The division of competences among the national institutions is aligned with the division of EU funding, with the majority of funding for food and agriculture policy coming from the European Regional Development Fund²³⁷.

The ME works with two main policy documents: the ISIS, mentioned in the previous section, where the food industry is outlined as one of the seven priorities; and the National Strategy for Promoting the Development of Small and Medium Enterprises (SSME) 2014-2020, where the food sector is targeted as one of 23 sectors²³⁸. There is no specific policy related to the food sector in this document, however. SSME also sets priorities for development of low-technology sectors by region, where foods are outlined as priority for the Plovdiv, Sliven and Yambol regions²³⁹.

The MAFF have developed and/ or currently operate a number of policy documents:

- **Strategy for Digitalisation of Agriculture and Rural Areas of the Republic of Bulgaria (SDARA);**

The SDARA includes specific reference to investing in precision agriculture and the use of blockchain technology within the agriculture sector.

- **Risk and Crisis Management Programme in the Sector “Agriculture” (RCMPA);**

²³⁶ Innovation Strategy for Intelligent Specialisation of the Republic of Bulgaria 2014-2020, p. 85, https://www.mi.government.bg/files/useruploads/files/innovations/ris3_26_10_2015_bg.pdf - last seen in June 26, 2021

²³⁷ Interview with representative of ME, June 25, 2021

²³⁸ Interview with representative of ME, June 25, 2021

²³⁹ National Strategy for Promoting the Development of Small and Medium Enterprises (SSME) 2014-2020, p. 14 and pp.31-32, <https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&id=881> - last seen in June 29, 2021

The RCMPA sets three priorities, two of which are relevant for food systems R&I: efficient, competitive and market-oriented agriculture; and sustainable management of fishery resources through conservation of biodiversity and ecosystems. Both of these focus on balancing increased productivity with long-term sustainability.

- **National Action Plan for the Development of Organic Production (NAPDOP);**

The strategic goals of the NAPDOP are: 1) Improvement of effectiveness of the organic production and expansion of the national and foreign market of organic products; 2) Maintenance of effective institutional and legal framework for development of organic farming and of effective controlling and monitoring system; and 3) Stimulation of practice-oriented research, education, training and consulting in the field of organic production.

- **National Programme for Beekeeping for the Period 2020-2022 (NPB).**

The NPB includes six measures: A) Technical assistance for beekeepers and beekeepers' associations; B) Fight against aggressors and diseases in the hives; C) Rationalisation of mobile beekeeping; D) Measures to support the performance of physio-chemical analysis of bee products; E) Measures to support the renewal of beehives in the Community and F) Cooperation with specialised bodies for the practical implementation of applied research programs in the field of beekeeping and bee products.

Besides these, a number of forestry/agriculture programmes were also implemented during the reference period. These include the Programme of the Government for Stable Development of the Republic of Bulgaria in the Sector of Agriculture and Forests for the Period (SDAF) 2014-2018; the National Strategy for Development of the Forest Sector in the Republic of Bulgaria (NSDFS) 2013 – 2020; and the NPB 2017-2019.

5 Public funding available for food R&I

The public funding for R&I in Bulgaria is provided at national level, mainly through the SRF and NIF. Food R&I, and since 2007, have been among the eligible activities but have not been specifically targeted. In addition, the subsistence of the state scientific organisations includes target funds for scientific activity; and the scientific institutes with the MAFF receive subsistence through their budgets. According to data of the National Statistical Institute (NSI), the total government budget allocations for scientific research and development activities generally increased in the last four years, reaching almost 284 million BGN (about EUR 145 million) in 2020.

Distribution of data by socio-economic objectives is also available; however, the share of the food industry is unknown. Nevertheless, the biggest amount of money is allocated in R&D in the agricultural sector (49.7 million BGN, or about 25.4 million EUR), which means that the share of Food R&I represents substantial share of the total national R&I investment (18% or more). According to interviewees from MES and ME, there are no specific goals for national investment in food R&I; but there are general goals for the total R&I spending (2%) that still are not achieved.

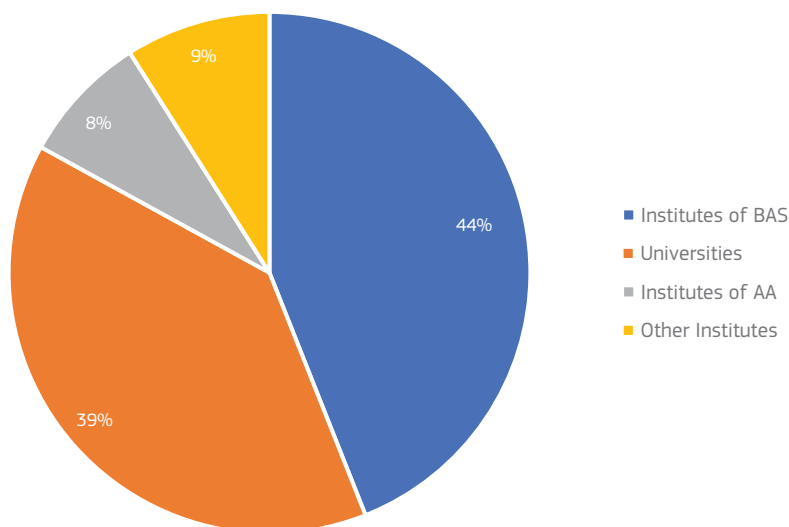
6 Main recipients of public food R&I investment

The main recipients of budget funds operated by MES, include the state universities, such as the Agricultural University and the University of Food Technologies, and scientific organisations, including the Bulgarian Academy of Science and the Agricultural Academy, as well as the scientific infrastructural projects included in the roadmap for scientific infrastructure. The annual reports for the activity of SRF provide breakdowns by scientific areas, on the one hand, and by types of beneficiaries, on other, for the main competition held: the Competition Fundamental research. Since 2016, the funds planned to be allocated to Agricultural sciences vary between 8% and 10% of the total budget of the Competition; and the money actually spent for advanced payments and payments under contracts from previous years range from 0.48 to 2.65 million BGN (EUR 0.25 to 1.36 million) annually²⁴⁰.

A breakdown of scientific field by type of beneficiaries was not available, but for the Competition as a whole, the biggest share both in terms of funds and number of projects granted is those of the institutes with the BAS – about 40-45% in the different years, followed by those of the universities (38-40%). The shares of the institutes with the AA and of other institutes are almost equal and vary about 8-9%.

²⁴⁰ Annual reports for the activity of SRF 2016-2020, <https://fni.bg/?q=node/67> - last seen in July 12,2021

Figure 2: Total funds under Competition Fundamental research of the SRF by type of beneficiaries (2020)



Source: Ministry of Education and Science, Science Research Fund

The budget of NSP “Healthy Foods for a Strong Bioeconomy and Quality of Life” (NPS FOOD) is EUR 0.8 million BGN for 2018 and EUR 0.7 million BGN for 2019. NSP “Reproductive Biotechnologies in Animal Husbandry in Bulgaria” (REPROBIOTECH) costs to the national budget totally 6 million BGN for four years: from 2018 to 2021.

The MAFF provides budget funds to the Agricultural Academy and the number of Institutes with different specialisations in the agricultural sector within its structure. For 2020, the budget of AA amounted to almost 28 million BGN (EUR 14.3 million)²⁴¹.

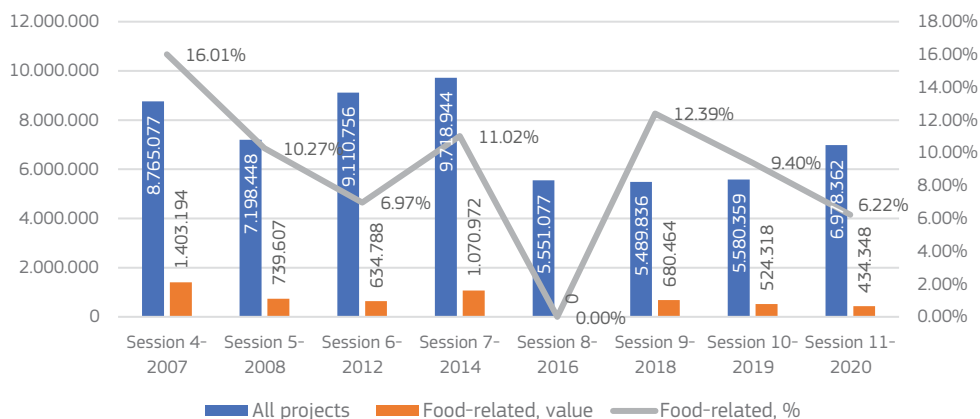
The budget funds for innovations operated by ME target predominantly enterprises and business organisations, but universities and scientific organisations are also eligible as partners in innovation projects. Between 2007 and 2020, the NIF granted support to more than 300 projects, at the total amount of 58.39 million BGN (EUR 29.86 million). Of all projects, 34 were food-related and the financial support they received equals to nearly 5.49 million BGN (EUR 2.81 million), or 9% of the total amount²⁴². The share of

²⁴¹ Law on the State Budget of The Republic of Bulgaria for 2020, p.34, https://www.mh.government.bg/media/filer_public/2020/01/16/zakon-dbrb-2020.pdf - last seen in July 14,2021

²⁴² Results - NIF, <https://www.sme.government.bg/?cat=26> - last seen in July 17,2021

the supported food-related projects varied from 16% to 0% over the years, and a general decrease can be noted, as shown in Figure 3.

Figure 3: Total and food-related support by NIF, 2007-2020*



Source: SMEPEA, Results-NIF

* The total amount for the eighth session is estimated based on the ranking of projects published at the SMEPEA website and publications in the media, due to the lack of public information about the funded projects and contacts concluded.

7 Structural Funds available for Food R&I

The MES is the managing body of the Operational Programme Science and Education for Intelligent Growth 2014-2020 (OPSEIG). The ME is managing body of the Operational Programme Innovation and Competitiveness 2014-2020 (OPIC). Both do not target food specifically, but do include food R&I projects.

Specifically-food targeted are the funds managed by the MAFF: the Rural Development Programme 2014-2020 (RDP), managed by the State Fund Agriculture (SFA), and the Operational Programme Maritime and Fisheries 2014-2020 (OPMF), managed by the Maritime and Fisheries Executive Agency (MFEA) at the MAFF. However, R&I are not outlined as a separate budget line or measure. The priorities and measures in OPMF are formulated strictly according the Union priorities. Innovations are mentioned, but in combination with other goals and measures, and the separation of funding for R&I is again unclear.

8 Links to FOOD2030 priorities and pathways

Both programmes: NPS FOOD and NPS REPROBIOTECH correspond primarily to the second FOOD2030 priority: *Climate smart and environmentally sustainable food systems*, but also to the fourth: *Innovation and empowerment of communities*. In terms of FOOD2030 pathways, they fit best the *food safety system of the future*.

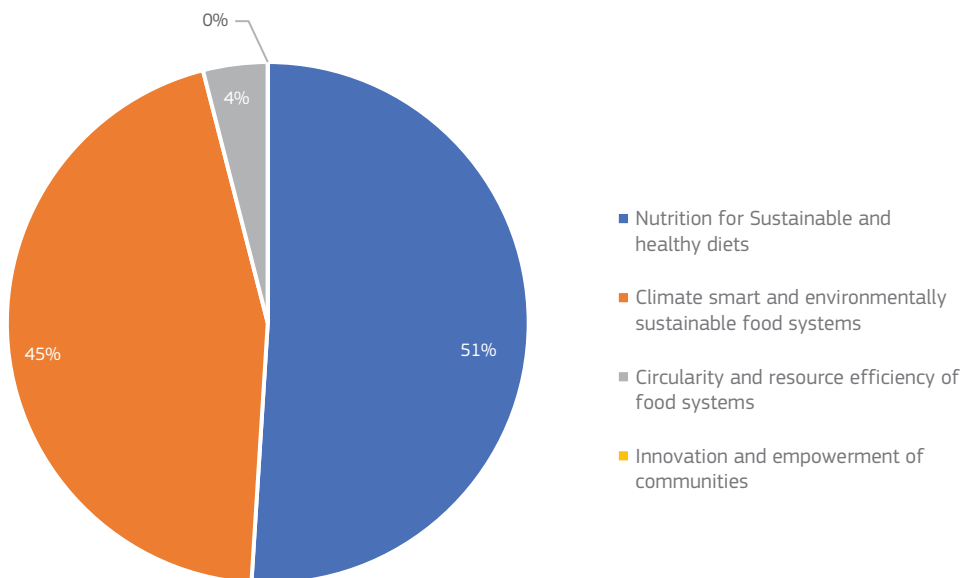
The goals of the five scientific infrastructures from the field Industry for Healthy Life and Biotechnologies, included in NRSI cover all four FOOD2030 priorities and six of its ten pathways. All of the Impact areas of SDARA match priority *Climate smart and environmentally sustainable food systems*, and pathways *Governance and systems change* and *Food systems and data*.

The activities under Strategic goal 3 of NAPDOP correspond to priorities *Climate smart and environmentally sustainable food systems* and *Circularity and resource efficiency of food systems*, and pathways *The food safety system of the future*, *Governance and systems change*.

Of these funds, NIF was the only one for which granular data was able to be identified. The majority of food-related projects funded by NIF (as shown in Figure 4) address priorities *Nutrition for sustainable and healthy diets* (19 of 34 projects and 51% of funds allocated) and *Climate smart and environmentally sustainable food systems* (14 of 34 projects and 45% of funds allocated). One project matches the priority *Circularity and resource efficiency of food systems* (4% of funds allocated)²⁴³.

²⁴³ Estimation based on the data available at the website of SMEPEA: Results - NIF, <https://www.sme.government.bg/?cat=26> - last seen in July 17,2021

Figure 4: Funds allocated by NIF to food-related projects by FOOD2030 priorities

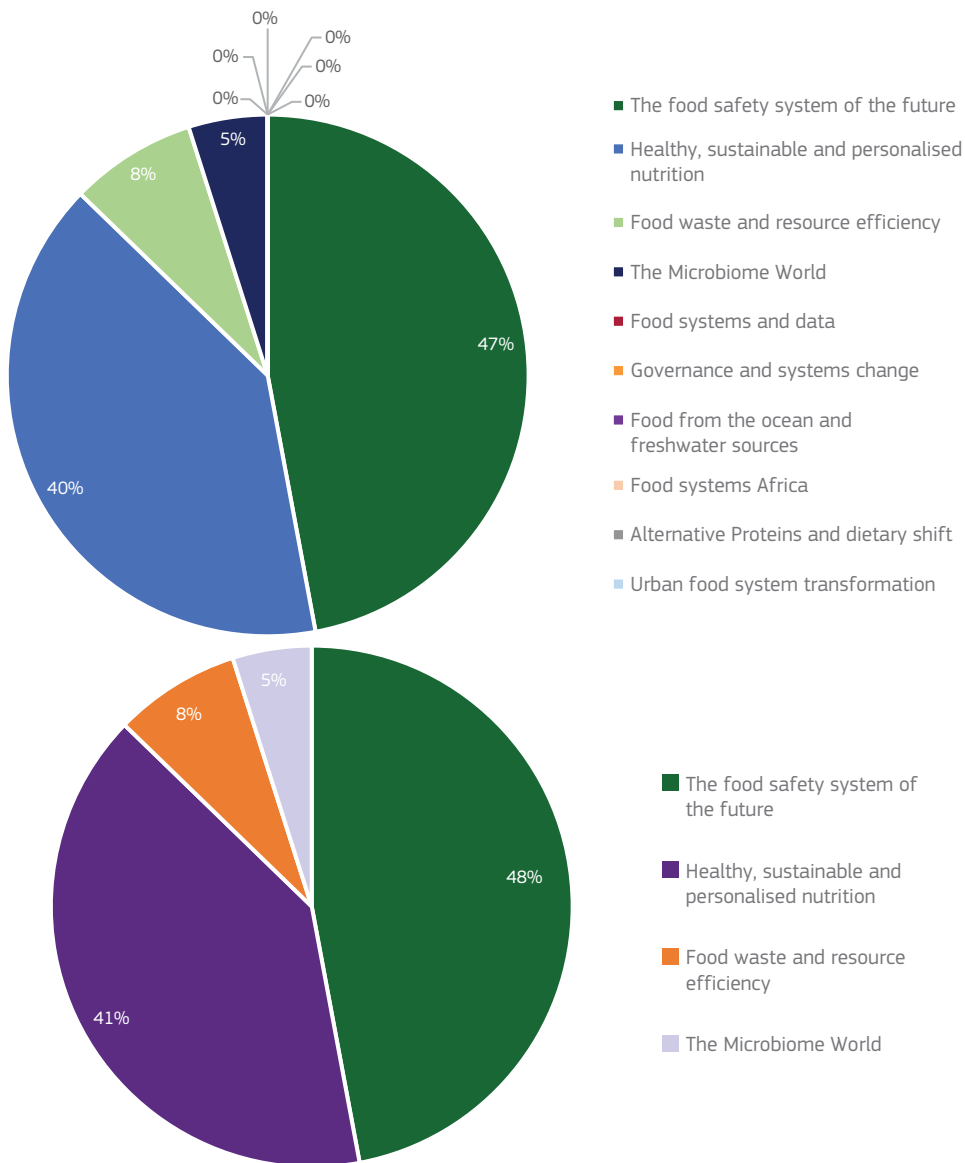


Source: SMEPEA, Results-NIF

The distribution of NIF support is similar in terms of FOOD2030 pathways. Almost half of the support to food-related projects: 48% of the funds allocated (to 16 of 34 projects) could be aligned to the pathway *The food safety system of the future*; and 41% of the funds (to 15 of 34 projects) could be aligned to the pathway *Healthy, sustainable and personalised nutrition*. Two of the supported projects (8% of funds) match the pathway *Food waste and resource efficiency*, and one (5% of funds) matches the pathway *The Microbiome World*²⁴⁴.

²⁴⁴ Estimation based on the data available at the website of SMEPEA: Results - NIF, <https://www.sme.government.bg/?cat=26> - last seen in July 17,2021

Figure 5: Funds allocated by NIF to food-related projects by FOOD2030 pathway



Source: SMEPEA, Results-NIF

9 Data gaps and limitations

Until 2020, when the SASRI was established, several different authorities were responsible for national R&I policy. They developed different policy documents, operated with different funds and respectively, are able to provide information on their activities only. On the other hand, the division of the national food policy by different ministries is objectively based, as it follows international conventions and traditions for division of economic activities. Similarly, data provided by NSI also could not provide precise information on food R&I, as Bulgaria follows the statistical standards accepted in EU.

Additionally, databases with individual projects received national funding either do not exist or are not organised in a manner that allows their quick retrieving and provision upon request. The partial information found contains different types of information, even for one and the same funding source for the different years and is published in formats that do not allow easy aggregation.

Besides these obstacles, the data gathering phase of the project implementation in Bulgaria took place in the summer months, when many officials take their annual holidays, and in a period of political instability (and probably personal changes in the government administration). This meant there was limited capacity to cooperate with the data collection.

Summary of data sources: Bulgaria

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Education and Science	https://www.mon.bg/bg/
	Small and Medium Enterprises Promotion Executive Agency with the Minister of Economy	https://www.sme.government.bg/
	Ministry of Agriculture, Food and Forests	https://www.mzh.government.bg/bg/
Food innovation related policies	Strategy for Digitalization of Agriculture and Rural Areas of the Republic of Bulgaria	https://www.mzh.government.bg/bg/politiki-i-programi/politiki-i-strategii/strategiya-za-cifrovizaciya-na-zemedelieto-i-selskite-rajoni-na-/
	Risk and Crisis Management Programme in the Sector “Agriculture”	https://www.mzh.government.bg/bg/politiki-i-programi/politiki-i-strategii/programa-za-upravlenie-na-riskovete-i-krizite-v-otrasl-zemedelie/
	National Action Plan for the Development of Organic Production	https://www.mzh.government.bg/bg/politiki-i-programi/politiki-i-strategii/nacionalen-plan_za_razvitie_na_bioproizvodstvoto/
	National Programme for Beekeeping for the Period 2020-2022	https://www.mzh.government.bg/bg/politiki-i-programi/politiki-i-strategii/nacionalna-programa-po-pchelarstvo/
	National Strategy for Promoting the Development of Small and Medium Enterprises 2014-2020	https://www.mi.government.bg/files/useruploads/files/vip/sme_strategy.pdf

National R&I Strategies	Updated National Strategy for Development of Scientific Research in the Republic of Bulgaria 2017-2030	https://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=1231
	National Roadmap for Scientific Infrastructure 2020-2027	https://www.mon.bg/bg/53
	National Scientific Programme “Healthy Foods for a Strong Bioeconomy and Quality of Life”	http://www.nnp-food.au-plovdiv.bg/
	National Scientific Programme “Reproductive Biotechnologies in Animal Husbandry in Bulgaria”	http://reprobiotech.eu/%d0%bc%d0%b8%d1%81%d0%b8%d1%8f-%d0%b8-%d1%86%d0%b5%d0%bb%d0%b8/
	National Scientific Programme “Intelligent Plant Growing”	NA
	National Scientific Programme “Intelligent Animal Husbandry”	NA
	Innovation Strategy for Intelligent Specialisation of the Republic of Bulgaria 2014-2020	https://www.mi.government.bg/files/useruploads/files/innovations/ris3_26_10_2015_bg.pdf
EU Structural funds on agri-food projects		
	Description	Link

Summary of amount spent from structural funds in agriculture and food projects	Operational Programme Innovation and Competitiveness 2014-2020	https://www.opic.bg/uploads/2020/12/operativna-programa-2.pdf
	Operational Programme Science and Education for Intelligent Growth 2014-2020	https://www.mon.bg/bg/706
	Rural Development Programme 2014-2020	https://www.opic.bg/uploads/2020/12/operativna-programa-2.pdf
	Operational Programme Maritime and Fisheries	https://www.eufunds.bg/sites/default/files/uploads/pmdr/docs/2020-12/Programme_Snapshot%20of%20data%20before%20send_2014BG_14MFOP001_7_1_bg%281%29.pdf
Food innovation funding		
	Name and description	Link
From desk research	Datasheets Total government budget allocations for R&D and Government budget allocations for R&D by socio-economic objectives	https://www.nsi.bg/en/content/6781/government-budget-allocations-rd-gbard
	Annual reports for the activity of SRF 2016-2020	https://fni.bg/?q=node/67
	Rules for the activity of the Consortium under the National Scientific Program “Reproductive Biotechnologies in Animal Husbandry in Bulgaria”	http://reprobiotech.eu/%d0%ba%d0%be%d0%bb%d0%b5%d0%ba%d1%82%d0%b8%d0%b2/
	Results – NIF, sessions 4 to 11	https://www.sme.government.bg/?cat=26

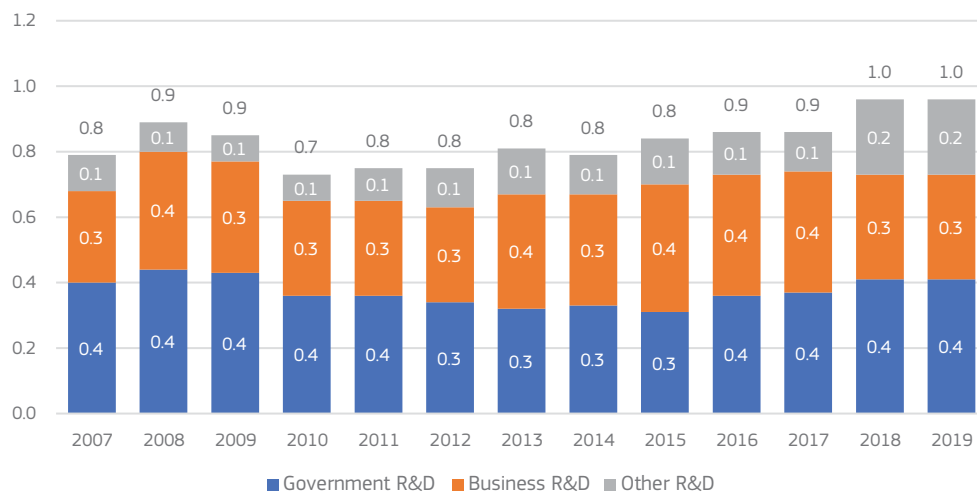
CROATIA

1 Overview of national R&I landscape

Food constitutes one of the pillars of the R&I strategy in Croatia. The R&I system in Croatia is centralised at the national level. Within the Government, until 2013, the **Ministry of Science and Education** had the leading role in policymaking for innovation. However, after the EU Accession, this role has been shared with the **Ministry of Economy, Entrepreneurship and Crafts**.

In particular, the MSE is responsible for science policy and the functioning of the research system. The MSE is supported by the **National Council for Science, Higher Education and Technological Development** as an independent advisory body in the domain of scientific research. Innovation policy and related policy on entrepreneurship are the responsibility of the MEEC.

Figure 1: R&I expenditure in Croatia, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main Providers of Food R&I funding at national level

There is a different institutional setup in regards of innovation funding. ESIF funds play a crucial role in funding R&I in Croatia, with 90% of the project-based financing originally being derived from ESIF. As noted, on a policymaking level related to R&I, the MSE and the MEEC are the main actors. However, for R&I funding, other institutions are also involved. The **Ministry of Agriculture** is the managing authority for the European Agricultural Fund for Rural Development (EARDF), **Ministry of Labour and Pension System** for the European Social Fund (ESF) and the **Ministry of Regional Development and European Funds** for the European Regional Development Fund (ERDF)²⁴⁵.

The **Croatian Science Foundation (CSF)** is the main national funding body for competitive research projects. CSF aims to foster research excellence, competitiveness and the integration of the Croatian research area into the European Research Area, while the **Agency for Science and Higher Education** is responsible for setting up a national network for quality assurance and evaluation of scientific research and higher education. The **Croatian Agency for Small Business, Innovation and Investment (HAMAG-BICRO)** is responsible for implementing all business R&I-related ESIF measures and providing support in the implementation of the Smart Specialisation Strategy (S3) and the Innovation Strategy.

Regarding specifically the R&I project funding in food systems, the Ministry of Agriculture and the CSF are the main national funding bodies responsible for funding research projects. HAMAG-BICRO also provides funding for a smaller portion of R&I projects targeted towards public and private organisations in different stages of the innovation process.

Other relevant actors

In total, there are more than 190 scientific organisations in the Croatian R&I landscape, including 25 public research institutes, 87 higher education institutions (HEIs), 70 research organisations other than public institutes and HEIs, and 25 private research organisations, which are either independent institutes or belong to corporations (for example, Podravka in the food industry²⁴⁶). In general terms, it is observed that there is a strong focus on research in the public sector and commercialisation in the private sector²⁴⁷.

The main stakeholders specifically dedicated to R&I related to agri-food systems that can be highlighted include **Faculty of Food Technology and Biotechnology (University**

²⁴⁵ <https://rio.jrc.ec.europa.eu/country-analysis/Croatia/country-report>

²⁴⁶ http://pregledi.mzos.hr/Ustanove_Z.aspx

²⁴⁷ Same as 2

of Zagreb), Faculty of Food Technology (University of Osijek), Agricultural Institute Osijek, Faculty of Agriculture (University of Zagreb), the Ruđer Bošković Institute, Faculty of Chemistry and Technology (University of Split), Faculty of Agrobiotechnical Sciences Osijek and Institute of Agriculture and Tourism in Poreč, Križevci College of Agriculture.

Other relevant actors and contributors to the R&I related to agri-food systems include **the Croatian Agriculture and Forestry Advisory Service, Croatian Agency for Agriculture and Food, Croatian Center for Agriculture, Food and Rural Affairs, Croatian Agriculture Chamber, Rural development network, food processors** and other input providers.

2 National R&I Strategy

The principles of the Croatian R&I policy for the 2014-2020 period are described in the Partnership Agreement adopted between Croatia and the European Commission. This Partnership Agreement brings together investment under different funds for the period 2014-2020. In this context, EUR 600 million was earmarked for the thematic objective of strengthening research, technological development and innovation from a total of EUR 10.6 billion allocated to the country under this Partnership Agreement²⁴⁸. The **Smart Specialization Strategy of Republic of Croatia 2016-2020 and Action plan for the implementation of Smart Specialization Strategy of Republic of Croatia 2016 - 2017** were developed within this scope as a key precondition for accessing the funds from ESIF within the abovementioned thematic objective of strengthening research, technological development and innovation.

The objectives of S3 are formulated in five pillars:

- Health and quality of life;
- Energy and sustainable environment;
- Transport and mobility;
- Security.
- Food and the bio-economy.

²⁴⁸ except territorial cooperation

In line with the R&I policy, several other important documents were adopted, including the **Strategy for Fostering Innovation of the Republic of Croatia 2014-2020**, **Strategy of Education, Science and Technology** and the **Croatian Research and Innovation Infrastructures Roadmap 2014-2020**²⁴⁹.

3 Overview of national food policy

The policy related to food systems in Croatia is governed on a national, regional and local level. The Ministry of Agriculture of Croatia is the central national authority responsible for implementing agri-food policy and performing administrative and other tasks in the field of agriculture, fisheries, forestry, rural development, management and disposal of state-owned agricultural land, agricultural policy, market and structural support in agriculture, food and tobacco industry and veterinary²⁵⁰. Regional authorities (counties) are mainly responsible for carrying out tasks related to rural development, e.g., activities related to agricultural holdings, tourism, development of villages and rural areas. In line with their respective development strategies, each county can finance R&I projects related to food systems through responsible administrative departments. Local authorities (cities, municipalities) are responsible for the organisation of LEADER groups and projects and supporting individual applicants for funding under the organisation of LEADER groups and projects in accordance with the Rural Development Programme²⁵¹.

Based on the Partnership Agreement between Croatia and the EU, the **Croatian Rural Development Programme (RDP)** for the same period 2014-2020 was also developed and formally adopted by the European Commission in 2015. In this context, the RDP provides main strategic orientations for the food systems, including R&I related to food systems. In particular, the RDP outlined Croatia's priorities for using EUR 2.3 billion that was available for the period 2014-2020 (EUR 2 billion from the EU budget and EUR 0.3 billion of national funding)²⁵². Within the RDP, the main and cross-cutting objective of the programme was knowledge transfer and innovation in agriculture, forestry and rural area with an aim to support the transfer of knowledge, information actions, advisory services, farm management and farm relief services and co-operation. Under this particular objective, support for around 42,000 people was foreseen, in the context of training for increasing the knowledge and skills of those employed in the agricultural and forestry sectors, together with more than 100 cooperation projects and 33 Operational Groups to be established

²⁴⁹ <https://www.hgk.hr/documents/strategijapoticanjainovacija1812145bfbff9da5870.pdf>

²⁵⁰ <https://poljoprivreda.gov.hr/o-ministarstvu/9>

²⁵¹ <https://portal.cor.europa.eu/divisionpowers/Pages/Croatia-Agriculture.aspx>

²⁵² https://enrd.ec.europa.eu/sites/default/files/hr_rdp_qnt_summary_v1_3.pdf

under the European Innovation Partnership. A particularly important measure from the RDP that relates to the R&I in food systems is Measure 16.1.2, which aims to support the implementation of projects awarded under Measure 16.1.1 “support for establishment and operation of operational groups of the EIP for agricultural productivity and sustainability”.

In previous years, several institutional reforms occurred related to the overall agri-food landscape. Aside from the integration of the Agriculture and Forestry Advisory Service into the Ministry of Agriculture, technology and innovation centres for livestock (Croatian Agriculture Agency) and crop (Croatian Centre for Agriculture, Food, and Villages) were reformed, whereby staff, assets and activities were partially transferred to the Ministry of Agriculture and partially merged into a new Croatian Agency for Agriculture and Food. The Agency carries out programmes that are of strategic interest to the Republic of Croatia and establishes an infrastructure in cooperation with scientific institutions that is of interest to the entire Agri-food system of the Republic of Croatia²⁵³.

With the new programming cycle, several important documents have been developed or are being in the process of preparation. In particular, adopted in February 2021, the **2030 National Development Strategy** (NDS) of Croatia is the new overarching document aiming to provide strategic guidance to all development policies and lower-ranking strategic planning documents. In the NDS, one of the strategic goals is self-sufficiency in food and the development of the bio-economy. Within this strategic goal, four priorities of the public policy until 2030 are outlined²⁵⁴:

- Increasing the productivity of agriculture and aquaculture and their resilience to climate change in an environmentally acceptable and sustainable way;
- Contributing to climate neutrality, reducing pesticide use and increasing organic production in line with the new EU guidelines under the Green Plan and the “from Farm to Fork” Strategy and the EU Biodiversity Strategy;
- Strengthening competitiveness and innovation in agriculture and aquaculture;
- Reviving rural areas and improving the quality of life in rural and coastal areas.

It should be highlighted that with regards to the second priority, a greater investment towards research and development in the agri-food sector, aquaculture and the bioeconomy is foreseen.

²⁵³ <https://www.hapih.hr/about-us/>

²⁵⁴ <https://hrvatska2030.hr/wp-content/uploads/2021/02/Nacionalna-razvojna-strategija-RH-do-2030.-godine.pdf>

Currently, the new **Croatia's National Agriculture and Rural Development Strategy** (NARDS) and **new Common Agricultural Policy** (CAP) Strategic Plan are in preparation by the Ministry of Agriculture, in line with the programming requirements established for the next EU budget period (2021–2027). The main objectives outlined in draft NARDS are derived from NDS and are as following:

- Increase the Productivity and Climate Resilience of Agricultural Production;
- Strengthen the Competitiveness of the Agri-Food System;
- Renew the Rural Economy and Improve Livelihoods in Rural Space, and a cross-cutting objective;
- Stimulate Agri-Food Innovation (horizontal).

In particular, regarding the strategic objective 4), the draft strategy outlines two specific objectives:

SO1 Facilitate capital investment focused on technology and innovation

Under SO1, the goal is to leverage public funds for rural development to incentivize closer linkages between scientific institutions and the agri-food sector and channel increased private investment into basic and applied research activities and achieve the introduction of new inputs, products, technologies, and solutions by agri-food producers and processors.

SO2 Improve access to R&DI and uptake of knowledge and technology supporting decision-making and investments (including climate and sustainability)

Under SO2, the goal is to improve coordination, collaboration and partnerships between agri-food chain actors and knowledge generation and transfer institutions, increase public support for (basic and applied) research innovations and their dissemination and adoption, and invest in skills and knowledge of farm advisors, especially as regards compliance requirements and transformative innovations (digital technologies, climate-smart agriculture, information and data exchange).

Furthermore, regarding technology and innovation, the draft strategy recognizes technological developments in genetics, nano and precision technologies, remote sensing, traceability (blockchain), (big) data analytics, the internet of things, artificial intelligence, robotics and e-commerce as opportunities to raise productivity, lower costs, reduce risks,

improve value addition, and develop new markets for Croatia's Agri-food sector. Digital technologies are assessed to hold particularly high potential, as they significantly reduce costs of sharing information and conducting transactions in agri-food chains and in knowledge and innovation systems by enabling easy access to capital goods at lower costs.

4 Public funding available for food R&I

The R&I policy mix related to food R&I in Croatia includes of budget-based financing for public Higher Education Institutions (HEI) and public research institutes and project-based financing from EU, national and other sources. As noted, R&I project financing in Croatia is estimated to be predominantly funded from EU sources (90%), with a smaller contribution of World Bank, bilateral and national budget funding (10%). The public and bilateral funding are mostly implemented through CSF and Croatian Ministry of Agriculture, while HAMAG-BICRO implements five programmes in support of public and private organisations in different stages of innovation process (PoC, RAZUM, TEHCRO, IRCRO, UTT)²⁵⁵.

As the main funder of national R&I projects, the CSF houses several publicly funded programmes that aim to support advanced scientific research recognised at the international level by investing in advanced scientific ideas and excellent researchers in all scientific fields and promoting international criteria of excellence. The two main publicly funded programmes with a significant number of R&I projects that relate to food systems are “Research Projects” programme and “Installation Research Projects” programme:

- **The “Research Projects” programme** funds fundamental research whose goal is creating new and enhancing existing knowledge about a specific area and that is directed at better understanding of the research topic, as well as applied research that is conducted with clear technological, economic or social aims in mind. Projects are funded for a period of 4 years;
- The goal of the **“Installation Research Projects” programme** is to provide support to the establishment of new research groups of young scientists in order to accelerate the establishment of their autonomous research careers after the acquisition of a doctoral degree. The Programme enables young scientists to establish their own research group and laboratory during a five-year funding period.

²⁵⁵ The Government of Croatia received 20 million EUR from the International Bank for Reconstruction and Development for the implementation of Second Science and Technology Project (STP II). The Component B of the project referees specific research and innovation programs. HAMAG-BICRO is responsible for sub-financing of respective subcomponents under Component B (five programmes stated in the text).

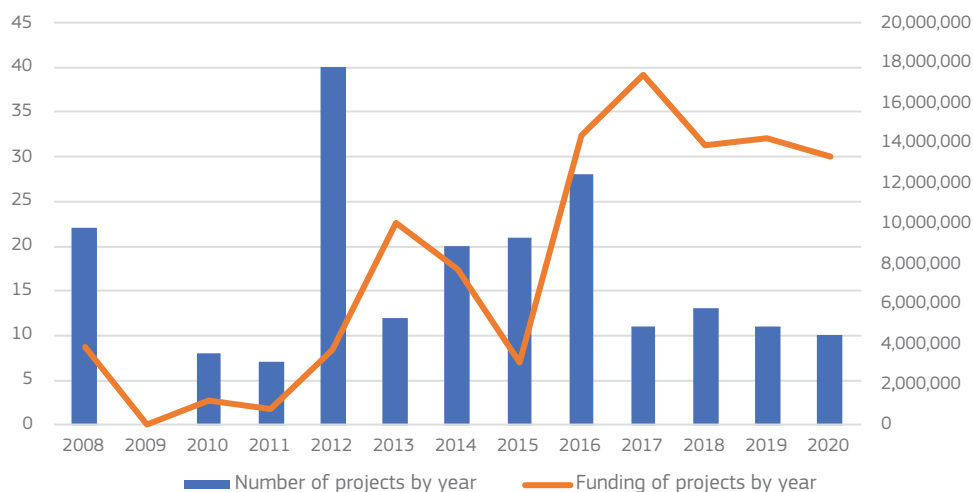
The project proposal should primarily include the development of new research topics and/or methodology.

In addition to CSF, VIP projects were one of the main funding sources of national R&I projects related to food systems. Through the VIP projects, research was expected to respond directly to problems of agricultural producers, to create new production technologies and to apply technologies adapted to different production conditions, especially the conditions of family farms. A system for transfer of knowledge to farm advisors was established in the form of regular workshops and development of specific technical packages for advisors, upon completion of research²⁵⁶. As previously noted, since 2018, VIP projects are gradually being substituted by EU-funded European Innovation Partnership projects, and upon fulfilment of its financial obligations, VIP will cease to exist. The analysed VIP projects (2008-2018) were funded exclusively from the state budget.

According to data available from CSF and VIP, a total of 203 R&I food-related projects were developed by Croatian organisations between 2008 and 2020, receiving a total of EUR 13.8 million in funding. A review of the number of projects approved during this period shows that 2012 and 2016 were the years with highest number of projects approved (40 and 28 respectively). The year in which the highest funding was used for food-related projects was 2017 (EUR 2,310,000).

²⁵⁶ <https://poljoprivreda2020.hr/wp-content/uploads/2019/12/AKIS.pdf>

Figure 2: R&I food related projects between 2008 and 2020²⁵⁷.



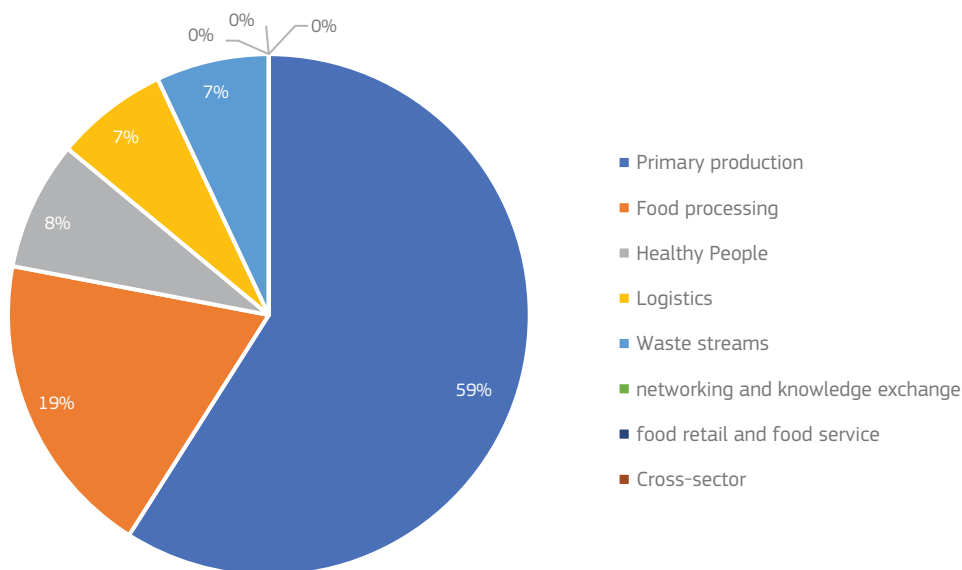
Source: CSF and VIP

Funding by sector

When analysing the sectors receiving funding for food-related R&I actions, the majority of public funding appears to be directed towards projects and/or actions related to primary production (59%). It is notable that between 2008 and 2020, there was no public investment in Networking and knowledge exchange, food retail and food service and Cross-sector as observed in Figure 3.

²⁵⁷ Call year was designated as the project year

Figure 3: Distribution of the funding by sector.

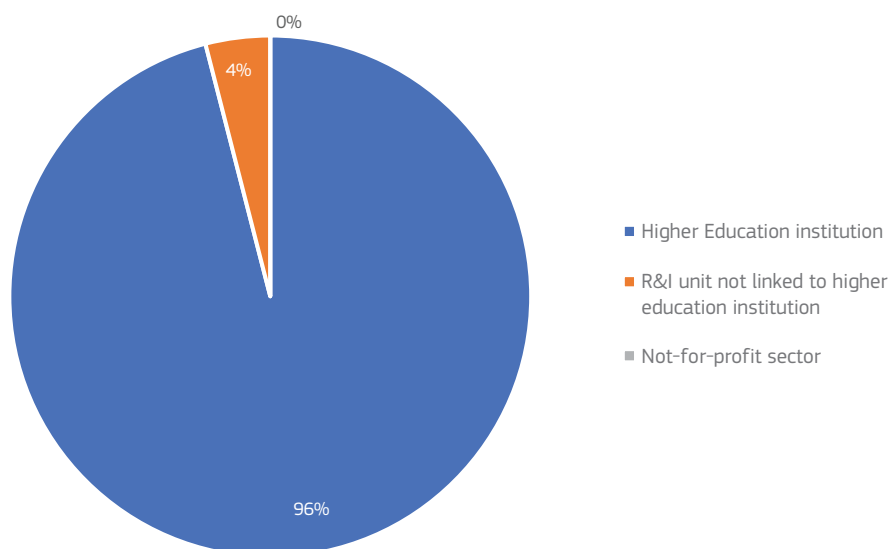


Source: CSF and VIP

5 Main recipients of public food R&I investment

A review of the data available shows that HEIs received the highest amount of food R&I funding (EUR 13.3 million, corresponding to 96% of the total funding), followed by R&I Units not linked to HEIs (EUR 516,000, or 4% of the total). HEIs coordinated 194 projects between 2008 and 2020, whereas R&I Units not linked to HEIs coordinated 9. Among the sample of projects from CSF and VIP, no recipients of funding from not-for-profit sector were observed.

Figure 4: Distribution of the funding by recipients.



Source: CSF and VIP

6 Structural Funds available for Food R&I

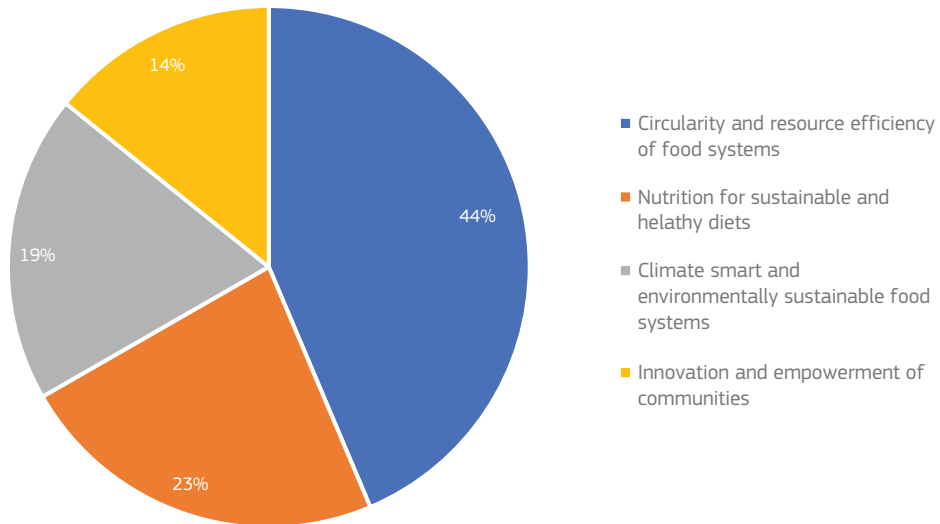
Croatia, through four national programmes, benefits from ESIF funding of EUR 10.7 billion. The total budget for the theme of Research and Innovation in the period was EUR 744.1 million. From the total budget for the theme of Research and Innovation, 1% or EUR 10.3 million was the budget from EAFRD²⁵⁸.

7 Links to FOOD2030 priorities and pathways

According to the data analysis, the main single priority is Circularity and resource efficiency of food systems (44%, corresponding to EUR 6.1 million), followed by Nutrition for sustainable and healthy diets (23%, corresponding to EUR 3.2 million), Climate smart and environmentally sustainable food systems (19%, or EUR 2.6 million) and Innovation and empowerment of communities (14%, or EUR 1.9 million).

²⁵⁸ <https://cohesiondata.ec.europa.eu/countries/hr>

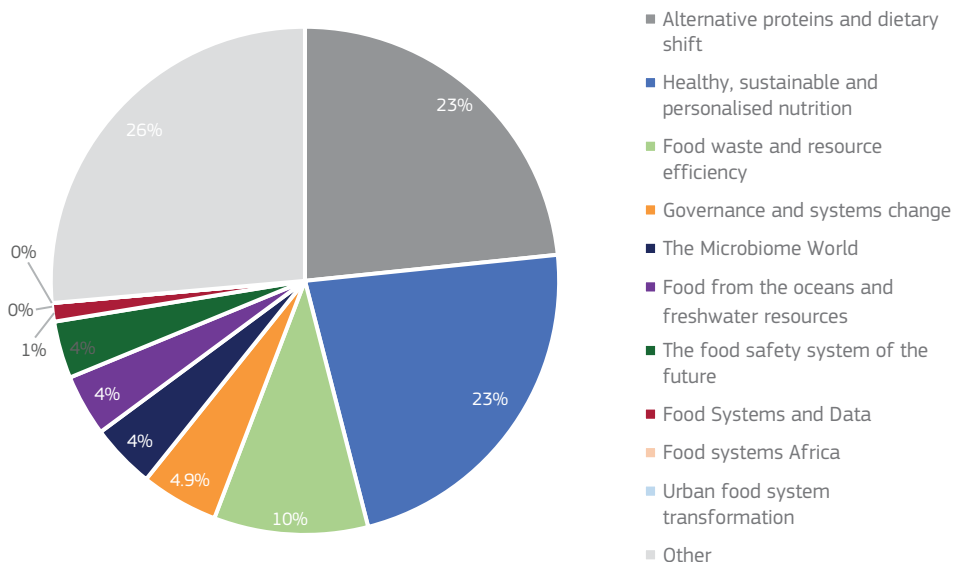
Figure 5: Distribution of funding by FOOD2030 priority



Source: CSF and VIP

With regards to FOOD2030 pathways, publicly funded food R&I in Croatia assigns a large share to Alternative proteins and dietary shift (23%, corresponding to EUR 6.5 million), followed by Healthy, sustainable and personalised nutrition (23% and EUR 6.3 million). Further details can be observed in Figure 6.

Figure 6: Distribution of funding by FOOD2030 pathway



Source: CSF and VIP

8 Data gaps and limitations

The results of the analysis are based on publicly available information and data from the Croatian Ministry of Agriculture's and CSF's website.

Information not available on the website of Croatian Ministry of Agriculture includes among others: project description, keywords, technology readiness level (TRL), publications and patents.

Information not available on the website of CSF includes among others: technology readiness level (TRL), publications and patents.

Summary of Data Sources: Croatia

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture	https://poljoprivreda.gov.hr/
	Croatian Science Foundation	https://hrzz.hr/
	Croatian Agency for SMEs, Innovations and Investments	https://hamagbicro.hr/
Food innovation related policies	Draft version of Croatia's National Agriculture and Rural Development Strategy 2020 – 2030	https://poljoprivreda.gov.hr/UserDocsImages/dokumenti/novosti/Nacrt_strategije_poljoprivrede_2020_2030.pdf
	Rural Development Programme for Croatia 2014-2020	https://ruralnirazvoj.hr/files/Program-ruralnog-razvoja-Republike-Hrvatske-2014.-2020.-odobrena-inacica-EN-verzija-9.1.pdf
National R&I Strategies	Smart Specialization Strategy of Republic of Croatia 2016-2020	https://www.hgk.hr/documents/strategijapametnespecijalizacijerh201620205dd26c823704e.pdf
	Strategy for Fostering Innovation of the Republic of Croatia 2014-2020	https://narodne-novine.nn.hr/clanci/sluzbeni/dodatni/434155.pdf
	Strategy of Education, Science and Technology	https://narodne-novine.nn.hr/clanci/sluzbeni/full/2014_10_124_2364.html#footnote-29081-152

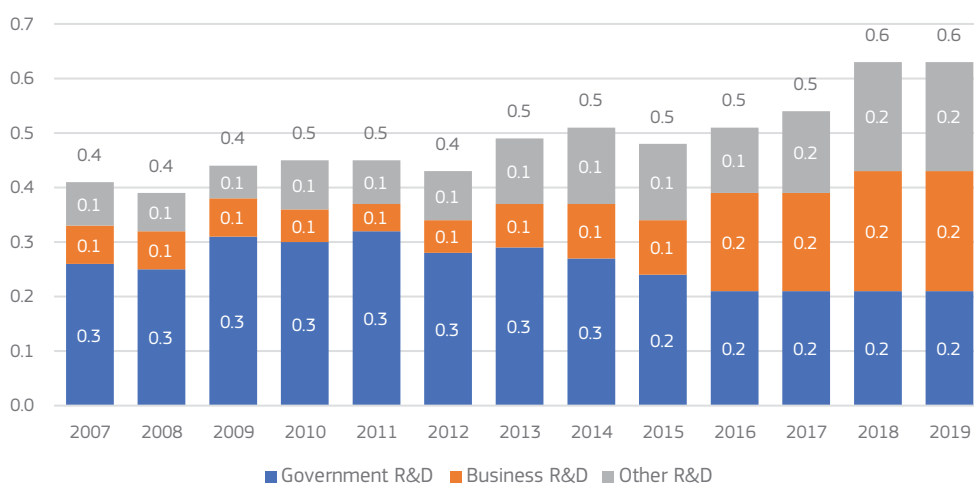
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Croatia, through 4 national programmes, benefits from ESIF funding of EUR 10.7 billion. The total budget for the theme of Research and Innovation in the period was EUR 744.1 million. From the total budget for the theme of Research and Innovation, 1.4% or EUR 10.3 million was the budget from EAFRD.	https://cohesiondata.ec.europa.eu/countries/hr
From desk research	Ministry of Agriculture (VIP programme)	https://poljoprivreda.gov.hr/istaknute-teme/poljoprivreda-173/drzavne-potpore/vip-vijece-za-istrazivanja-u-poljoprivredi/215
	Croatian Science Foundation	https://hrzz.hr/financiranje/baza-projekata/

CYPRUS

1 Overview of national R&I landscape

Cyprus does not have a specific food R&I strategy, but the sector “Agriculture/Food Industry” is included in the smart specialisation strategy 2015–2020. Figure 1 provides an overview of national R&D expenditure as a proportion of GDP in Cyprus between 2007 and 2019²⁵⁹. Although figures have risen and fallen depending on sector, overall expenditure has increased over this period. Government expenditure has decreased as a proportion of GDP since reaching a peak of 0.3% in 2011, but remained the largest contributor until 2018. Since government expenditure began to fall in 2012, business expenditure has experienced the highest growth and is currently the highest contributor at 0.2% of GDP in 2019, representing an increase in private sector innovation.

Figure 1. Gross expenditure on R&D in Cyprus as a percentage of GDP



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

By sector of performance, business enterprises accounted for 43% (EUR 70.7 million) of total R&I expenditure, higher education institutions for 38% (EUR 63 million), private non-profit institutions for 11% (EUR 18.6 million) and government for 7% (EUR 12.2 million) during 2019²⁶⁰.

²⁵⁹ 2019 is the last year for which complete figures are available

²⁶⁰ Press release (2019), [Research and Development Activity in Cyprus](#)

Main Providers of Food R&I funding at national level

The Research and Innovation Foundation (RIF)²⁶¹ is the main public funding institution for R&I in Cyprus and is responsible for the distribution of national funding provided by the Ministry of Finance. Its activities cover a wide variety of sectors, including research and innovation in food systems. RIF has been responsible for supporting research activities since 1996 but has expanded the scope of its responsibilities to support the development of innovation since 2007. Following a restructuring in 2018, RIF now operates as the executive arm of the national research and innovation governance system under strategic guidance from the Deputy Ministry of Research, Innovation and Digital Policy²⁶². The National Board for Research and Innovation (NBRI)²⁶³ also operates at the strategic level and is the principal advisory body for defining research and innovation strategy. The Chief Scientist plays a role in coordinating the formulation of national R&I policy and the operation of the entire national R&I governance system, including the Committee of Ministry Research and Innovation (R&I) Coordinators. Each ministry appoints a R&I Coordinator as a central point of communication to encourage an integrated and comprehensive approach to research and innovation issues, a strategy adopted in 2020.

Other relevant actors

The main public research institutions conducting research and innovation in food systems funded by RIF include the Agricultural Research Institute (ARI), Department of Fisheries and Marine Research and State General Laboratory (Ministry of Health), in addition to a number of public and private universities.

ARI research primarily focuses on increasing the yield and quality of agriculture and livestock production. The seven core areas of research include Viticulture/Arboriculture, Plant Breeding, Horticulture/Floriculture, Plant Protection, Soil/Water Use and Environment, Animal Production, and Rural Development and Agrobiotechnology.

The Department of Fisheries and Marine Research implements programmes related to the sustainable management of the national fishing industry. Activities related to food R&I include the modernisation of fishing technology, research into aquaculture and the development of fisheries and management of fishery resources.

²⁶¹ [Research and Innovation Foundation \(RIF\) Website](#)

²⁶² [Deputy Ministry of Research, Innovation and Digital Policy Website](#)

²⁶³ [National Board for Research and Innovation \(NBRI\) Website](#)

The State General Laboratory is tasked with promoting safe and healthy foods. It conducts applied research programmes focusing on the prevention, investigation and solution of problems in the food chain to achieve long-term food safety.

2 National R&I Strategy

Cyprus is in the process of growing a relatively young R&I system and has set a national target for R&D expenditure to increase to 2% of GDP by 2023. This will require an additional spend of EUR 280 million per annum. If achieved, the country is projected to rise from being ranked 25th to inside the top 12 EU nations in R&D investment intensity. A Research & Innovation Strategy Framework was introduced by NBRI for the period 2019 - 2023 titled '**Innovate Cyprus**' to aid the attainment of this target. The framework consists of nine Strategic Pillars (SP) and Strategic Enablers (SE) focusing on the following key areas: Governance, National R&I Strategy, Research Excellence, Knowledge Transfer & Commercial Exploitation, Innovative Entrepreneurship, Cultural Change, International Collaboration, Communication, Digital Transformation.

A Smart Specialisation Strategy (S3CY)²⁶⁴ was adopted for the period 2015 – 2020 with the aim of focusing resources on prioritised sectors. These sectors were chosen based on their competitive advantage or their potential to generate knowledge-driven growth and include 1) Energy 2) Tourism 3) Built Environment/Construction 4) Transport/Marine 5) Agriculture/Food Industry 6) Health. Information Technology, Environment and Human Resources have been identified as horizontal priorities. The Specialisation Strategy is expected to be updated in Q3 2022.

3 Overview of national food policy

The **Rural Development Programme 2014-2020** is the main agricultural policy and funding framework for the development of the primary production sector and is the responsibility of the **Ministry of Agriculture, Rural Development and Environment**. Its purpose is to improve the competitiveness of the agricultural sector, ensure the sustainable management of natural resources and achieve equal development through the creation of employment²⁶⁵. EUR 243 million (53% of the total budget) is expected to be provided by the European Agricultural Fund for Rural Development (EAFRD), with the remaining expenditure covered by national sources of funding. Due to a delay in the

²⁶⁴ Research and Innovation Foundation (2015), [Smart Specialisation Strategy Executive Summary](#)

²⁶⁵ Ministry of Agriculture, Rural Development and Environment, [Rural Development Programme 2014-2020](#)

adoption of the new EU Common Agricultural Policy, an additional EUR 64.2 million has been provided by the European Commission to cover a transition period during 2021-2022. A range of stakeholders benefit from the programme including farmers, producer groups, businesses, local authorities and other bodies relating to the sustainable development of food production. The policy was preceded by the **Rural Development Programme 2007-2013** which was implemented by the **Department of Agriculture**. It included total public expenditure of EUR 325 million combined with EUR 162 million from EAFRD (50% contribution rate).

4 Public funding available for food R&I

The Research and Innovation Foundation (RIF) has confirmed that the majority of public expenditure on food R&I programmes in Cyprus is financed through EU Structural Funds. Two major national funding programmes were introduced between 2007 and 2020 to finance projects in prioritised sectors identified as having high potential for growth (more detail below). RIF also participated in the **Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE JPI)**, providing a total of EUR 339,000 to three food R&I co-funded projects.

5 Main recipients of public food R&I investment

The main recipients of public food R&I expenditure in Cyprus are the Agricultural Research Institute, State General Laboratory, non-profit research institutions including the Frederick Research Centre, Cyprus Institute and Institute of Rural and Regional Development, and a number of public and private universities such as the University of Cyprus, University of Nicosia, Cyprus University of Technology, Open University of Cyprus.

6 Structural Funds available for Food R&I

Since 2008, RIF has announced two funding framework programmes co-financed by European Structural and Investment Funds (ESIFs). These include DESMI 2008-2010 and the RESTART Programmes 2016-2020. Projects funded between 2010 and 2016 were covered by the DESMI framework as there was no other official programme introduced during this period.

The **DESMI 2008-2010** framework of programmes comprised a total budget of EUR 120 million. Two thematic actions covered food R&I. The Sustainable Development Programme funded six projects totalling EUR 707,317 related to 'Agriculture, Farming, Fisheries and Aquaculture'. These projects focused on enhancing primary production by improving the quality of livestock using genetics, preventing disease in flora caused by herbivorous mites and options for sustainable water use. In addition, the Health and Biological Sciences Programme funded seven projects totalling EUR 1,044,507 related to 'Food Science and Biotechnology'. The primary aim of these projects was to improve characterisations of flora, the nutrition of food products and understandings of how domestic plant sources can be exploited for use in medication.

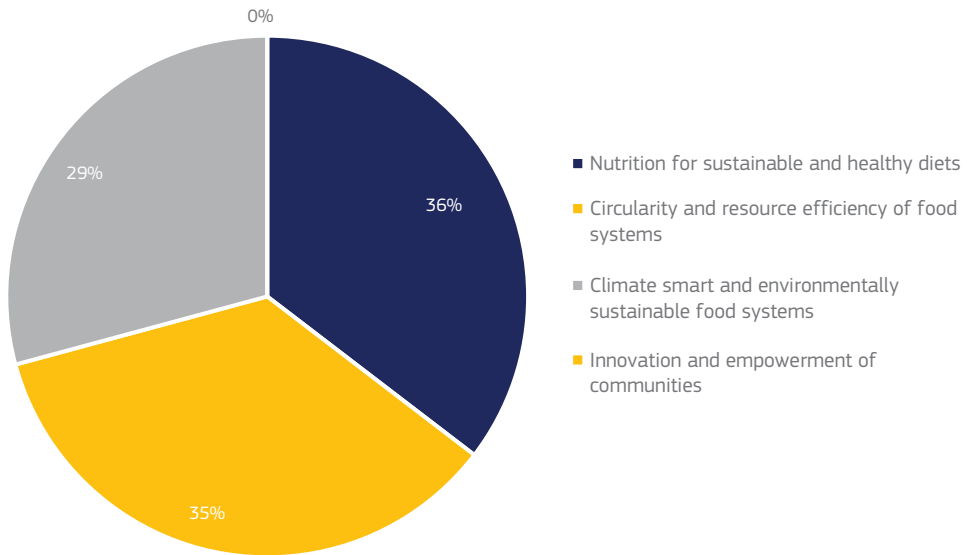
RESTART 2016-2020 Programmes for Technological Development and Innovation target the priority sectors identified in S3CY, including the agricultural and food Industry. The programmes were delivered in conjunction with the Competitiveness and Sustainable Development 2014-2020 programme which is the national development strategy utilising resources from the European Regional Development Fund (ERDF). A total budget of EUR 137.7 million was provided to the RESTART programmes, with EUR 45 million financed by the ESIFs. Some of this funding will be delivered over the period 2021-2027 using ERDF and the Cyprus Operational Programme 'THALIA 2021-2027'. RIF has provided data on 45 food R&I projects funded through RESTART programmes totalling EUR 9 million of public funding (7% of the allocated budget) across both public and private organisations.

7 Links to FOOD2030 priorities and pathways

National funding for food systems R&I projects was provided as part of Cyprus's participation in the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE JPI). Funding of EUR 339,000 was provided for a total of 3 projects. As shown in figure 2, the majority of funding was allocated to addressing challenges related to nutrition for sustainable and healthy diets (EUR 120,000 or 36%) and circularity and resource efficiency of food systems (EUR 120,000 or 35%²⁶⁶). The remaining amount of funding (EUR 99,000 or 29%) was awarded to address the climate smart and environmentally sustainable food systems priority.

²⁶⁶ Each of these pathways accounts for 35.5% of the total, but one has been rounded up to 36% and the other down to 35% to maintain a total of 100%

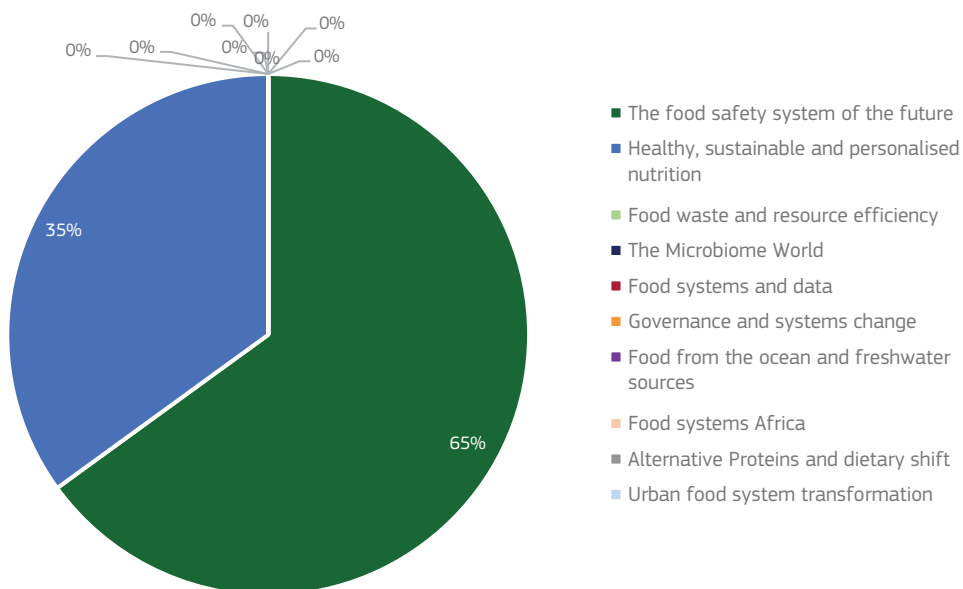
Figure 2: Distribution of national funding by FOOD2030 priorities.



Source: Research and Innovation Foundation (RIF)

The majority of national funding (EUR 219,000 or 65%) was allocated to projects contributing to the 'healthy, sustainable and personalised nutrition' pathway, while the remaining funds (EUR 120,000 or 35%) were provided to projects addressing the 'food safety system of the future' pathway. This is shown below in figure 3.

Figure 3: Distribution of national funding by FOOD2030 pathway



Source: Stakeholder in Research and Innovation Foundation (RIF)

8 Data gaps and limitations

Aside from the information provided on JPIs, no data was available on national funding for the period 2007-2020. This has been confirmed by contacts at the Research and Innovation Foundation. The results of this report are based on publicly available information accessed online and data provided by the Research and Innovation Foundation. The data provided by RIF was collated from an extensive database using a key word search and therefore may not capture all projects involved with food R&I systems in Cyprus.

Summary of data sources: Cyprus

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Research and Innovation Foundation (RIF)	https://www.research.org.cy/en/
National R&I Strategies	Cyprus Research and Innovation Strategy Framework 2019-2023 – Innovate Cyprus	https://www.research.org.cy/wp-content/uploads/InnovateCyprusCYRIStrategyFramework2019-2023NBRIMay2019.pdf
	Smart Specialisation Strategy	https://www.research.org.cy/wp-content/uploads/S3Cy_ExSummary_Mar15_GrEn.pdf
From interviewees	Ad hoc document produced by GSRI.	Not public.

CZECHIA

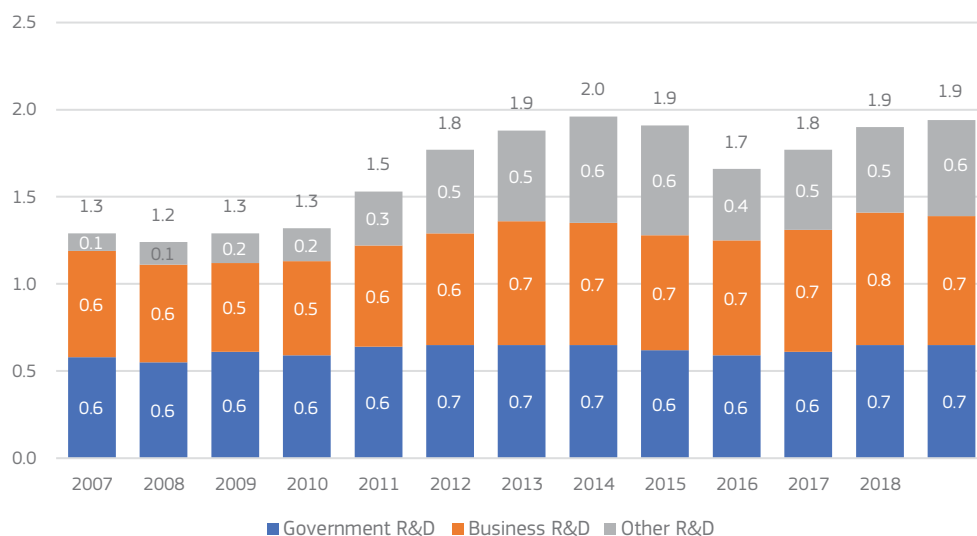
1 Overview of national R&I landscape

This report provides a brief overview of the public funding available for food systems R&I in Czechia, including a breakdown of the national public funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.

The **total R&D and innovation expenditure in Czechia as a share of GDP is 2.0%**, of which 60% are company resources, and 40% are government and European resources.²⁶⁷ Around 29% of government and European resources was from European Structural and Investment Funds (ESIF).²⁶⁸

Czechia has a specific food R&I strategy, outlined in the vision for research, development and innovation in the agriculture sector (2016).

Figure 1: R&D expenditure as a % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

²⁶⁷ Innovation Strategy 2019 <https://www.vyzkum.cz/FrontClanek.aspx?idsekce=867922&ad=1&attid=867987#:~:text=The%20share%20of%20total%20R%26D,are%20government%20and%20European%20resources.>

²⁶⁸ RIO report

R&I policy making in the Czech Republic is centralised in terms of governance, while regional authorities' main role is to administer EU Structural Funds.

Main Providers of Food R&I funding at national level

The main institutions responsible for public funding of R&I in the Czech Republic are the **Ministry of Industry and Trade** (MIT), which is responsible for policies in the domain of business R&I, the **Ministry of Education, Youth and Sports** (MEYS), the central administrative authority for R&D in the public sector, responsible for funding higher education institutions, research infrastructures, and promoting international collaboration, and the **Ministry of Agriculture** (eAGRI), responsible for food and agricultural R&I.²⁶⁹

The main agencies that provide competitive funding for innovation are:

- the **Technology Agency of the Czech Republic** (TA CR), the national agency established in 2009 to support applied research, experimental development and innovation.²⁷⁰
- the **Czech Science Foundation** (GA CR), providing funding for basic research through open competitions organised thematically in five scientific areas (technical, natural, medical, social and agricultural sciences).
- the **Czech Academy of Sciences** (CAS), a non-governmental unit of the R&I system, funding provider and one of the most important research performers, consisting of 54 independent public research institutes

Other relevant actors

The **Council for Research, Development and Innovation** (CRDI) is the main advisory government body for R&I policy. The CRDI is led by the Prime Minister and administratively supported by the Government Office for Science, Research and Innovations.²⁷¹

²⁶⁹ JRC RIO report

²⁷⁰ <https://www.tacr.cz/en/technology-agency-of-the-czech-republic/>

²⁷¹ Ibid

2 National R&I Strategy

The latest national R&I strategy is the **2019-2030 Innovation Strategy**, that outlines key goals and objectives, among which:²⁷²

- Strengthening R&D funding as a share of GDP, with a target of reaching 3% in 2025 and 3% in 2030 (of which 1% from public resources).
- Increase the institutional component of R&D funding for research organisations that achieve excellent results in defined research priorities and increase targeted support for institutions whose results are applied in practice.
- Maintain research funding from European sources and support the participation in Horizon Europe.
- Fully implement an assessment system and continuously monitor and evaluate impacts with a focus on the impact on society.
- Support research topics that meet the criteria cross-sectionally: globally competitive basic research; sufficient capacity for follow up applied research; successful applications (new quality of life solutions, patents, licences sold, products); real interconnection to the corresponding company environment and fields with breakthrough technology potential.
- Encourage obtaining funds from non-public sources through financial instruments.

The previous Innovation Strategy (the National Research, Development and Innovation Policy of the Czech Republic, published in 2016 and assessing the 2009-2015 strategy with an Outlook to 2020²⁷³) was mainly focused on establishing a functioning system of RDI management, promoting collaboration and knowledge sharing among public and private actors, and strengthening research on new technologies and procedures to improve business processes' efficiency. The strategy was preceded by the National innovation policy of the Czech Republic for 2005-2010.

The latest Czech Innovation Strategy only briefly mentions the agriculture and food sector (in relation to food security), but one of its main goals is to strategically target the support for applied research to the current and potential future needs of society, which could imply

²⁷² Innovation Strategy 2019-2030

²⁷³ http://www.czech-research.com/wp-content/uploads/2016/09/IRDIP_2016-2020_eng.pdf

funding for food and agriculture. The vision for research, development and innovation in the agriculture sector is instead outlined in a **Concept of the Ministry of Agriculture 2016-2022**, where the key aim is “*support for innovative agriculture and forestry through advanced procedures and technologies*” and one of the three key areas is sustainable food production.

3 Overview of national food policy

The Czech national food policy is mainly represented by the following strategies:²⁷⁴

The Strategy of the Ministry of Agriculture of the Czech Republic with outlook to the year 2030 outlines nine main ambitions and six key gaps to be addressed, with the main aim to secure food self-sufficiency, reduce environmental and transport costs, increase the competitiveness and efficiency of the food industry. The strategy also has a specific research and innovation focus.

Ambitions:

- Ensuring food security and improving the impacts of agriculture on natural resources
- Increasing the supply of safe, high-quality, and affordable food to consumers
- Emphasis on improving food safety and consumer protection
- Environmentally friendly growth in food efficiency and productivity
- Development and use of knowledge of scientific and technological developments
- Promoting food research and implementing its results in practice, including collaborative projects within product chains

²⁷⁴ Ad a) <http://eagri.cz/public/web/mze/ministerstvo-zemedelstvi/koncepce-a-strategie/strategie-resortu-ministerstva-1.html>
(only in Czech language)

Ad b) http://eagri.cz/public/web/file/324778/323923_514597_StrategieBP_en.pdf

Ad c) <http://www.zdravi-2020.cz/dokumenty/health-2020-national-strategy.pdf>

Ad d) http://www.mzcr.cz/Verejne/dokumenty/akcni-plan-y-pro-implementaci-narodni-strategie-zdravi-2020_10814_3016_5.html
(only in Czech language)

Ad e) <http://www.mzp.cz/>

Ad f) <http://www.mzp.cz/>

- Research on food safety, functional foods
- Cooperate on common agricultural policy and trading rules
- Improving consumer awareness of healthy eating and nutrition in line with a healthy lifestyle

Gaps:

- Climate change - worsening production conditions
- Avoiding losses in the food chain and minimising food waste
- Increase productivity of food industry
- Better cooperation between agriculture and food industry, suppliers and trade companies
- Better cooperation between food industry and research
- Better European and global collaboration in research of new food

The **Food Safety and Nutrition Strategy 2014 -2020** (FSNS), also under the responsibility of the Ministry of Agriculture, outlines the main objectives of the Czech Republic in the field of food safety and nutrition. In relation to food safety, the key aims concern the **production and marketing** of safe food, the provision of **verified information** on quality and safety, and **protection of consumers**. Regarding nutrition, the main objectives relate to the **promotion of a healthy diet** through evidence-based health education and **information dissemination** among consumers, producers and distributors. It was preceded by the Food Safety and Nutrition Strategy 2010 -2013, which was heavily focused on risk assessments and on collaboration with the European Food Safety Authority.

Other strategies and policies that are not specifically targeted at the agri-food system, but that are indirectly relevant and have an R&I focus are the [Health 2020 National Strategy for Health Protection and Promotion and Disease Prevention](#) (H2020) and related action plans for implementation, under the responsibility of the Ministry of Health,²⁷⁵

²⁷⁵ https://www.iccp-portal.org/system/files/plans/CZE_B3_Health%202020%20%E2%80%93%20National%20Strategy%20for%20Health%20Protection%20and%20Promotion%20and%20Disease%20Prevention.pdf

and the **Adaptation Strategy to climate change in the Czech Republic and the National Action Plan for Climate Change**, under the responsibility of the Ministry of Environment.

4 Public funding available for food R&I

According to data made available by the Research, Development and Innovation Council information system²⁷⁶, a total of **153 R&I food-related projects** were funded by Czech national authorities between 2007 and 2020²⁷⁷, receiving a total of **EUR 56.2 million** in funding. The database was searched using the relevant keywords²⁷⁸ and filtering by the related discipline. The projects have also been filtered by funding scheme and type of competition, excluding from our analysis projects that were part of co-financing schemes or using EU Structural Funds.²⁷⁹ A review of the projects approved during this period shows that 2007 was the year with less projects starting in this field and with the least funding granted (0.44 million EUR), while 2019 was the year registering most projects approved and the largest funding amount spent in food-related research and innovation (9.26 million EUR).

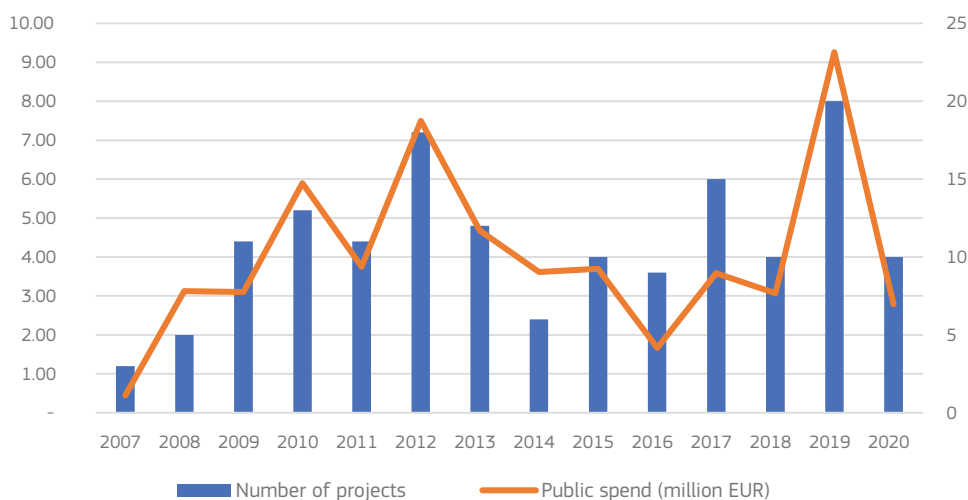
²⁷⁶ <https://www.isvavai.cz/cep?s=rozsirene-vyhledavani>

²⁷⁷ Note: year the call was launched.

²⁷⁸ Keywords used: *food; agriculture; fisheries; agri-tech; agri tech; precision farming; soil; food production; food processing; packaging; nutrition; food waste; foodwaste; water; food safety; food systems; supply chains; sustainability; eco-innovation; environmental impact;*

²⁷⁹ List of funding programmes excluded from our analysis: We have assumed that other funding programmes did not make use of EU funds

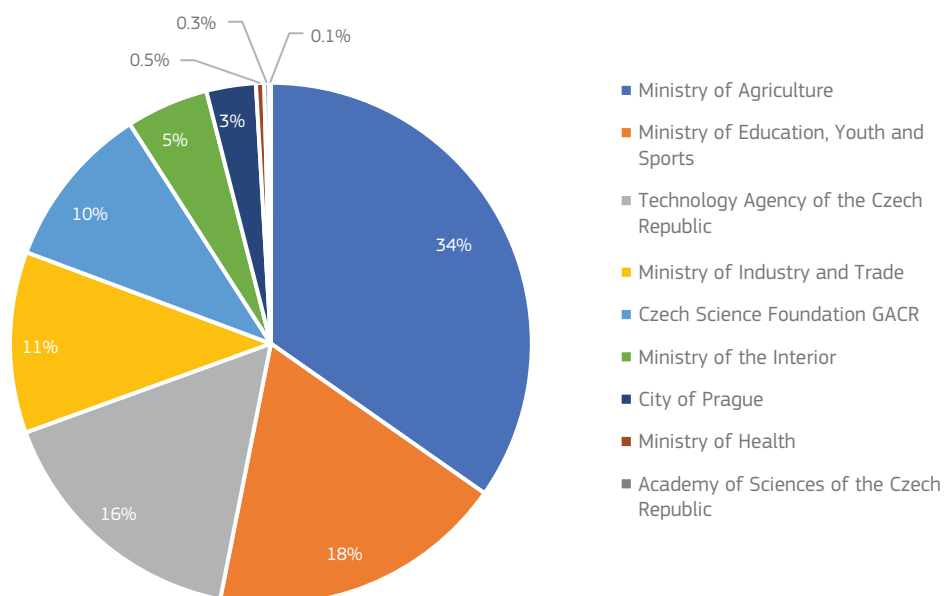
Figure 2: Number of food-related R&I projects and funding amounts between 2007 and 2020 (million EUR)



Source: R&D&I Information system of the Czech Republic

Looking at funding organisations, national public spend was distributed across the different organisations (Figure 3). A **third of the funding (34%)** has been granted **by the Ministry of Agriculture**, followed by the **Ministry of Education, Youth and Sports**, that provided 18% of the funding and the Technology Agency of the Czech Republic that provided 16% of the funding. A very small proportion of the funding was also provided by the City of Prague (3%), the Liberec Region (less than 1%) and the Academy of Sciences (also less than 1%).

Figure 3: Public funding for food systems related R&I projects, by funding source, 2008-2021



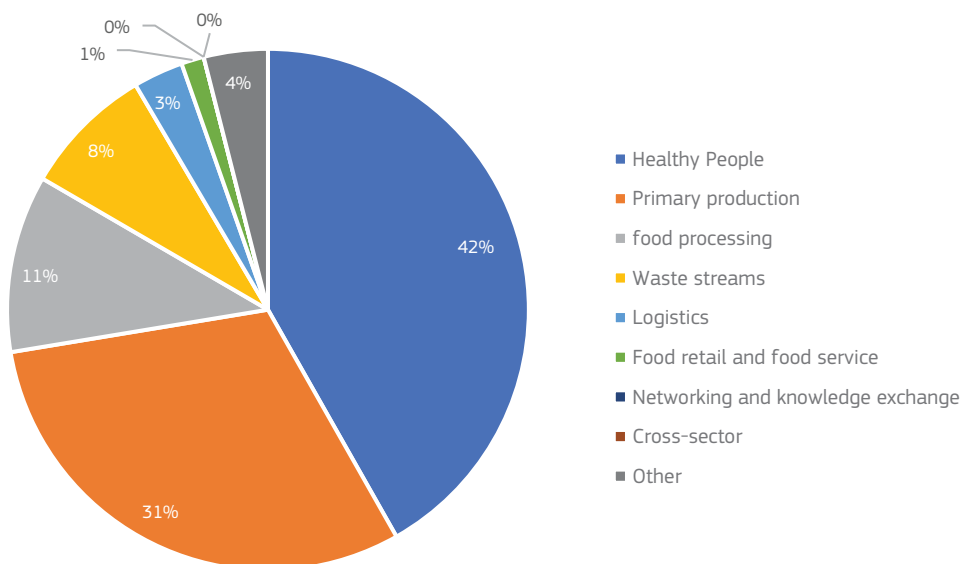
Source: R&D&I Information system of the Czech Republic

In terms of type of research, the majority of funded projects concerned **applied research** (60%), followed by **basic research** (30%), with a small proportion concerning **innovation and experimental development**.

Funding by sector

When analysing the sectors receiving funding for food-related R&I projects, almost half of public funding appears to be directed towards **projects related to health** (42%), as observed in figure 4. **Primary production** was also a key sector, with 31% of granted funding. **Food processing and waste streams** accounted respectively for 11% and 8% of the total funding, while only four projects (worth 1.7 million EUR) concerned **logistics** and two projects (worth 0.79 million EUR) were in the **food retail and food service sector**. A relatively small proportion (4%) of the funding was not directed towards a specific sector but concerned the whole food supply chain.

Figure 4: National public funding by sector



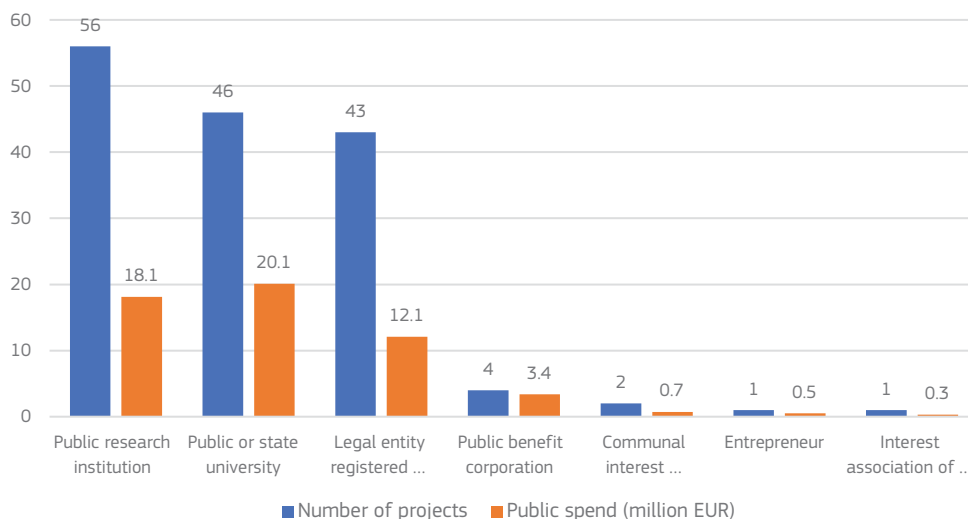
Source: R&D&I Information system of the Czech Republic

5 Main recipients of public food R&I investment

The primary recipients of public food R&I investments are **public universities and research institutions** (68% of the funding). The single largest recipient of public funds is the **Czech Academy of Sciences**, accounting for about a third of the total public funding. The Academy then distributes institutional funds among research institutes, as well as practicing target-oriented financing on the basis of public competitions evaluated involving international peer reviews. National funding for higher education institutions is distributed by the MEYS. Government R&I funding to **commercial entities** (accounting for 23% of the funding) is provided, for example, to programmes of the Czech Technology Agency, to stimulate public-private cooperation and commercialisation of research results.²⁸⁰ As shown in Figure 5, a small proportion of the food-related R&I funding is directed at **public benefit corporations** (6%), and the remaining spend to **community interest companies, entrepreneurs and civic associations** (1% respectively).

²⁸⁰ RIO report

Figure 5: Funding by beneficiary



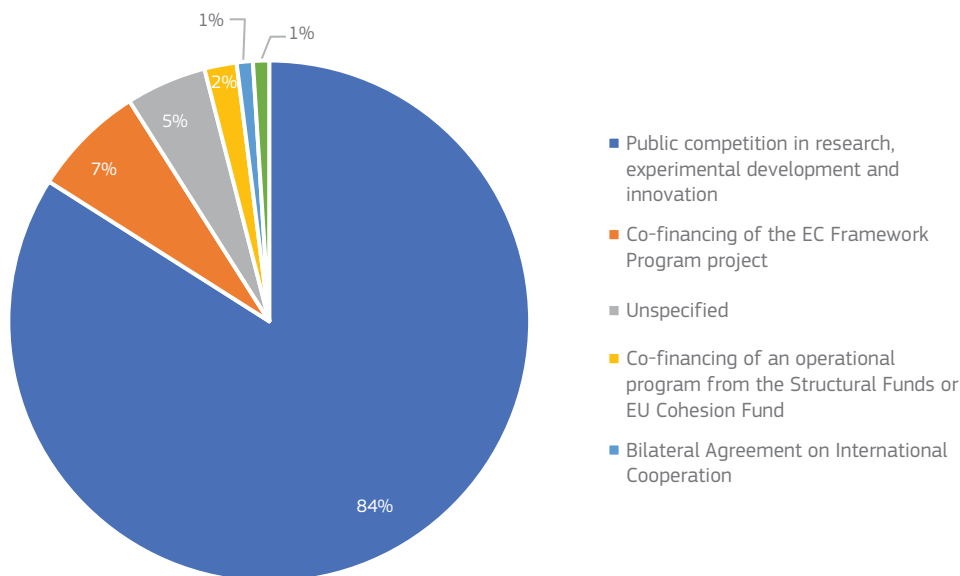
Source: R&D&I Information system of the Czech Republic

6 Structural Funds available for Food R&I

EU Structural Funds contribute to R&I funding in Czechia. In the period 2007-2013, ESIF dedicated to R&I in the Czech Republic amounted to 4.5 billion EUR. In the period 2014-2020, almost 3 billion EUR of ESIF were made available for R&I in the country.²⁸¹ In relation to food-related R&I, only a relatively small proportion of the projects in the Research and Innovation council database (8%) comes from co-financing of the EC Framework Programmes, from the Structural Funds or EU Cohesion Fund. Figure 6 illustrates the split of food related projects by type of competition, based on the data extracted from the database.

²⁸¹ http://www.vyzkum.cz/storage/att/B065C84983FDB6E21CD85CD132E55382/MDoussineau_S2E_03_03_16.pdf

Figure 6: Food-related R&I projects by type of competition

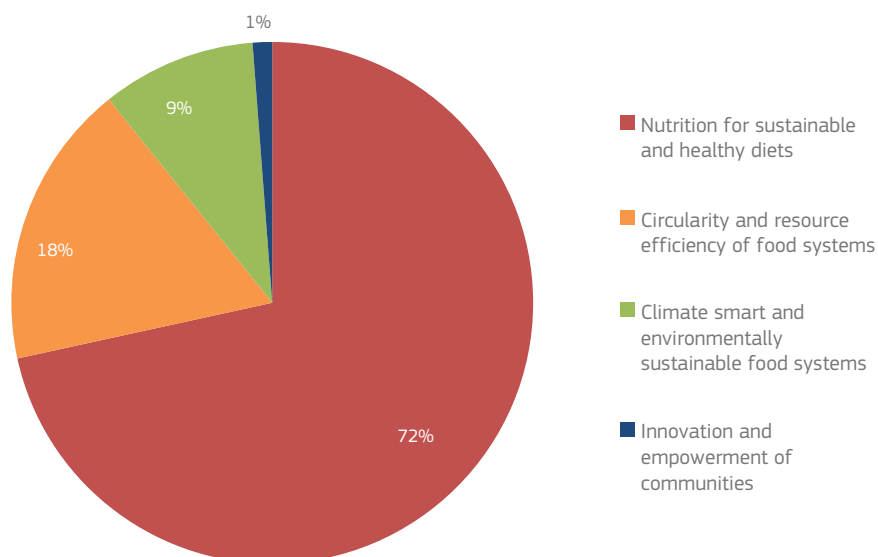


Source: R&D&I Information system of the Czech Republic

7 Links to FOOD2030 priorities and pathways

National funding for R&I in the field of food system mainly targeted projects that sought to address challenges linked to **Nutrition for sustainable and healthy diets** (72% of all the funding, or EUR 40 million). This encompasses mostly projects related to food safety and authenticity, as well as the production of food with higher nutritional value. Almost a fifth (18%) of the food-related public funding was targeted to projects addressing **Circularity and resource efficiency** of food systems. The remaining funding aimed to support technologies and innovations related to **Climate smart and environmentally sustainable food systems** (9%), with only a minimal proportion of the funding (1%, four projects) directed at **Innovation and empowerment of communities**.

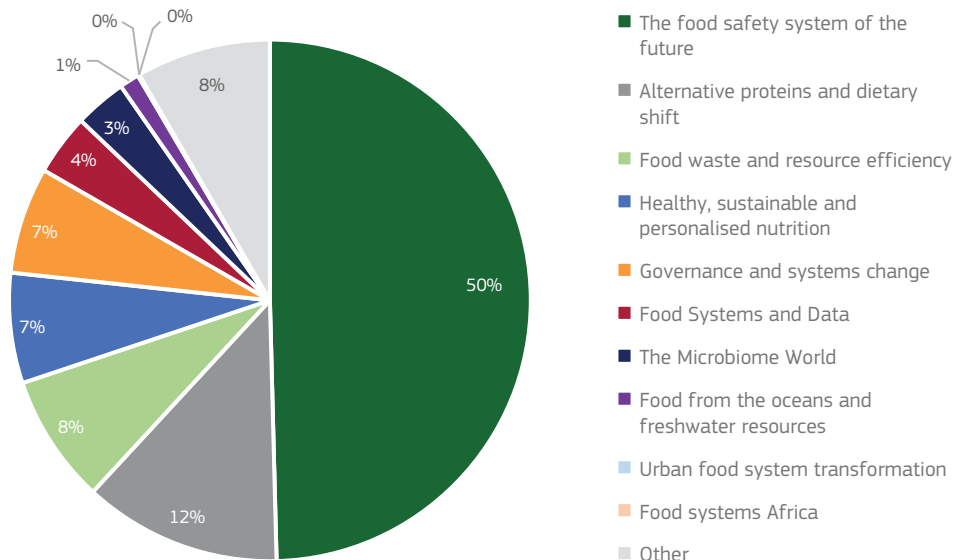
Figure 7: Public spend on food-related R&I projects by Food2030 priority



Source: R&D&I Information system of the Czech Republic

In terms of the alignment with the pathways of the Food 2030 initiative, Czechia's R&I funding on food systems between 2008 and 2020 mainly corresponded to the pathway **Food safety system of the future** (50%, corresponding to EUR 27.8 million). Projects related to the pathways **Alternative proteins and dietary shift** and Food waste and resource efficiency accounted for 12% (corresponding to EUR 6.9 million) and 8% (corresponding to EUR 4.5 million) of the funding respectively. Only a limited number of projects are related to food from the oceans and freshwater resources (three projects, 1% of the funding), to urban food transformation or African food system (one project each, less than 1% of the funding).

Figure 8: Public spend on food-related R&I projects by Food2030 pathway



Source: R&D&I Information system of the Czech Republic

8 Data gaps and limitations

The results of the analysis are based on publicly available information and data from the Research and Innovation Council database. Information not available on the database includes technology readiness level (TLR), publications and patents. The exclusion of the EU Structural Funds from the analysis has been done on the basis of filtering by type of competition and programme name, but the programmes included in the analysis may nonetheless contain a proportion of the ESIF.

Summary of data sources: Czechia

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Industry and Trade (MIT)	https://www.mpo.cz/en/
	Ministry of Education, Youth and Sports (MEYS)	https://www.msmt.cz/?lang=2
	Ministry of Agriculture (eAGRI)	http://eagri.cz/public/web/en/mze/
Food innovation related policies	Strategy of the Ministry of Agriculture of the Czech Republic with outlook to the year 2030	http://eagri.cz/public/web/mze/ministerstvo-zemedelstvi/koncepcie-a-strategie/strategie-resortu-ministerstva-1.html
	Food Safety and Nutrition Strategy 2014 -2020 (FSNS)	http://eagri.cz/public/web/file/324778/323923_514597_StrategieBP_en.pdf
	Health 2020 National Strategy for Health Protection and Promotion and Disease Prevention (H2020) and Action Plans for implementation, under the responsibility of the Ministry of Health	http://www.zdravi-2020.cz/dokumenty/health-2020-national-strategy.pdf http://www.mzcr.cz/Verejne/dokumenty/akcni-plany-pro-implementaci-narodni-strategie-zdravi-2020_10814_3016_5.html
	The Adaptation Strategy to climate change in the Czech Republic and the National Action Plan for Climate Change	http://www.mzp.cz/
National R&I Strategies	National R&I Strategy 2009-2015 with an Outlook to 2020	http://www.czech-research.com/wp-content/uploads/2016/09/NRDIP_2016-2020_eng.pdf
Specific food innovation related R&I competitions/ funding		http://www.czech-research.com/rd-funding/national-funds/
		https://gacr.cz/en/
		https://www.avcr.cz/en/

From desk research	Research, Development and Innovation Council	https://www.vyzkum.cz/Default.aspx?lang=en
	Research, Development and Innovation Council Information System (public funding database)	https://www.isvavai.cz/cep?s=rozsirene-vyhledavani
	Technological profile CR – Innovation Activities Database	https://www.techprofil.cz/find.asp?action=LineList&SearchForm=MapDefQueries

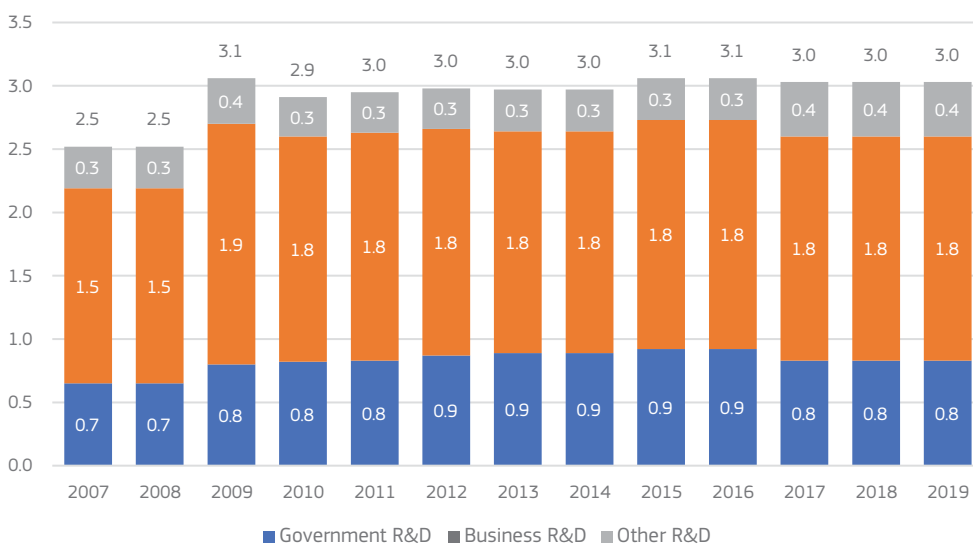
DENMARK

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Denmark from 2007 to 2019.²⁸² Following an initial increase between 2008 and 2009 in both government and business R&I expenditure, overall investment in R&D has remained relatively steady in this period – at approximately 3.0% of GDP.

Denmark has a food R&I strategy, as part of the Green Solutions of the Future launched in 2020.

Figure 1: R&I expenditure in Denmark, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

²⁸² 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Danish R&I expenditure is relatively high compared to other EU Member States, with public R&D sitting at just under 1% of GDP. Denmark is an innovation leader in the EU, though there is a potential to improve the innovativeness and performance of companies and SMEs in particular.

Main Providers of Food R&I funding at national level

The **Ministry of Higher Education and Science** is the key organisation responsible for strategic oversight of R&I in the country.

Denmark actively promotes R&I and the country has a strong centrally organised coordination, which lies under the responsibility of the Ministry of Higher Education and Science, and is supported by its two agencies: the **Agency for Science and Higher Education**, and the **Agency for Institutions and Educational Grants**. Tasks related to innovation are also under the responsibility of the **Ministry of Industry, Business and Financial Affairs**. Several other ministries also have large R&I programmes, namely the **Ministry of Environment and Food**; the **Ministry of Energy, Utilities and Climate**; and the **Ministry of Foreign Affairs**.

Other relevant actors

The available R&I funds include those from the **National Research Foundation**, the **Independent Council for Research**, the **Innovation Fund Denmark** and private funds. R&I performers (i.e. those who receive R&I funding) include universities (main performers), public research units, government research institutes and private companies. Firms are highly R&I performative and the private sector is responsible for two thirds of all the R&I developed in the country. **Novo Nordisk** in particular is highly involved in R&I. In food-related R&I, the spotlight is on **Arla Foods**. The private sector is increasingly gaining ground in R&I. According to data from Eurostat, in 2019, public sector spending in R&I represented 0.8% of the country's GDP, whereas that of companies represented 2%.²⁸⁵

²⁸⁵ <https://www.dst.dk/en/Statistik/emner/uddannelse-og-viden/forskning-udvikling-og-innovation/forskning-og-udvikling>

2 National R&I Strategy

The R&I strategy “**Denmark – Ready for the Future**” (“*Danmark – Klar til Fremtiden*”)²⁸⁴, launched in 2017, has two priorities:

- Increase the quality of R&I;
- Increase the societal impact of R&I.

The first priority proposes that Danish research must be of the highest international quality; it must be at Nobel Prize level; its quality must be seen across the scientific spectrum; talented researchers must have attractive career opportunities; Denmark’s research infrastructures must be of the highest level; and Danish international research cooperation must be strengthened. The second priority focuses on the need to use R&I for the good of society: R&I must strengthen the development and use of technological solutions; it must reach and create value to companies; the public sector has to be developed based on evidence-based knowledge; the merit of researchers must resonate simultaneously in research, in the educational field and in the general dissemination of knowledge; research must be publicly-available; R&I in the country must strengthen coherence and cross-sectoral interaction. The strategy is not structured by research field. Its priorities are common to any scientific area.

The strategy is supported by the **FORSK2025** catalogue²⁸⁵, which provides an overview of the most relevant research areas in the near future, based on more than 400 consultations with ministries, R&I organisations, companies and universities. The catalogue is used to define research priorities and the distribution of funds. The four main areas identified by FORSK2025 are:

1. New technological opportunities: new solutions with potential applications across several sectors;
2. Green growth: competitive solutions to global challenges in areas such as environment, climate, energy, construction, transport and food (in the latter, namely focusing on food safety, animal health and animal welfare; aquatic production; emerging food trends; microbiology and production technology, among others);
3. Improved healthcare: new possibilities for disease prevention and treatment;

²⁸⁴ <https://ufm.dk/publikationer/2017/danmark-klar-til-fremtiden>

²⁸⁵ <https://ufm.dk/forskning-og-innovation/forsk2025>

4. Individuals and society: capacity building to effectively offer a better environment and better well-being, with particular focus on socially vulnerable groups.

Denmark's **Smart Specialisation priorities**, envisaged for the period 2014-2020, are the following:

- Manufacturing & industry;
- Energy production & distribution;
- Sustainable innovation;
- Human health & social work activities;
- Agriculture, forestry & fishing.

These priority areas are identified in a collection of strategies, as the country does not have one single combined Smart Specialisation strategy. For the aforementioned period, the **INNO+ initiative** supports smart specialisation investments in: food production and bio economy; transport, environment and urban development; health solutions; innovative production and innovative digital solutions.

Before 2014, the country did not have a R&I national policy. The first one ("*Forsknings- og innovationspolitisk redegørelse*"²⁸⁶) was launched in that year and provided an overview of the Danish R&I policy guidelines, highlighting the following topics: all talent must be at stake; more knowledge must be translated into value; world-class research infrastructure; a global effort; integrity and openness in research.

3 Overview of national food policy

In late 2020, the government launched the **Green Solutions of the Future – Strategy for investment in green research, technology and innovation**, which includes as one of its four priorities the following: climate and environment-friendly agriculture and food production²⁸⁷. The strategy sets the intention to substantially lift the level of green research funds, particularly in areas in which impacts are the largest, namely in agriculture,

²⁸⁶ <https://ufm.dk/publikationer/2014/forsknings-og-innovationspolitisk-redegorelse>

²⁸⁷ <https://ufm.dk/en/publications/2020/filer/green-solutions-of-the-future>

alongside industry, the energy sector and transportation, all of which are involved in food system' operations. The four green missions prioritised in 2021 are:

- Carbon capture and storage or utilisation;
- Green fuels for transportation and industry;
- Climate and environment-friendly agriculture and food production;
- Recycling and reduction of plastic waste.

The Danish Agriculture & Food Council, representing the farming and food industry of Denmark, is operating a strategy to make **Denmark's food system carbon neutral by 2050**. In close collaboration with other Danish research and in line with the United Nations' global objectives, this plan aims to build an economically sustainable path to climate-neutral food systems.²⁸⁸ The plan to have net zero emissions encompasses all the food system's sub-sectors, from primary production to logistics and waste streams, relying on solutions provided by massive investments in R&I.

Associated to its organic production growth, Denmark has been developing its sustainable gastronomy credentials, also supported by the fact that the country had the world's first legislation on organic farming in 1987. **Gastro 2025**²⁸⁹, a plan to develop culinary diplomacy, was launched in 2019. The initiative sets the ambition to make Denmark a global centre for sustainable gastronomy inspired by the intention to provide better food for more people. The Ministry of Environment and Food has successfully been hosting **the World Food Summit – Better Food for More People**, attracting international attention and bridges for international cooperation in food-related fields. In September 2017, the "**World-class Food Innovation Towards 2030**"²⁹⁰ was launched. It set a strategy for the Danish food industry with the purpose of turning six challenges into opportunities, involving multiple stakeholders in mutual, innovative and complementary food research. The following are the challenges identified:

1. Supply of high-quality raw materials in a circular economy;
2. Products for the global consumer;

²⁸⁸ <https://agricultureandfood.dk/climate-neutral-2050/climate-neutral-2050>

²⁸⁹ https://fvm.dk/fileadmin/user_upload/MFVM/Foedevare/Handout_Regeringens_Gastro_2025_EN_.pdf

²⁹⁰ <https://lf.dk/-/media/lf/aktuelt/publikationer/lf/2017/foedevarestrategi-pixi-2017-web.pdf>

3. Food safety 2.0;
4. Foods for a healthier life;
5. Efficient and agile production;
6. Faster and safer to market through utilisation of big data.

Denmark has also shown intentions of enlarging and improving its organic food production. In 2015, the Ministry of Food, Agriculture and Fisheries presented the **Organic Action Plan for Denmark**²⁹¹, which identifies the following action points:

1. An increased export effort;
2. The promotion of domestic demand for organic food;
3. Cross-sector cooperation for more organic production;
4. The development of the organic business sector;
5. Increase the number of greener organic producers;
6. Make organic production more resilient and less costly.

A striking example of the ambitions set forth in the action plan, the city of Copenhagen has achieved 90% organic food in all its public kitchens without increasing their operating budgets²⁹². The Organic Action Plan not only proposes environmental, but as well economic and health benefits to the Danish population. Alongside the government, Organic Denmark, a non-profit partly public-funded, is largely responsible for the adoption of organic food policy in the country. It is a membership-based association representing the organic food industry, including farmers, companies and consumers.

The food and agricultural cluster **Food Nation**, whose patron is the Royal Highness Crown Prince Frederik of Denmark, is yet another entity contributing to strengthen the food systems in Denmark, from primary production to food technology, research and know-how.

²⁹¹ <https://bit.ly/3zMinto>

²⁹² <https://www.nationalfoodstrategy.org/wp-content/uploads/2020/07/What-we-can-learn.pdf>

Even though Denmark has been branded globally as a sustainable and organic food production country, its industry has lobbied for decreased environmental regulation domestically. The **2015 Food and Agricultural Package**, influenced by the food industry lobby, was criticised (including by the European Commission) for easing the regulatory burden to the detriment of the environment, as it proposed lifting restrictions on the use of nitrogen fertilizer, among other actions.

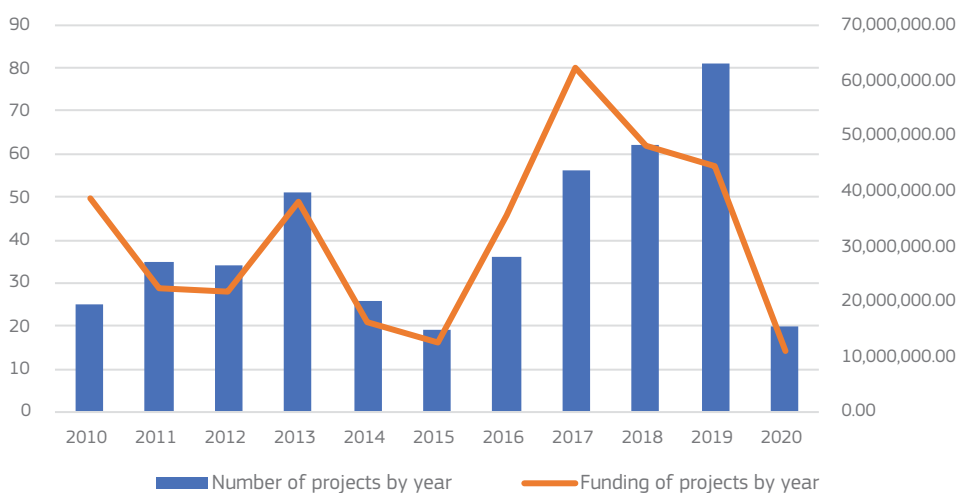
4 Public funding available for food R&I

As described above, Denmark has launched a number of strategies supporting investment and research in food systems. In fact, one of the country’s key challenges is the accommodation of the complex and complementary interactions in food systems research. There are three programmes funding food-related R&I in the country: the **Innovation Fund Denmark**, the **Green Development Programme** and the **Green Project Bank**.

With regards to the public funding available for food-related R&I, projects funded by the three aforementioned programmes, between 2010 and 2020, amount to EUR 350.8 million. Data was not available prior to the 2010-2020 period.

The year with the highest allocation of funds was 2017 (EUR 62.3 million). The lowest amounts are found in 2015 and 2020 (EUR 12.4 and 10.9 million respectively) (Figure 2).

Figure 2: R&I food related projects between 2010 and 2020.

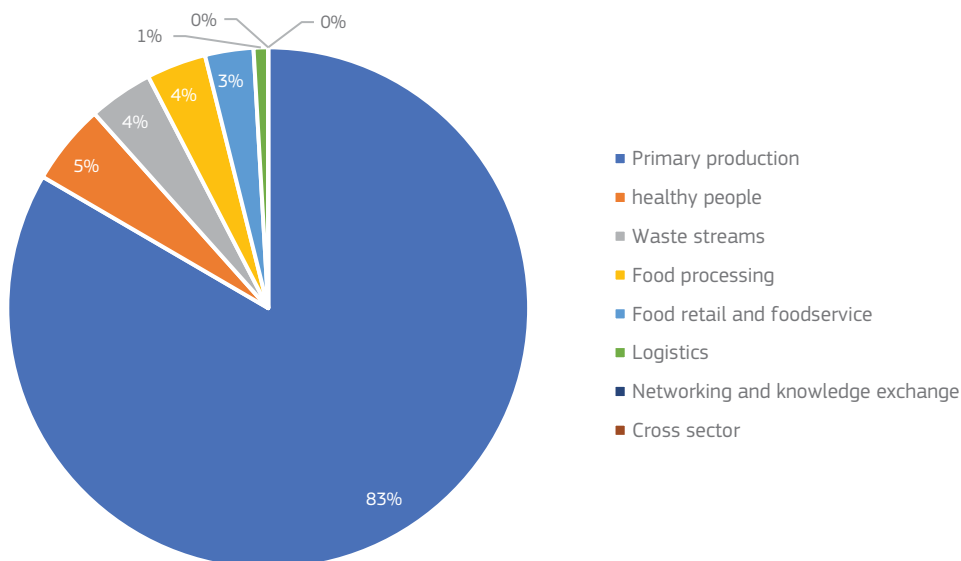


Source: Innovation Fund Denmark, Green Development Programme and Green Project Bank

Funding by sector

The sector in food-related R&I which received most public funding was primary production (83%; EUR 287.8 million). All the other sectors present minor variations, the majority ranging between 3 and 5%²⁹³.

Figure 3: Distribution of funding by sector.



Source: Innovation Fund Denmark, Green Development Programme and Green Project Bank

5 Main recipients of public food R&I investment

The databases used in this analysis often do not identify the coordinator of each project or the involved entities. It is thus not possible to identify the main recipients of funding in an accurate and consistent manner.

²⁹³ In 14 of the projects analysed it was not possible to find a correspondence between the themes of research and the sector. The total funding associated to these projects is 5.5 million euros.

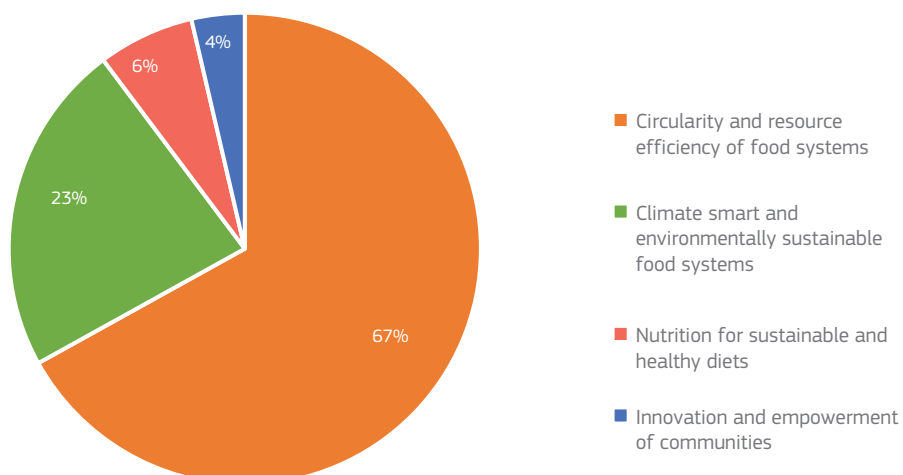
6 Structural Funds available for Food R&I

Denmark benefits from structural and investment funds of 1.5 billion, through four national operational programmes (Innovation and Sustainable Growth in Businesses, Educational and Entrepreneurial Growth, Natural Rural Development and Maritime and Fisheries). In the 2014-2020 period, 11 projects on food systems R&I were financed by the Innovation and Sustainable Growth in Businesses operational programme with an EU contribution of EUR 11.3 million.

7 Links to FOOD2030 priorities and pathways²⁹⁴

With regards to the FOOD2030 priorities, research in Denmark has prioritized circularity and resource efficiency of food systems (67%; EUR 206.7 million). This is followed by climate smart and environmentally sustainable food systems (23%, EUR 70.4 million). As can be seen in Figure 4, the two other priorities, nutrition for sustainable and healthy diets, and innovation and empowerment of communities, received 6% and 4% respectively.

Figure 4: Distribution of funding by FOOD2030 priority



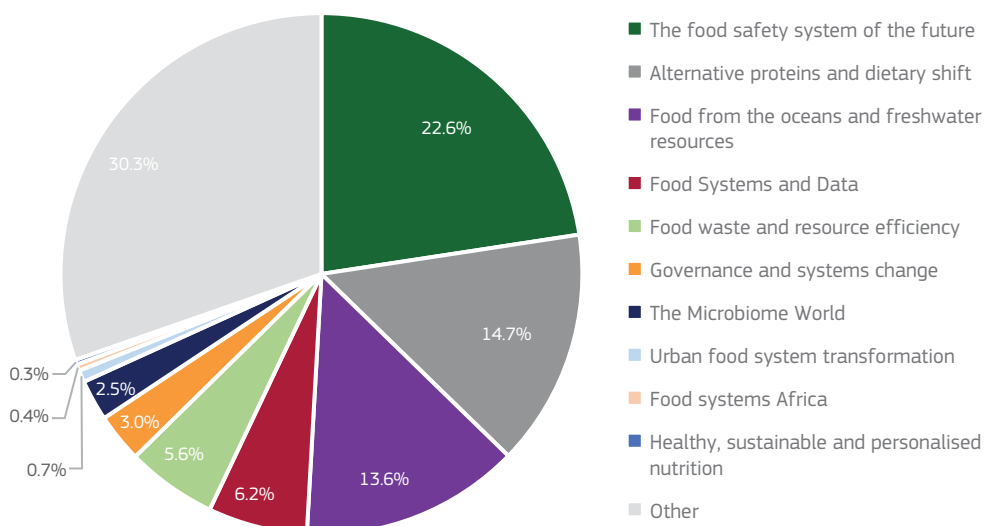
Source: Innovation Fund Denmark, Green Development Programme and Green Project Bank

²⁹⁴ In 64 of the projects analysed it was not possible to find a correspondence between the themes of research and the FOOD2030 priorities. The total funding associated to these projects is 42.1 million euros. In addition, in 39 of the projects analysed it was not possible to find a correspondence between the themes of research and the FOOD2030 pathways. The total funding associated to these projects is 44.6 million euros.

Denmark shows a well-distributed interest in all the FOOD2030 pathways. The prioritized four are: Food safety systems of the future (23%, EUR 79.2 million), Alternative proteins and dietary shift (15%, EUR 51.6 million) and Food from the ocean and freshwater resources (14%, EUR 47.7 million).

Figure 5 presents the share allocated to all the FOOD2030 pathways.

Figure 5: Distribution of funding by FOOD2030 pathway



Source: Innovation Fund Denmark, Green Development Programme and Green Project Bank

8 Data gaps and limitations

The publicly available databases from the funding programmes do not include some topics which could be interesting for this analysis. These are: the type of entity and identification of the coordinators of the actions (available only for some projects), technology readiness level (TRL), publications and patents.

Summary of data sources: Denmark

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Higher Education and Science	https://ufm.dk/en
	Ministry of Environment and Food	https://en.mim.dk/
Food innovation related policies	Green Solutions of the Future – Strategy for investment in green research, technology and innovation	https://ufm.dk/en/publications/2020/filer/green-solutions-of-the-future
	World-class Food Innovation Towards 2030	https://lf.dk/-/media/lf/aktuelt/publikationer/lf/2017/foedevarestrategi-pixi-2017-web.pdf
National R&I Strategies	Denmark – Ready for the Future	https://ufm.dk/publikationer/2017/danmark-klar-til-fremtiden
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	11 projects on food R&I were financed by the Innovation and Sustainable Growth in Businesses operational programme with an EU contribution of EUR 11.3 million	https://regionalt.erhvervsstyrelsen.dk/eu-structural-funds-2014-2020
Food innovation funding		
	Name and description	Link
Specific food innovation related R&I competitions/ funding	Innovation Fund Denmark	https://innovationsfonden.dk/
	Green Development Fund	https://gudp.lbst.dk/
	Green Project Bank	https://groenprojektbank.dk/
Available data (reports, datasets)		
Source	Name and description	Link
From desk research	Innovation Fund Denmark	https://innovationsfonden.dk/
	Green Development Fund	https://gudp.lbst.dk/
	Green Project Bank	https://groenprojektbank.dk/
From interviewees	Ministry of Environment and Food – Green Project Bank	https://groenprojektbank.dk/
	Ministry of Higher Education and Science	https://ufm.dk/

ESTONIA

2 Overview of national R&I landscape

This report provides a brief overview of the public funding available for food systems R&I in Estonia, including a breakdown of the national public funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.

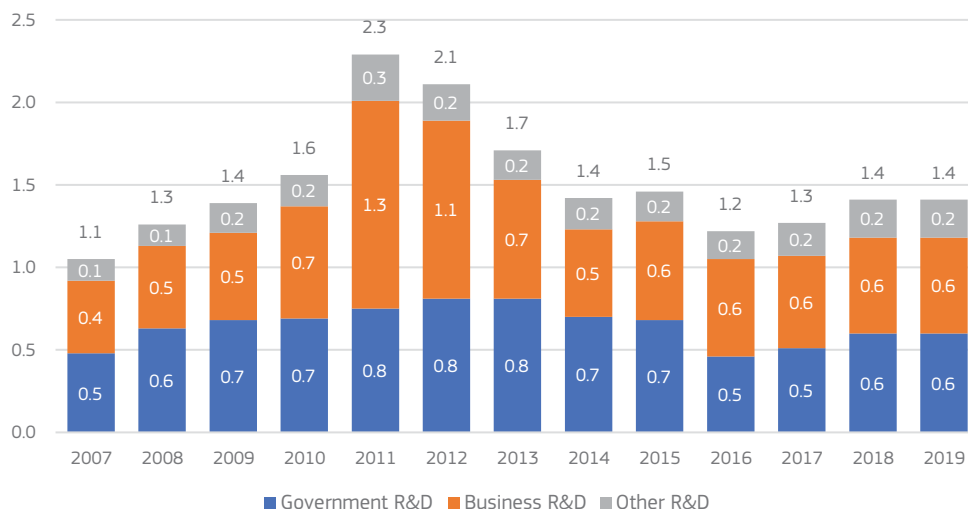
Figure 1 below shows national expenditure on R&I as a percentage of GDP in Estonia from 2007 to 2019.²⁹⁵ After a significant increase in overall expenditure as a proportion of GDP from 2007 to 2011 (largely driven by increases in business expenditure), levels of investment decreased both in terms of government and business expenditure from 2012 onwards. 2019 levels remain higher than in 2009 across all categories. Estonia was able to maintain its overall investment in R&I following the financial crisis by replacing national R&I investment with funding from the EU Structural Funds. The Structural Funds now represent approximately of the national R&I budget.²⁹⁶

In Estonia, Food and R&I is embedded in the R&I strategy and food policies but there isn't a separate specific strategy.

²⁹⁵ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

²⁹⁶ https://www.hm.ee/sites/default/files/pr_estonia_-_final_report_.pdf

Figure 1: R&I Expenditure in Estonia, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main Providers of Food R&I funding at national level

Responsibility for developing and implementing research and innovation policy in Estonia is divided between the Ministry of Education and Research (MER) and the Ministry of Economic Affairs and Communications (MEAC). Additionally a national R&D Council, chaired by the Prime Minister, is responsible for coordinating R&I policy nationally. In 2011, the Estonian government committed to increasing its overall R&I expenditure to 1%. Although this target has not yet been met, each Ministry has a responsibility for including, implementing and funding R&I in their respective policy fields. This means that for food systems R&I, the Ministry of Rural Affairs in particular plays a significant role.

MER has five agencies relevant to R&I.

- The **Estonian Research Council**, which provides competitive funding and institutional grants.
- The **Innovate Foundation**, which is responsible for coordinating and promoting general and vocational education

- The **Archimedes Foundation**, which is responsible for administering EU Structural Funding and overseeing the Erasmus+ programme (as well as coordinating other national and international training, education and research programmes)

Enterprise Estonia is responsible for foreign direct investment (FDI), company start-ups and innovation on behalf of MEAC as well as supporting some interdisciplinary R&D partnerships between academia and the private sector.

In 2019, the Estonian R&I system was subject to an independent peer review by the Horizon 2020 Policy Support Faculty.²⁹⁷ The review identified a gap in the absorptive capacity for innovation in the private sector, as well as a corresponding gap in government support for capacity building within the private sector. As a result of this review, five recommendations were put forward for the future:

- Ensure political commitment to the importance of R&I in national policy and the 1% target for government spend on R&D
- Establish and implement thematic priorities for R&I policy, in the light of the societal challenges and Estonia's smart specialisation strategy
- Establish an innovation agency to support R&D and build absorptive capacity • Strengthen the system of 'intermediary organisations' able to support industrial innovation
- Modernise and 'profile' research at the universities, making them better adapted to innovation and the production of human capital to meet national needs
- The second point on implementation of thematic priorities is of particular importance to ensure increased investment in food systems R&I at national level going forward.

3 National R&I Strategy

Knowledge based Estonia was the national research, development and innovation strategy for 2007 to 2013. While this focused primarily on improving the national R&I environment and did not have a thematic focus, *per se*, it did touch upon agriculture (but

²⁹⁷ https://www.hm.ee/sites/default/files/pr_estonia_-_final_report_.pdf

not food systems) in its aim of ensuring that R&I be used to find solutions to specific socio-economic challenges at sectoral level.²⁹⁸

Between 2014 and 2020 there were two main R&I strategies:

- the **Estonian Entrepreneurship Growth Strategy**, which focused on increasing productivity and channelling investment to specific target areas (the most relevant of which, from a food systems perspective is health technologies and services); and
- the **Estonian Research and Development and Innovation Strategy**, which included the goal of using applied research and development to ensure food security.

Since 2021, these strategies have been superseded by Estonia 2035, a single overarching strategy, which considers how R&I can be used to address societal challenges. Estonia 2035 is focused around five goals: people, society, economy, living environment, and governance. Although none of these is specifically targeted towards food, it is touched upon under people (which considers health and nutrition) and economy (which includes issues such as biodiversity and conservation).

4 Overview of national food policy

National food policy in the 2007–2020 period was governed by the **Estonian Rural Development Programmes** for 2007–2013 and 2014–2020. These were financed primarily through the European Agricultural Fund for Rural Development (the EAFRD), with some co-funding from the Estonian government. For the 2007–2013 period, four main areas of intervention were identified, namely:

- Competitiveness of agriculture, private forestry and food industry;
- Maintenance of agricultural environment and landscape;
- Off-farm entrepreneurship in rural areas and village life;
- Local initiative (LEADER).
- The 2014–2020 Rural Development Plan had the overall objective of increasing the competitiveness of agriculture, including sustainable management of natural

²⁹⁸ <https://cs.ioc.ee/excs/policy/teadm-pohine-eesti2-en.pdf>

resources and improved climate mitigation and adaptation. This included six priorities:

- **Priority 1:** Improving knowledge transfer and innovation in the agricultural and forestry sector and rural areas
- **Priority 2:** Improving the viability of agricultural holdings and the competitiveness of all agricultural forms in all areas and promoting innovative agricultural technologies and sustainable forest management
- **Priority 3:** Promoting the organisation of food chain in agriculture, including the processing and marketing of agricultural products, animal welfare, and risk management
- **Priority 4:** Restoring, preserving and improving agricultural and forestry ecosystems
- **Priority 5:** Promoting resource efficiency and supporting the transition to low-CO2 emission and climate resilient economy in agriculture and food and forestry sectors
- **Priority 6:** Promoting social inclusion, poverty reduction and the rural economic development

While all these priorities are relevant for food systems R&I, priority, two, three and five are of particular interest: Priority two focuses on ensuring a viable, resource-efficient and sustainable food system; Priority three, meanwhile, is intended to support the creation and route to market of agricultural products (including both primary production and food processing); finally, priority five focuses on the importance of ensuring the food industry is adapted to the realities of climate change, including reducing greenhouse gas and ammonia emissions, investing in energy efficiency and the conservation/capture of carbon dioxide within the agriculture and forestry sector.

5 Public funding available for food R&I

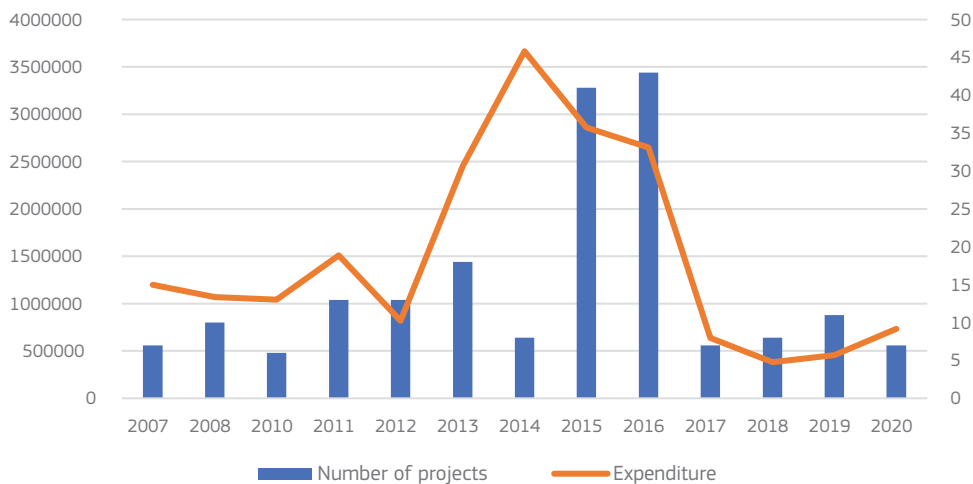
Public funding for food R&I in Estonia is provided primarily by the Ministry of Agriculture. In addition, some funding is provided for food systems R&I by Enterprise Estonia and the Estonian Research Council. Representatives from Enterprise Estonia confirmed via email that there is no specific information available on food R&I funded by the Agency, but one interviewee from a different national institution did confirm that some of their broader

funding programmes may include food systems R&I. Finally, the Estonian Research Council confirmed that, in addition to funding from the Structural Funds, some national funding is available for food systems R&I projects, however it was not possible to access information on the amount of funding provided or granular project level data. The Ministry of Agriculture funds three programmes from the state budget with relevance for food systems R&I. These are:

- The **National Programme for Plant Breeding** (with two iterations within the reference period: “National Programme for Plant Breeding from 2009–2019”, for which a total of EUR 1,130,738 was provided, and “Plant Breeding Programme 2020–2030”).
- Programmes funded through the **National Development Plan**, focused primarily on plant genetic resources. During the reference period this included the “Collection and Conservation of Plant Genetic Resources for Food and Agriculture in 2007–2013” programme and the “Collection and Conservation of Plant Genetic Resources for Food and Agriculture in 2014–2020” programme. The most recent iteration of this programme “Collection, Conservation and Utilisation on Plant Genetic Resources for Food and Agriculture in 2021–2027” was launched earlier this year. A total of EUR 401,600 was allocated to these projects.
- The **Agricultural Applied Research and Development Programme** with three iterations during the reference period: “Agricultural Applied Research and Development 2004–2008”, “Agricultural Applied Research and Development 2009–2014”, and “Agricultural Applied Research and Development 2015–2021”.

Project level data on the third programme was provided by the Ministry of Rural Affairs and has been analysed, in combination with data already collected by the SCAR Food Systems Working Group, to feed the more detailed analysis below. This includes 192 projects worth a total of almost EUR 19.5 million (see figure 2 below). This covers projects funded by the Ministry of Agriculture, Ministry of Rural Affairs, Ministry of Environment Environmental Investment Centre, the Estonian Research Council and the Estonian University of Life Sciences.

Figure 2: R&I food related projects between 2007 and 2020

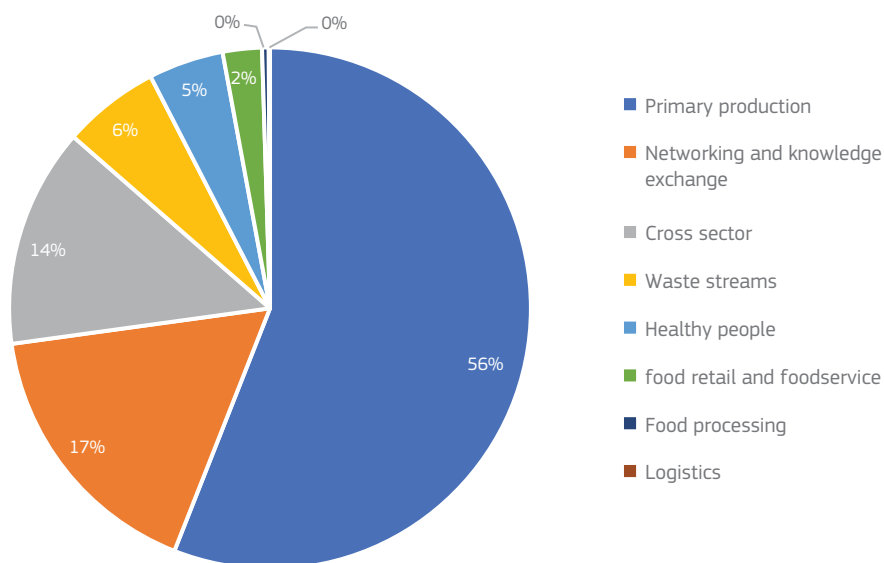


Source: Ipsos analysis of data provided by the Ministry of Rural Affairs and SCAR Food Systems Working Group
 Base: 192 projects

Funding by sector

Figure 3 shows the breakdown of funding provided through the Agricultural Applied Research and Development Programme by sector. While primary production accounts for the majority (EUR 10.9 million, or 56% of overall funding), networking and knowledge exchange and cross-sectoral projects combined also represent almost one third (EUR 5.9 million or 31%) of funding. This suggests that a significant proportion of funding is being provided to support interdisciplinary cooperation.

Figure 3: Breakdown of project funding by sector



Source: Ipsos analysis of data provided by the Ministry of Rural Affairs and SCAR Food Systems Working Group
Base: 192 projects

6 Main recipients of public food R&I investment

Information was not available on the recipients of public sector funding in the data provided as part of this research. However, a review of the project descriptions suggests that the majority of funding is being allocated to primary and applied research projects, with only a few projects dedicated to later stage innovation. The lack of granular data on projects funded by Enterprise Estonia may explain this gap. However, representatives from Enterprise Estonia confirmed by email that no funding was available for food systems R&I from the Agency, suggesting that although some food systems projects may be included in broader calls, this is not a significant source of food systems R&I funding.

7 Structural Funds available for Food R&I

During the reference period for this study, Estonia received an estimated total of EUR 6.9 billion in Structural Funds (EUR 3.4 billion in 2007-2013²⁹⁹ and EUR 3.5 billion³⁰⁰ between 2014 and 2020). As mentioned above, approximately 10% of this money was used to finance R&I nationally. In terms of food systems, the two most important sources of funding in this period were the European Regional Development Fund (ERDF) and the European Maritime and Fisheries Fund (EMFF).

Under Estonia's EMFF Operational Programme for 2014 to 2020, funding was provided for five priority objectives. These included developing an affordable, sustainable and profitable environment for fisheries, aquaculture and fish processing, improving the economic viability of coastal and inland fisheries, and promoting cooperation between research institutions, educational institutions and the fisheries sector.

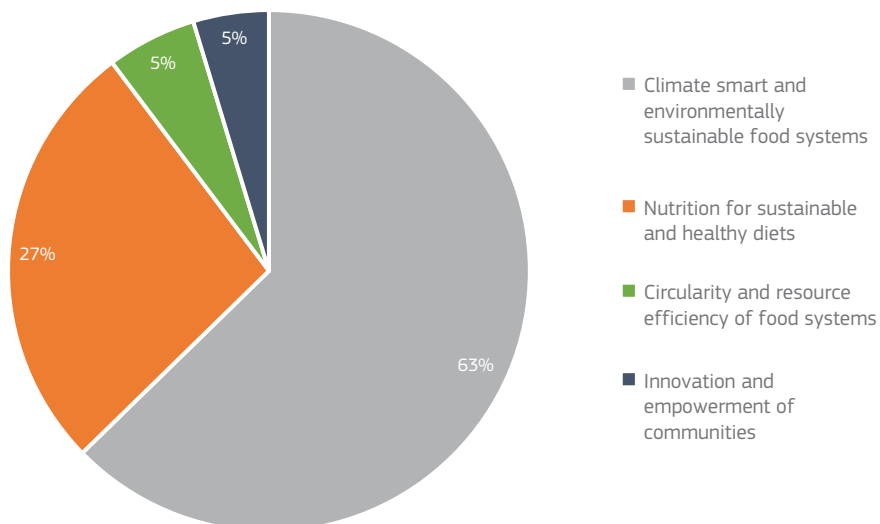
8 Links to FOOD2030 priorities and pathways

National funding for R&I in the field of food systems mainly targeted projects that sought to address challenges linked to the second FOOD2030 priority **Climate smart and environmentally sustainable food systems** – these accounted for 63% of the funding considered, or EUR 12.2 million. These reflect a strong focus at national level on improving the competitiveness of the agricultural sector, with projects focused on aspects such as organic farming, animal health and biosecurity, and the introduction of new technologies (e.g. for feeding livestock, milking and improving the efficiency of production processes). Projects targeted at addressing **Nutrition for Sustainable and Healthy Diets** constituted 27% (EUR 5.3 million) of food-related public funding. The remaining funding aimed to support technologies and innovations related to **Circularity and resource efficiency of food systems** (EUR 1.1 million, or 6% of all funding analysed) and **Innovation and empowerment of communities** (EUR 912,575, or 5% of all funding analysed).

²⁹⁹ https://ec.europa.eu/regional_policy/en/information/publications/factsheets/2009/european-cohesion-policy-2007-2013-in-estonia-priorities-and-impact-of-cohesion-policy-in-the-member-states

³⁰⁰ <https://www.mkm.ee/en/objectives-activities/foreign-financing/european-union-structural-funds>

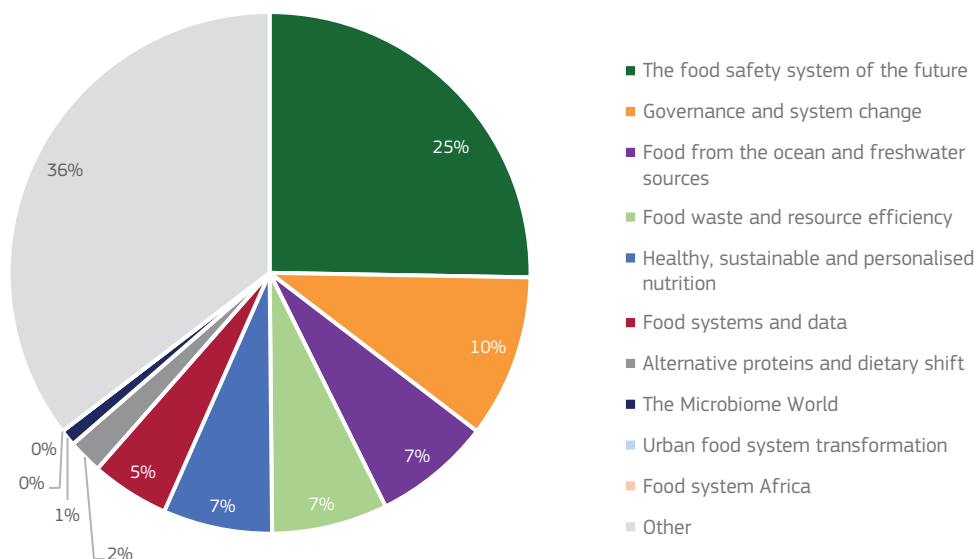
Figure 4: Public spend on food-related R&I projects by Food2030 priority



Source: Ipsos analysis of data provided by the Ministry of Rural Affairs and SCAR Food Systems Working Group
Base: 192 projects

Figure 5 provides information on the extent to which the projects analysed mapped against the Food 2030 pathways. A significant proportion (35%) of food R&I projects identified didn't align with any of the pathways. Of those that did, the most significant was "the food safety system of the future", which accounted for 25% (EUR 4.9 million). This was followed by governance and systems change (10% or EUR 2 million) and "food from the oceans and freshwater resources" (7% or EUR 1.4 million). No funding was allocated to projects aligned with "urban food system transformation" or "Food systems Africa".

Figure 5: Public spend on food-related R&I projects by Food2030 pathway



Source: Ipsos analysis of data provided by the Ministry of Rural Affairs and SCAR Food Systems Working Group
 Base: 192 projects

9 Data gaps and limitations

The results of the analysis are based on data provided by the Ministry of Rural Affairs and the previous mapping carried out by the SCAR Food Systems Working Group. As no public databases were available, it has not been possible to verify the completeness of the dataset provided. It was extracted, however, in cooperation with the research team and using the keywords provided. Additionally, it is expected that some funding (particularly that allocated through Enterprise Estonia and the Estonian Research Council) may be missing from the dataset, as it was not possible to identify this as funding for food-related R&I specifically.

Summary of data sources: Estonia

Country context		
Description		Link
Institutions responsible for funding R&I on food systems		https://cs.ioc.ee/excs/policy/teadm-pohine-eesti2-en.pdf https://www.hm.ee/sites/default/files/pr_estonia_-_final_report_.pdf
Food innovation related policies		<p>Link</p> https://op.europa.eu/en/publication-detail/-/publication/d34f8cdc-fad3-11e9-8c1f-01aa75ed71a1 https://www.mkm.ee/en/objectives-activities/foreign-financing/european-union-structural-funds https://haldus.taltech.ee/sites/default/files/2021-11/ME_TUTECON_WP_2015_2.pdf https://ec.europa.eu/regional_policy/en/information/publications/evaluations/2016/country-report-estonia-work-package-1-ex-post-evaluation-of-cohesion-policy-programmes-2007-2013-focusing-on-the-european-regional-development-fund-erdf-and-the-cohesion-fund-cf
	Name and description	Link
Specific food innovation related R&I competitions/ funding	Dataset provided by Ministry for Rural Affairs	<p>National Programme for Plant Breeding</p> <p>National Development Plan</p> <p>Agricultural Applied Research and Development Programme</p>

FINLAND

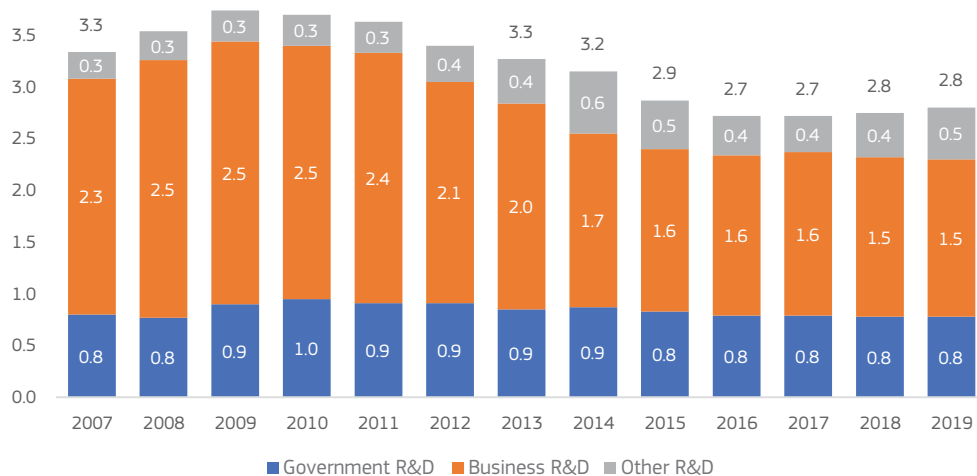
1 Overview of national R&I landscape

This report provides a brief overview of the public funding available for food systems R&I in Finland, the Finnish food policy and R&I strategy, and a breakdown of the national public funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.

R&I governance in Finland is centralised in terms of strategies and guidelines, which are led by the Finnish Government.³⁰¹ Figure 1 below outlines Finnish expenditure on research and development as a percentage of GDP since 2007, divided into government R&D, business R&D and other R&D (which consists of R&D from higher education, the private non-profit sector and the rest of the world). R&D expenditure as a percentage of GDP has declined from 2010 to 2016 and started to grow again from 2017.

Finland has a specific food R&I strategy mainly outlined in the Ministry of Agriculture and Forestry research strategy 2017-2022.

Figure 1: R&I expenditure as a percentage of GDP in Finland between 2007 and 2019 (million EUR)



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

³⁰¹ Rio report: <https://publications.jrc.ec.europa.eu/repository/handle/JRC111280>

Main Providers of Food R&I funding at national level

Public funding for R&I is mainly allocated through the **Ministry of Education and Culture** (MEC, 60%), the **Ministry of Economic Affairs and Employment** (MEAE, 27%), and their associated agencies: the **Academy of Finland** and **Business Finland** (previously Tekes).³⁰² The Ministries supervise and steer the activities of the agencies, with Business Finland focusing on research, development and innovation funding under the supervision of the Ministry of Economic Affairs and Employment, while the Academy of Finland (under the Ministry of Education and Culture) focuses on scientific research and expertise in science policy.³⁰³ Regional activities are mainly funded through EU structural funds. There is a high degree of autonomy at the regional level for the design and implementation of regional policies.³⁰⁴

The **Ministry of Agriculture and Forestry** also directly funds R&I and supervises the Agency for Rural affairs (Mavi), as well as the European Regional Development Fund (ERDF) and European Social Fund (ESF). The other two relevant bodies for public funding of R&I in Finland are **Sitra**, an independent fund established by the government in 1967, which reports to the parliament and promotes sustainable well-being, and **Raisio Research Fund**, an independent food focused research fund.³⁰⁵

Other relevant actors

Other relevant governmental actors in food-related policy are the **Ministry of Health and Social Welfare** (responsible for the nutrition policy) and the **Ministry of Environment** (responsible for the climate change adaptation plan and circular economy strategy). **The Research and Innovation Council** (RIC) is responsible for directing science and technology policy and preparing relevant plans and proposals.³⁰⁶

³⁰² Statistics Finland 2017c. Statistics Finland (2017c). Government R&D funding decreases further in the budget for 2017 http://tilastokeskus.fi/til/tkker/2017/tkker_2017_2017-02-23_tie_001_en.html.

The Government has decided to merge Tekes (the Finnish Funding Agency for Innovation) and Finpro (a provider of internationalisation advisory services). The process started by integrating Tekes and Finpro programmes in 2017, and the merged Business Finland began its operations at the beginning of 2018 (MEAE 2017a).

³⁰³ SCAR qual mapping

³⁰⁴ RIO report

³⁰⁵ SCAR qual mapping

³⁰⁶ Rio report

2 National R&I Strategy

In the **National Reform Programme** presented by the Finnish Government in 2017, the main objectives of the research and innovation policy are:³⁰⁷

1. Improving the quality and effectiveness of research activity;
2. Reforming public sector research structurally and operationally; and
3. Diversifying the structure of business and industry.

The **Research and Innovation Council's 2017 roadmap** of key actions, largely based on the National Reform Programme, outlines as its ultimate objective "making Finland the most attractive and competent environment for experiment and innovation by 2030". The four key objectives of the RIC vision are 1) ensuring the competence base, 2) the development of platforms for competence and growth, 3) internationalisation as a prerequisite for quality and impact, and 4) clear processes for strategic decision-making.³⁰⁸ The roadmap follows the **2011-2015 Research and Innovation Policy Guidelines** by the Research and Innovation Council, which outlined the main development principles for public research and innovation funding, including co-ordination and steering of policy actions to be strengthened at government level and the prioritisation and selection of subject matters to be undertaken.³⁰⁹

The R&I strategic objectives related to the food sector in the period under consideration are mainly outlined in the **Ministry of Agriculture and Forestry research strategy 2017-2022**³¹⁰, which targets the following themes:

- conditions for competitiveness and growth of business based on bioeconomy and food;
- sustainable use of renewable natural resources;
- health, wellbeing and safety of humans, animals and plants;

³⁰⁷ Finland National Reform Programme 2017 a6276438-a236-425d-a867-9f5387a1a8b2 (vm.fi)

³⁰⁸ RIO report

³⁰⁹ https://iritrends.res-agora.eu/uploads/22/Research%20and%20innovation%20policy%20guidelines_Finland.pdf

³¹⁰ <http://mmm.fi/documents/1410837/1516675/Research+Strategy+2017-2022/8eb990cf-6b3b-40e3-a150-b06669d0925e>. The strategy was preceded by a research strategy for the forestry sector published in 2015: <https://mmm.fi/documents/1410837/1504826/Mets%C3%A4alan+tutkimusstrategia/07e7935d-b27e-4736-910c-76c724a6f29b/Mets%C3%A4alan+tutkimusstrategia.pdf?t=1450689710000>

- vitality of the rural areas; and
- production and utilisation of natural resource, real estate and spatial data.

For the period 2021-2035, the **Food R&I Strategy for Finland** was prepared with the main aim to “*position Finland as a key actor in the transition towards a healthful and sustainable global food system, which leads to economic growth and well-being of the people and society.*”³¹¹ It defines four sub-missions: 1. Healthy, safe, and sustainable diets are viable for all Finnish citizens. 2. Food and feed production in Finland is sustainable, competitive and resilient. 3. Resource efficiency and zero waste are key determinants in the Finnish food system. 4. Finland is a forerunner and leading testbed for sustainable food system innovations.

The accompanying implementation plan includes the establishment of a Finnish food research forum to promote food systems related education and research and increase dialogue across disciplines; a governmental, cross-ministry food research network, and the engagement of business actors through innovation ecosystems, for example, via the Technical Research Centre of Finland (VTT) platform “Food & Beyond” and the regional ecosystems that promote innovation activities to achieve improved efficacy of the Finnish research and infrastructure investments.

In terms of other strategies that are indirectly related to the food sector, research and development work is also one of the main three objectives of the **National climate change adaptation plan 2022**, to “enhanced the adaptive capacity of society, developed innovative solutions and improved citizens’ awareness on climate change adaptation.”³¹²

3 Overview of national food policy

The Finnish food policy is led by the Ministry of Agriculture and Forestry. A government report on food policy, published in 2017, contains the **vision for 2030 and sets key priorities and policy objectives.**³¹³

“In 2030, Finnish consumers eat tasty, healthy and safe Finnish food that has been produced sustainably and ethically. Consumers have the ability and possibility to make informed

³¹¹ <https://www.vttresearch.com/sites/default/files/2021-03/Food-research-and-innovation-research-for-Finland-2021-2035.pdf>

³¹² <http://mmm.fi/en/nature-and-climate/climate-change-adaptation>

³¹³ http://mmm.fi/documents/1410837/1923148/lopullinen03032017ruoka2030_en.pdf/d7e44e69-7993-4d47-a5ba-58c393bbac28

choices. A transparent, highly skilled, flexible, internationally competitive and profitable food system that responds to demand. The growth and advancement of the sector are supported by well-coordinated, high-level research, development, innovation and teaching. There is a high level of marketing and communication skills in the sector. Finland is a significant exporter of high quality and safe foodstuffs and food sector skills.”

This food policy replaces a number of documents and strategies, published between 2010 and 2013, that related to different aspects of the food system.³¹⁴ In relation to research, the aim in the food policy report is to ensure adequate public and private sector funding for research and development, and coordination between funding providers to enable multidisciplinary, long-term and effective projects, promote the internationalisation of research and education. The report mentions policy areas that are aligned with the Food2030 priorities, such as **food and public health, circularity and resource efficiency**, the adaptation of the food system to **climate change**, and the importance of **consumer communities** to continually change the food culture.

The Ministry of Agriculture also published the **Steps towards Climate Friendly Food** in 2014, aimed at further enhancing the sustainability of the Finnish food system, through 8 key measures: 1. Carbon sequestration into soil; 2. Measures relating to the use of peatlands; 3. Plant breeding; 4. Plant and animal health and preventing the spread of invasive alien species; 5. Handling and treatment of manure and more accurate nitrogen fertilization; 6. Energy efficiency and production and consumption of renewable energy; 7. Reducing food loss all through the food system; 8. Changes towards a more plant-based diet.

The **Finnish Circular Economy Strategy** (2016-2025), published by Sitra, also includes a chapter on sustainable food systems, with the key policy actions on creating a market for organic recycled nutrients; Minimise food waste by eliminating barriers and creating incentives; Support biogas systems and other renewable energy solutions to replace fossil fuels in agriculture.³¹⁵

In terms of health related food policy, the Ministry of Health and Social Welfare is responsible for the nutrition policy, for which the main strategies in place are the **Finnish**

³¹⁴ The new food policy report replaces the following documents:

- Huomisen ruoka - esitys kansalliseksi ruokastrategiaksi (Tomorrow's Food – National Food Strategy Proposal 2010)
- Government report on food policy (2010)
- Ruokaketjun toimenpideohjelma (Food Chain Action Plan 2011)
- Government report on food safety (2013)

http://mmm.fi/documents/1410837/1923148/lopullinen03032017ruoka2030_en.pdf/d7e44e69-7993-4d47-a5ba-58c393bbac28

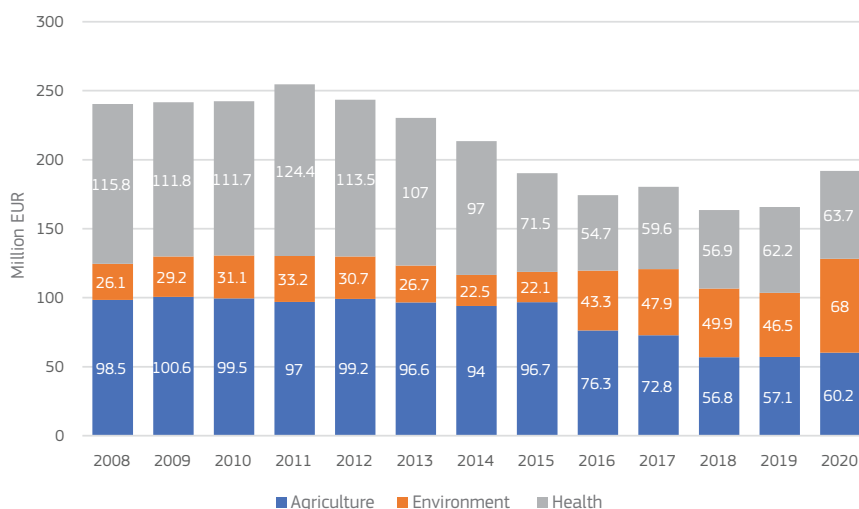
³¹⁵ <https://media.sitra.fi/2017/02/24032659/Selvityksia121.pdf>

nutrition policy in action³¹⁶ and **Nordic Nutrition Recommendations**³¹⁷, setting the guidelines for dietary composition based on the most recent global scientific research.

4 Public funding available for food R&I

According to Statistics Finland, between 2008 and 2020, R&D expenditure in the fields of Environment, Agriculture and Health was distributed as below. Agriculture represents a significant focus throughout the years within government R&D expenditure, and the share of R&D expenditure related to the environment progressively increased between 2008 and 2020.

Figure 2: Government R&D expenditure by socioeconomic objective between 2008 and 2020 (million EUR)



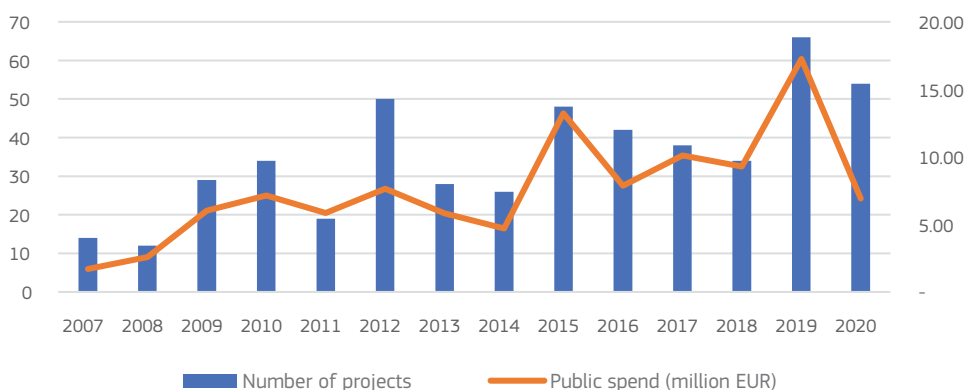
Source: Statistics Finland

³¹⁶ <https://valtioneuvosto.fi/documents/1271139/1449208/FOODFORHEALTH-content-compressed.pdf/341ca705-d7e4-4f8f-be06-d70b277cb004>

³¹⁷ <https://www.norden.org/en/theme/nordic-nutrition-recommendation/nordic-nutrition-recommendations-2012>

According to data made available by Business Finland, the Academy of Finland, and the Ministry of Agriculture³¹⁸, a total of **494 R&I food-related projects** were funded by Finnish national authorities between 2007 and 2020³¹⁹, receiving a total of **EUR 106 million** in funding. The databases were searched using the relevant keywords³²⁰ and filtering by the related discipline.³²¹ The projects have also been filtered by funding programme, excluding from our analysis projects that were part of co-financing schemes or using EU Structural Funds.³²² A review of the projects approved during this period shows that 2008 was the year with least projects starting in this field, while 2019 was the year registering most projects approved as well as with the largest funding amount spent in food-related research and innovation (EUR 17 million).

Figure 3: Number of food-related R&I projects and funding amounts between 2007 and 2020 (million EUR)



Source: Ipsos analysis of data provided by Business Finland, the Academy of Finland, and the Ministry of Agriculture. Base: 494 projects

National public expenditure on food systems related R&I projects was mostly granted by the **Academy of Finland** and by the **Development Fund for Agriculture and Forestry (Makera)**, governed by the Ministry of Agriculture (MMM). They accounted respectively for

³¹⁸ Business Finland project information:

https://tietopankki.businessfinland.fi/anonymous/extensions/Public_research_and_corporate_projects/Public_research_and_corporate_projects.html Filtering by keywords in project titles and goals

³¹⁹ Note: year the call was launched.

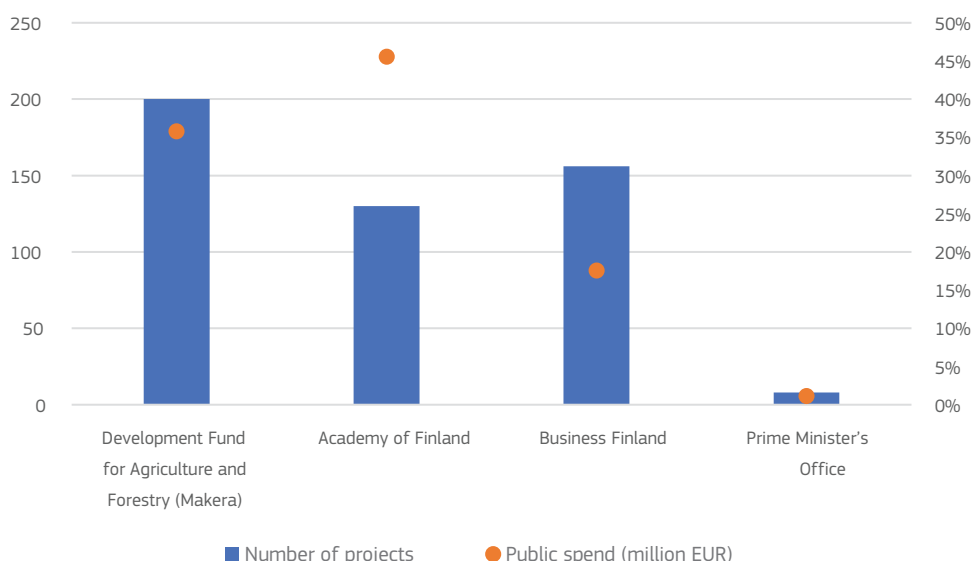
³²⁰ Keywords used: food; agriculture; fisheries; agri-tech; agri tech; precision farming; soil; food production; food processing; packaging; nutrition; food waste; foodwaste; water; food safety; food systems; supply chains; sustainability; eco-innovation; environmental impact

³²¹ Fields: Agricultural sciences, Biomaterials, Ecotoxicology and environmental impacts, Environmental research, Environmental science, Food engineering, Food sciences, Industrial processes

³²² We have assumed that other funding programmes did not make use of EU funds

almost half (46%) and 36% of the funding between 2007 and 2020. Business Finland provided 18% of the food-related R&I funding during this period, while a small proportion (eight projects worth less than 2% of the total amount) was funded by Prime Minister’s Office, as part of projects overseen by different ministries.

Figure 4: Public funding for food systems related R&I projects, by funding source, 2008-2021

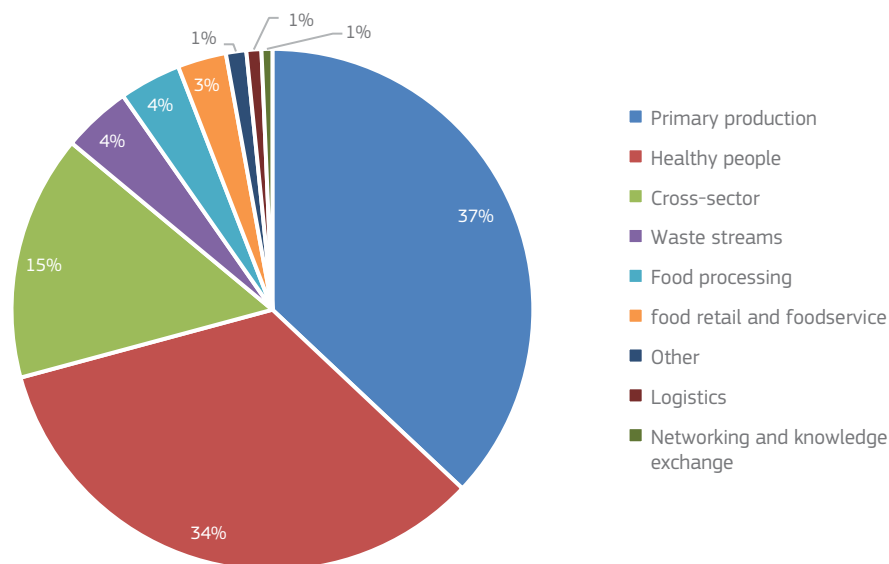


Source: Ipsos analysis of data provided by Business Finland, the Academy of Finland, and the Ministry of Agriculture. Base: 494 projects

Funding by sector

When analysing the sectors receiving funding for food-related R&I projects, more than a third of public funding appears to be directed towards Primary production (37%, corresponding to EUR 37.2 million) and towards project related to Healthy people (34%, corresponding to EUR 35.8 million). 15% (corresponding to EUR 16.1 million) went to projects of multiple sectors, followed by Waste streams (4% corresponding to EUR 4.5 million) and Food Processing (4%, corresponding to EUR 4.0 million). The remaining public contribution is then distributed in low proportions (approximately 1%) amongst the other sectors, with Networking and knowledge exchange receiving the lowest proportion, corresponding to EUR 0.7 million.

Figure 5: National public funding by sector



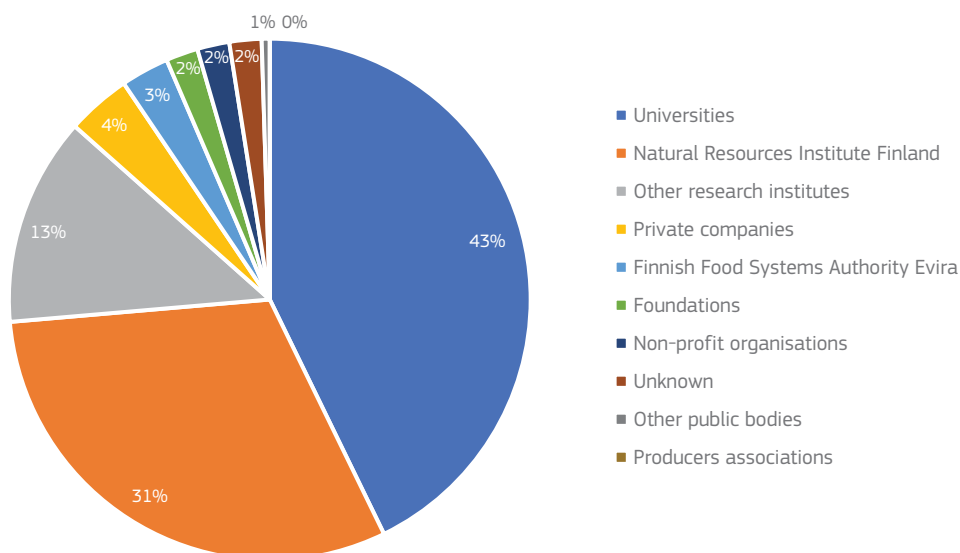
Source: Ipsos analysis of data provided by Business Finland, the Academy of Finland, and the Ministry of Agriculture. Base: 494 projects

5 Main recipients of public food R&I investment

The primary recipients of public food R&I investments in Finland are **public universities and research institutions** (74% of the funding).³²³ The single largest recipient of public funds is the **Natural Resources Institute Finland (Luke)**, accounting for about a third of the total public funding. As shown in Figure 6, universities receive 43% of the funding related to food systems, with the **University of Helsinki** receiving the largest share (EUR 27 million across 92 projects). Public R&I funding for **other research institutes** (such as the VTT Technical Research Centre of Finland and the Finnish Environment Institute) accounts for 13% of the total spend. Food-related public funding to **private companies** only constitutes around 4% of the total spend in the period considered, and it's mostly provided by Business Finland. A similar proportion (3%) has been granted to the **Finnish Food Safety Authority (Evira)**. The remaining spend was directed at **foundations, non-profit organisations, other public bodies** (such as the Finnish Food Authority) **and producers' associations**.

³²³ When analysing the database, only the main applicant has been considered.

Figure 6: Funding by recipient organisation



Source: Ipsos analysis of data provided by Business Finland, the Academy of Finland, and the Ministry of Agriculture. Base: 494 projects

6 Structural Funds available for Food R&I

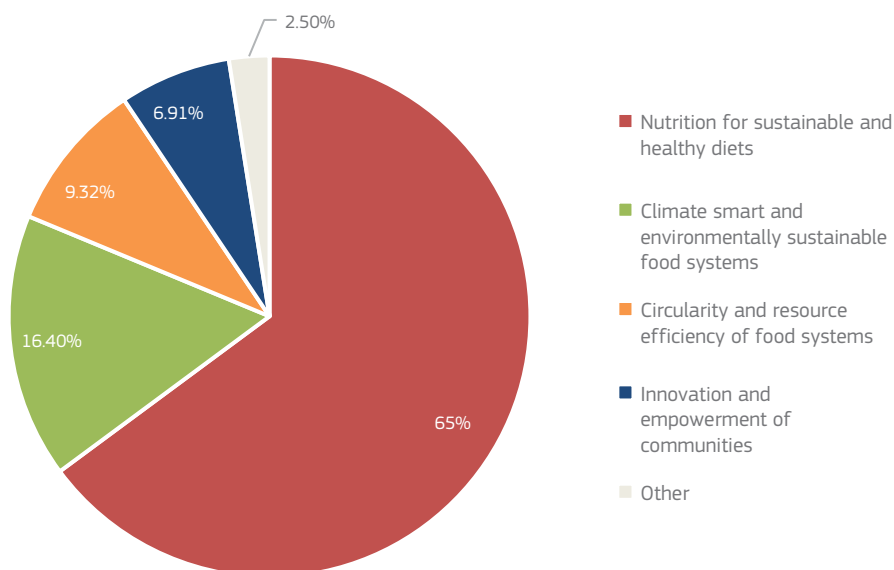
ESI funds implemented in Finland include the Structural Funds Programme, the European Agricultural Fund for Rural Development (EAFRD) and the Maritime and Fisheries Funds (EMFF). An evaluation of the structural funds programme in Finland, published in 2019, illustrates that **EAFRD funding has been allocated to primary production, rural small businesses and associations, the food industry, and education and development measures** targeted at rural populations.³²⁴ **ESF funding** has been granted to nearly 20 projects (1% of all ESF projects) which are **targeted directly at rural or agricultural contexts**. These include the promotion of rural employment, the development of nature/wildlife-related skills and entrepreneurship, the promotion of wellbeing at work among agricultural and rural entrepreneurs, the internationalisation of agricultural businesses. According to the SCAR working group mapping of R&I projects carried out in 2018, Finland mainly uses ERDF and ESF funds for regional-level projects related to food-related innovation. In the programming period 2014-2020, a total of 25% of ERDF funding was directed at low-carbon activities.

³²⁴ <http://www.rakennerahastot.fi/web/en/evaluation>

7 Links to FOOD2030 priorities and pathways

National funding for R&I in the field of food systems mainly targeted projects that sought to address challenges linked to the FOOD2030 priority Nutrition for sustainable and healthy diets (65%, corresponding to EUR 69 million). This encompasses mostly projects related to food safety in the primary production sector, as well as the production of food with high nutritional value, including from plant proteins. Projects targeted at addressing Climate smart and environmentally sustainable food systems constituted 16% of the food-related public funding (corresponding to EUR 17.4 million). Projects in this category ranged from climate-smart agriculture and diversifying cropping systems to the adaptive capacity of agri-food systems. The remaining funding aimed to support technologies and innovations related to Circularity and resource efficiency (9%, corresponding to EUR 9.9 million) and Innovation and empowerment of communities (7%, corresponding to EUR 7.3 million). A small proportion of the public funding (3%) was categorised as “other”, since it was focused on topics not directly linked with the FOOD2030 priorities, such as the competitiveness of the meat chain in the market.

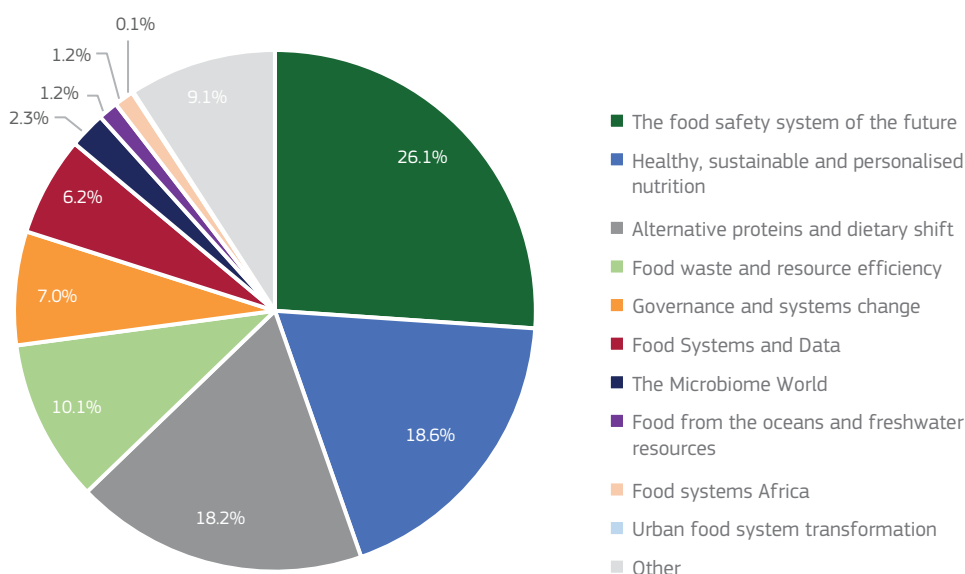
Figure 7: Public spend on food-related R&I projects by Food2030 priority



Source: Ipsos analysis of data provided by Business Finland, the Academy of Finland, and the Ministry of Agriculture. Base: 494 projects

In terms of the alignment with the FOOD 2030 pathways, Finland’s R&I funding on food systems between 2008 and 2020 mainly corresponded to the pathway Food safety system of the future (26%, corresponding to EUR 27.6 million). Projects related to the pathways Healthy, sustainable and personalised nutrition and Alternative proteins and dietary shift accounted for 19% (corresponding to EUR 19.6 million) and 18% (corresponding to EUR 18.2 million) of the funding respectively. Only a limited number of projects related to the Microbiome world (2%, corresponding to EUR 2.4 million), Food from the oceans and freshwater resources (1%, corresponding to EUR 1.3 million) to the development of a sustainable African food system (1%, corresponding to EUR 1.3 million) and Urban food systems transformation (0.1%, corresponding to EUR 0.09 million).

Figure 8: Public spend on food-related R&I projects by Food2030 pathway



Source: Ipsos analysis of data provided by Business Finland, the Academy of Finland, and the Ministry of Agriculture. Base: 494 projects

8 Data gaps and limitations

The results of the analysis are based on publicly available information from the Business Finland and Academy of Finland project databases, and data made available from the Ministry of Agriculture and Forestry. Publicly available databases were searched by relevant keywords contained in the project title and, where available, project description. Information

not available on the database includes technology readiness level (TRL), publications and patents. In some instances, for the projects contained in the Business Finland database, the granted amount was also classified as confidential and could not be included in the analysis.³²⁵ It should also be noted that food-related R&I spend data could not be accessed for the following financers: Ministry of the Environment, Ministry of Social Affairs and Health,³²⁶ and organisations providing regional funding (Centres for Economic Development, Transport and the Environment ELY Centres, Finnish Agency for Rural Affairs Mavi).

³²⁵ 62 projects had a confidential granted amount in the Business Finland database.

³²⁶ Data requested from the Ministry of Environment and Ministry of Social Affairs and Health

Summary of data sources: Finland

Country context	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture and Forestry	https://mmm.fi/en/research-and-development
	Business Finland	https://www.businessfinland.fi/en/for-finnish-customers/about-us/funding-information
	Academy of Finland	https://www.aka.fi/en/research-funding/peer-review-and-funding-decision/funding-decisions/
Food innovation related policies	Food R&I Strategy for Finland	https://www.vttresearch.com/sites/default/files/2021-03/Food-research-and-innovation-research-for-Finland-2021-2035.pdf
	Food2030 vision	http://mmm.fi/documents/1410837/1923148/lopullinen03032017ruoka2030_en.pdf/d7e44e69-7993-4d47-a5ba-58c393bbac28
National R&I Strategies	National Reform Programme	a6276438-a236-425d-a867-9f5387a1a8b2 (vm.fi)
	Research and Innovation Council's 2017 roadmap	https://publications.jrc.ec.europa.eu/repository/handle/JRC111280
	2011-2015 Research and Innovation Policy Guidelines	https://rritrends.res-agera.eu/uploads/22/Research%20and%20innovation%20policy%20guidelines_Finland.pdf
	Ministry of Agriculture and Forestry research strategy 2017-2022	http://mmm.fi/documents/1410837/1516675/Research+Strategy+2017-2022/8eb990cf-6b3b-40e3-a150-b06669d0925e

EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Structural funds in Finland	http://www.rakennerahastot.fi/web/en/structural-funds-in-finland
Food innovation funding		
	Name and description	Link
Specific food innovation related R&I competitions/ funding	Projectnet database	https://www.mitiatorakenteet.fi/hankehaavi/index.php
Available data (reports, datasets)		
Source	Name and description	Link
From SCAR quantitative mapping (where available)	Assessment of R&I on Food Systems – SCAR working group	Assessment_of_R_and_I_on_food_systems.pdf (europa.eu)
From desk research	Business Finland overall funding information	https://tietopankki.businessfinland.fi/anonymous/extensions/fundingawarded/fundingawarded.html
	Business Finland project information	https://tietopankki.businessfinland.fi/anonymous/extensions/Public_research_and_corporate_projects/Public_research_and_corporate_projects.html
	Luke Statistics database	http://statdb.luke.fi/PXWeb/pxweb/en/LUKE/search/?rxid=dc711a9e-de6d-454b-82c2-74ff79a3a5e0&searchquery=research

	Government spending tables from Statistics Finland and Central government's total expenditure and funding of R&D activities by year	https://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__tnt__tkker/?tablelist=true https://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin__tnt__tkker/statfin_tkker_pxt_11b8.px/table/tableViewLayout1/
	Academy of Finland database	Academy of Finland
From interviewees	List of Ministry of Agriculture and Forestry Makera R&I projects related to food systems	Privately shared
	List of R&I projects funded by the Prime Minister's Office (more than one Ministry)	Privately shared

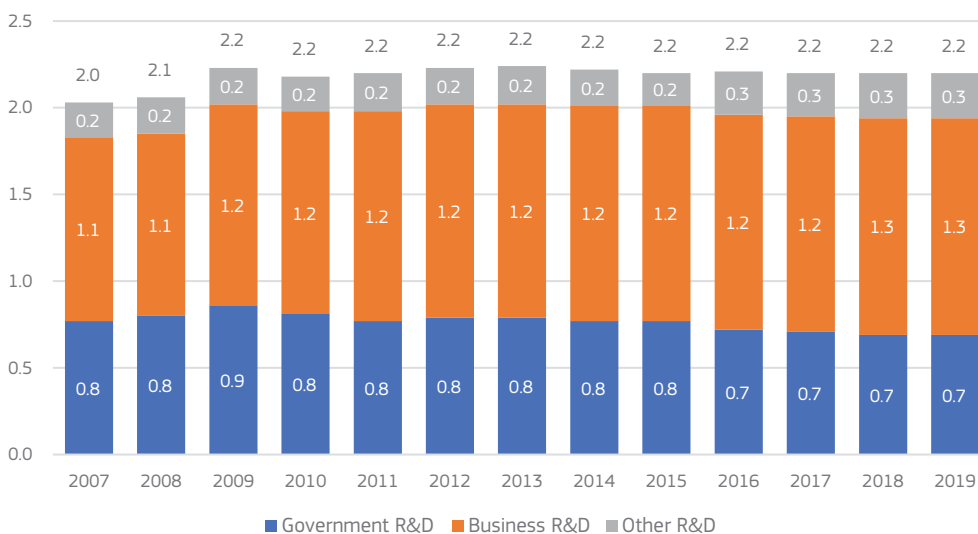
FRANCE

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in France from 2007 to 2019.³²⁷ After increasing slightly between 2007 and 2009, figures have remained relatively stable (with a peak of 2.2% in 2013). Government expenditure has also remained relatively stable, hovering between 0.7% and 0.9% of GDP across the entire reference period.

France has a food-specific R&I policy, the plan “Agriculture Innovation 2025 Food, launched in 2016 as part of France’s National Research Strategy.

Figure 1: R&I expenditure in France, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

³²⁷ 2019 is the last year for which complete figures are available

Main providers of Food R&I funding at national level

The main R&I funding agency in France is **ANR, the National Research Agency**, a public administrative body under the authority of the Ministry of Higher Education, Research and Innovation. ANR's research funding budget, dedicated to financing project-based research, includes public funds from the French State and funds from partnerships with other institutions. In 2019, the ANR's research funding budget was EUR 708 million. In addition to ANR, it's important to mention **ADEME, the French Agency for Ecological Transition**, a public agency under the joint authority of the Ministry for an Ecological Transition and the Ministry of Higher Education, Research and Innovation. ADEME advises, facilitates and finances research projects in areas such as energy, circular economy, food, mobility, air quality, adaptation to climate change, and soils.

Other French research organisations fostering R&I include **CEA (French Alternative Energies and Atomic Energy Commission)**, **CNRS (National Centre for Scientific Research)**, **INSERM (National Health and Medical Research Institute)**, **INRAE (National Research Institute for Agriculture, Food and the Environment)**, **IFREMER (National Institute for Ocean Science)**, **INRIA (National Institute for Research in Computer Science and Automation)** and **CNES (National Centre for Space Studies)**. Furthermore, the R&I ecosystems is backed-up by multiples clusters of universities, private research institutes and innovation agencies.

Other relevant actors

Besides INRA, the organisations in the country specifically for agri-food related R&I are **CIRAD**, **ODEADOM (Office for the Development of Agricultural Economy)**, the **National Forestry Office**, **ANSES (National Agency for Food, the Environment and Occupational Health Safety)**, the **National School of Water and Environmental Engineering of Strasbourg**, **Montpellier SupAgro**, **National Landscape School**, **ACTA (Technical Farming Institutes)**, **AgroParisTech**, **ACTIA (the French Network of Agri-Food Technical Institutes)**, **Institut Agro Rennes-Angers**, **VetAgroSup**, among others.

2 National R&I Strategy

“France Europe 2020”³²⁸ is the country’s strategic agenda for research, technology transfer and innovation. It was drawn up in line with the European Union’s strategy for R&I, and has the purpose of setting up the research priorities to meet the major challenges of the coming decades. France’s R&I strategy is revised every five years, based on consultations with the scientific and academic communities, and the socio-economic context. The strategy defines the multi-annual contracts concluded by the State with higher education institutions and public research bodies. It also outlines the programme of public bodies such as the ANR. “France Europe 2020” focuses on several dimensions, among which the following relevant for food-related research:

Mobilise stakeholders on major challenges:

- Manage natural resources and climate adaptation;
- Generate clean, secure and efficient energy;
- Foster industrial renewal;
- Improve health and well-being;
- Tackle food security and the demographic challenge;
- Promote innovative, inclusive and adaptive societies;
- Promote technical research;
- Encourage innovation and technology transfer;
- Increase the presence of French research in Europe and internationally.

In order to involve the scientific community and its social and economic partners as widely as possible, nearly 400 experts are mobilised and divided across the ten challenges of the first dimension. Each challenge is placed under the responsibility of a high-level scientific personality and a correspondent from the Ministry of Higher Education, Research and Innovation. The objectives of these working groups are to identify scientific and technological

³²⁸ https://cache.media.enseignementsup-recherche.gouv.fr/file/France-Europe_2020/18/3/AgendaStategie02-07-2013-EnglishLight_262183.pdf

priorities, taking into account the barriers to be overcome; and to bring together three or four major transversal and common priorities, encouraging cross-sector research.

3 Overview of national food policy

The **National Programme on Food and Nutrition**³²⁹ (PNAN) was launched in 2019 and will last until 2023. It sets the course of policy for food and nutrition for the period of five years, joining actions on food policy and nutrition. The key purpose of this plan is to promote healthy choices that are good for the environment, while reducing inequality of access to high quality food. French national authorities work with food companies to limit the amount of salt, sugar and fat in foods, encouraging behaviour that are more beneficial for the consumers. The axes of the PNAN cover the following areas:

- Social justice – with the purposes of improving the nutritional quality and diversity of the food offer, fighting food insecurity, and strengthening consumer information;
- Fight against food waste;
- Food education – with the goals of encouraging nutrition education amongst the younger population, and of promoting national food heritage;

The PNAN is in line with the recommendations of international agencies such as the World Health Organisation (WHO) and the Food and Agriculture Organisations of the United Nations (FAO). Its execution is supervised by the Ministry of Agriculture and Food.

With regards to research and innovation in food systems, in 2016 the government launched the plan “**Agriculture Innovation 2025**”³³⁰. The plan involves the Ministries of Agriculture, Research and Economy. The four priorities set out are:

1. Strengthening research on soils, agriculture and climate;
2. Placing agriculture at the heart of the National Research Agency (ANR);
3. Developing digital agriculture;
4. Creating “living laboratories” to foster open innovation within the country’s territories.

³²⁹ <https://bit.ly/3dm8XAr>

³³⁰ <https://www.enseignementsup-recherche.gouv.fr/cid99578/www.enseignementsup-recherche.gouv.fr/cid99578/lancement-du-plan-agriculture-innovation-2025.html>

Under priority no. 1, the purpose is to explore the potentials of agriculture to limit major challenges related with climate change, focusing namely on soils' quality data. Priority no.2 focuses on including agriculture research at the heart of the National Research Strategy, ensuring that three of the five priority action plans are mobilised for agricultural research projects. The third priority of the plan responds to the need of ensuring rapid dissemination of information between stakeholders in the agriculture sector. An agricultural data portal will be set up with the aim of enabling access to a set of public and private data that can be used for the benefit of agricultural production across the world, contributing to the emergence of new solutions and players. Finally, priority no. 4 aims to encourage innovation by bringing together farmers, businesses and researchers, who together can change agricultural ecosystems.

4 Public funding available for food R&I

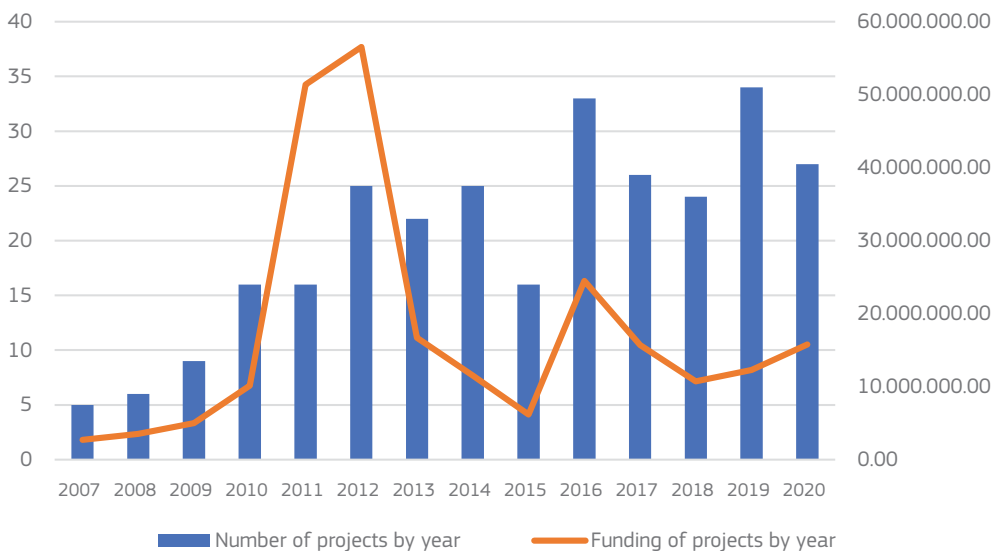
Two of the challenges tackled by the National Research Strategy and to which public funds are allocated are directly related to food systems:

- Manage natural resources and climate adaptation;
- Tackle food security and the demographic challenge.

According to data made available by ANR and ADEME, 284 R&I food-related actions were publicly funded between 2007 and 2020. Overall, the funding allocated to these projects corresponds to EUR 242.6 million.

The year in which more funding was used was 2012 (EUR 56.5 million). 2007 and 2008 registered the lowest amounts of funding used, EUR 2.7 and EUR 3.5 million respectively (Figure 2).

Figure 2: R&I food related projects between 2007 and 2020.

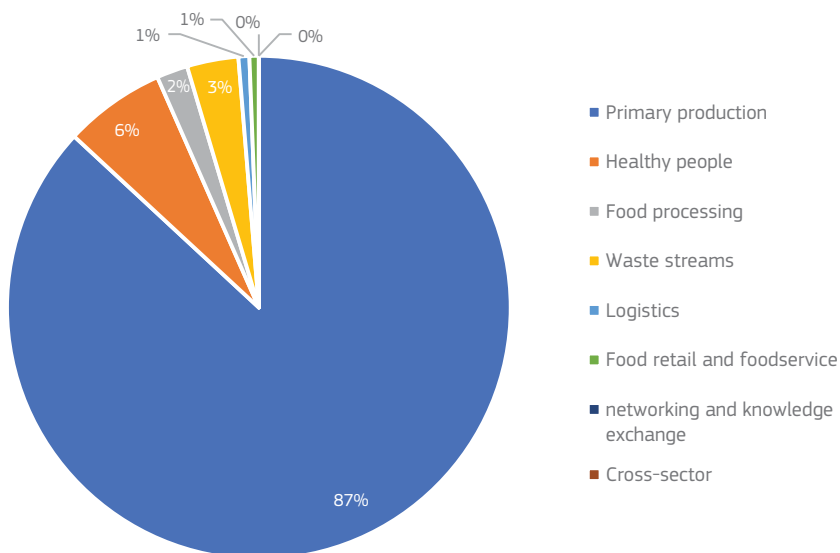


Source: ANR and ADEME

Funding by sector

The sector in food-related R&I which received most public funding was primary production (86%; EUR 210.9 million). The second sector receiving more public funds for R&I was the sector of healthy people, with EUR 15.7 million (Figure 3).

Figure 3: Distribution of funding by sector

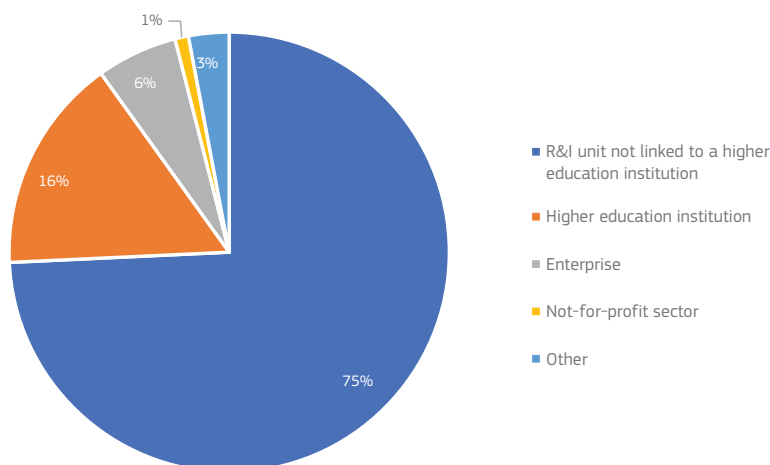


Source: ANR and ADEME

5 Main recipients of public food R&I investment

A review of the data shows that R&I Units not linked to Higher Education Institutions received the highest amount of Food R&I funding (EUR 181.3 million, corresponding to 75% of the total funding), followed by Higher Education institutions (EUR 39.2 million, or 16% of the total) (Figure 4).

Figure 4: Distribution of funding by recipient



Source: ANR and ADEME

6 Structural Funds available for Food R&I

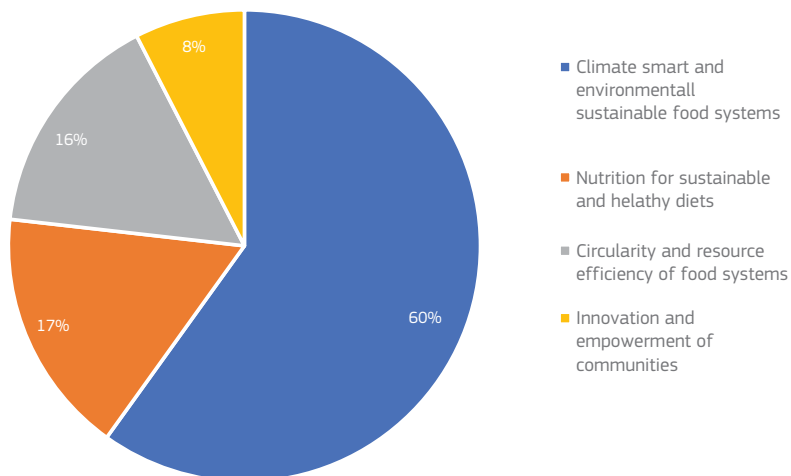
For the purposes of this report, the total amount of structural funds used for R&I projects for the reference period was not found in any publicly-available report or from consultations with relevant contacts.

7 Links to FOOD2030 priorities and pathways³³¹

With regards to the FOOD2030 priorities, the single priority receiving the most funding is climate smart and environmentally sustainable food systems (60%, corresponding to EUR 145.6 million). Circularity and resource efficiency of food systems and Nutrition for sustainable and healthy diets had a roughly equal proportion of public contribution at 17% (corresponding to EUR 41.2 million) and 16% (corresponding to EUR 38.8 million) respectively. Innovation and empowerment of communities receives the lowest proportion of public expenditure at 8%, corresponding to EUR 19.4 million.

³³¹ In seven of the projects analysed it was not possible to find a correspondence between the themes of research and the FOOD2030 priorities and pathways. The total funding associated to these projects is EUR 1.1 million.

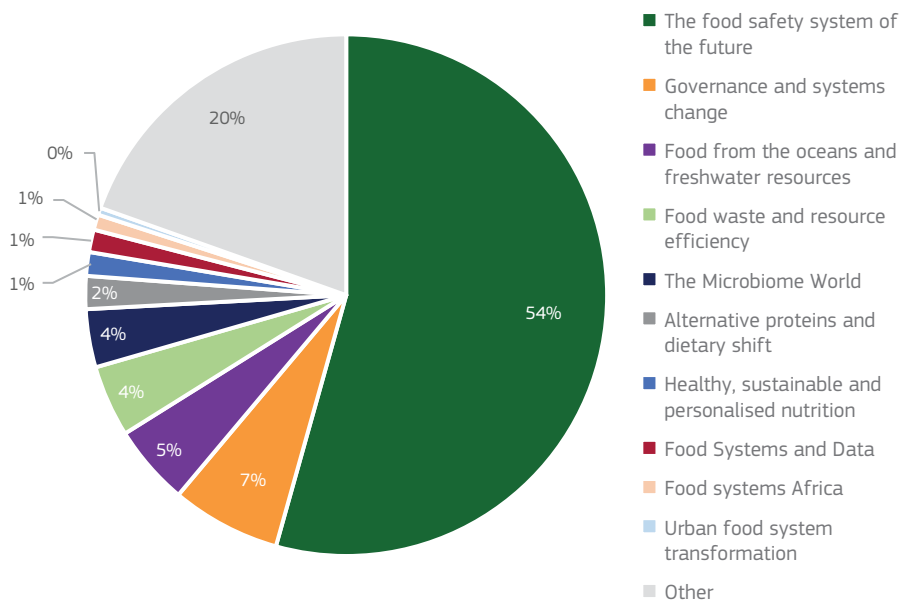
Figure 5: Distribution of funding by FOOD2030 priority



Source: ANR and ADEME

With regards to FOOD2030 pathways, publicly funded food-related R&I in France is mainly allocated to the pathway of Food safety systems of the futur (54%, corresponding to EUR 131.9 million), followed by Governance and system change (7%, EUR 16.4 million) and Food from the oceans and freshwater sources (5%, EUR 12.1 million). Urban food systems transformation was the pathway receiving less funding (0.4%; EUR 1.1 million). Figure 6 presents the share allocated to all the FOOD2030 pathways.

Figure 6: Distribution of funding by FOOD2030 pathway



Source: ANR and ADEME

8 Data gaps and limitations

The results of the analysis are based on publicly available information and data from the ANR and ADEME websites. Information not available on the databases includes among others: type of entity and identification of the coordinators of the actions, start and end dates, technology readiness level (TLR), publications and patents.

Summary of data sources: France

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	ANR – National Research Agency	https://anr.fr/
	ADEME, the French Agency for Ecological Transition	https://www.ademe.fr/
Food innovation related policies	Agriculture Innovation 2025	https://www.enseignementsup-recherche.gouv.fr/cid99578/www.enseignementsup-recherche.gouv.fr/cid99578/lancement-du-plan-agriculture-innovation-2025.html
National R&I Strategies	National Research Strategy/ France Europe 2020	https://cache.media.enseignementsup-recherche.gouv.fr/file/France-Europe_2020/18/3/AgendaStategique02-07-2013-EnglishLight_262183.pdf
From desk research	ANR – National Research Agency	https://anr.fr/
	ADEME	https://data.ademe.fr/datasets/investissements-d'avenir-projets

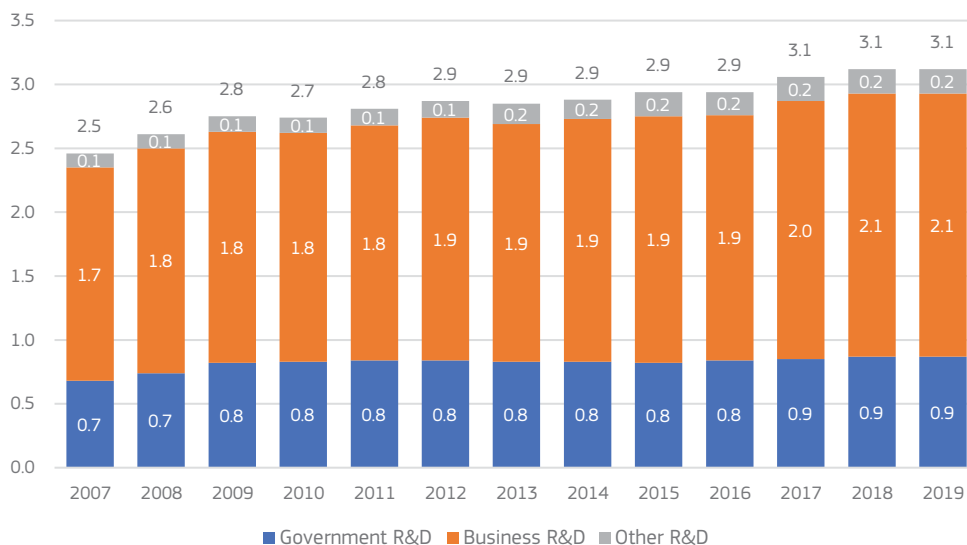
GERMANY

1 Overview of national R&I landscape

Research and Innovation in Germany is funded by three main actors: The Federal Government, the federal states, and the private sector. Overall, Germany aims to invest 3.50% of GDP in R&I by 2025 (as laid out in its R&I Strategy, see below). Figure 1 tracks levels of expenditure on R&I as a percentage of national GDP between 2007 and 2019. This shows a continuous increase throughout the years of the total level of R&I investments, from 2.5% in 2007 to 3.2% in 2019. However, this increase has largely been driven by the private sector, which provides the lion's share of R&I funding. Levels of publicly funded R&I as a proportion of GDP have remained relatively static over the past 15 years, gradually increasing over time.

The focus on R&I in food systems is provided by several specific R&I strategies in Germany, rather than one single policy.

Figure 1: R&I expenditure in Germany, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main providers of Food R&I funding at national level

The private sector is responsible for approximately two thirds of national R&I expenditure. This is actively facilitated by the federal government, as well as the regional and municipal governments, through measures such as tax breaks for example. The share of national R&I funding from the government sector has hovered around 30% throughout the past 15 years, but has increased in terms of the total amount, from EUR 10,140 million in 2007 to an estimated EUR 19,601 million in 2019³³².

R&I expenditure is divided between a number of different federal ministries.³³³ There are three main categories of public R&I expenditure:

- Institutional funding supports key research institutions and contributes to the necessary R&I infrastructure. Institutional funding amounts to over 40% of public R&I expenditure. The research institutions have a defined remit but are usually free to conduct research within this, but their task is usually to support policy making.
- Ministries also support R&I projects through different specialised funding programmes.
- Finally, the government also commissions departmental research in cases where there is a need for specific information to support the department's/ministry's work.³³⁴

Of the ministries with R&I funding power, several have overlapping responsibilities when it comes to funding food systems related R&I.³³⁵

The **Federal Ministry for Education and Research** (*Bundesministerium für Bildung und Forschung, BMBF*) is the biggest governmental funding entity. It is responsible for promoting basic as well as applied research and innovation in different thematic areas (such as life sciences and sustainability).

³³² Federal Ministry for Education and Research (2020). *Bundesbericht Forschung und Innovation 2020*. Available at: https://www.bundesbericht-forschung-innovation.de/files/BMBF_BuFI-2020_Hauptband.pdf.

³³³ It has to be noted that R&I is also being funded by the Federal States (*Länder*), but this is beyond the scope of this report, as it focuses on *national* R&I funding rather than *regional* funding.

³³⁴ Federal Ministry for Education and Research (2020). *Bundesbericht Forschung und Innovation 2020*. Available at: https://www.bundesbericht-forschung-innovation.de/files/BMBF_BuFI-2020_Hauptband.pdf.

³³⁵ Other funding ministries, such as the Federal Ministry for Economic Affairs and Energy, might also fund projects or institutions that touch upon aspects of the food system – however, this can be seen as less of a core competency of theirs, which is why the research in this report focuses on the funding from the above-mentioned ministries.

The **Federal Ministry for Food and Agriculture** (*Bundesministerium für Ernährung und Landwirtschaft, BMEL*). Its remit covers the whole of the food chain, from production to consumption. The BMEL seeks to make agriculture, forestry, fisheries, as well as food consumption and food waste, sustainable and climate-neutral, as well as sets out to ensure people have access to nutritious diets both at home and in less-developed countries.

The **Federal Office for Agriculture and Food** (*Bundesanstalt für Landwirtschaft und Ernährung, BLE*), under the responsibility of the BMEL, is a central implementing authority in the agricultural sector and (inter alia) coordinates research strategies and research funding within the agricultural domain.³³⁶

The **Agency for Renewable Resources** (*Fachagentur Nachwachsende Rohstoffe, FNR*) is an implementing authority of the Federal Ministry for Food and Agriculture, responsible for the coordination of research, development and demonstration projects within the field of renewable resources. This relates to certain aspects of food-systems R&I, most notably the production of bio-based products and/or bioenergy from food waste or by-products.³³⁷

The **Federal Ministry of Economic Affairs and Energy** (*Bundesministerium für Wirtschaft und Energie, BMWi*) is responsible (inter alia) for Germany's European, economic, energy and industrial policies. The BMWi provides funding to the Industrial Cooperative Research programme (*Industrielle Gemeinschaftsforschung, IGF*), which supports long-term research cooperation in industry networks and aims to connect basic and applied research, as well as foster interdisciplinary approaches. There is a particular focus on involving small and medium-sized enterprises (SMEs). While the IGF itself does not prescribe a thematic focus, it works closely and provides part of the funding for the **Research Association of the German Food Industry** (*Forschungskreis der Ernährungsindustrie, FEI*), a non-profit, registered association supporting research projects in all fields of food science, food technology and nutritional science.

The **Federal Ministry for the Environment, Nature Conservation and Nuclear safety** (*Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, BMU*). Founded as a reaction to the Chernobyl disaster, it bundles together responsibilities for environmental issues. Providing funding for R&I is one of the BMU's key tasks, amongst others (most notably setting the legal framework conditions surrounding environmental policy).

³³⁶ Federal Office for Agriculture and Food (n.d.). *The Federal Office for Agriculture and Food – Tasks and Services*. Available at: https://www.ble.de/SharedDocs/Downloads/DE/Publikationen/BLE-eng.pdf;jsessionid=8A667884B4AC84A0C886E18401BA6C4F.2_cid335?__blob=publicationFile&v=1

³³⁷ Primary production of crops for use of bio-based products and/or biofuel also relate to wider questions of land and resource use relevant to food systems.

The **Federal Ministry for Economic Cooperation and Development** (*Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, BMZ*) invests around EUR 1.5 billion a year in projects addressing food security, rural development and the protection of natural resources³³⁸.

The **German Research Foundation** (*Deutsche Forschungsgemeinschaft, DFG*) is a central self-governing research funding organisation. The DFG does not have a thematic focus but instead funds curiosity-driven basic research projects across all disciplines, as well as interdisciplinary projects. Individuals, universities or other research organisations can apply for funding, and selection is made based on scientific criteria. The DFG receives the majority of its funding from the national government, mostly in the form of institutional funding, as well as some funding earmarked for specific projects. Similarly, the Federal States (*Länder*) also provide funding to the DFG in these two categories. The DFG's current budget amounts to EUR 3.3 billion.³³⁹

2 National R&I Strategy

Germany's Research and Innovation policy is laid out in the '**High-tech strategy**'. First launched in 2006, the strategy saw several iterations throughout the years:

The first **High-tech strategy for Germany**³⁴⁰ (2006) sets three broad fields of action (innovation for a healthy and safe life, innovation for a communicative and mobile life, innovation through cross-cutting technologies). However, the strategy does not pursue distinct socio-economic objectives but seeks to improve competitiveness and cooperation.

In October 2007, resulting from the EU setting a number of greenhouse gas reduction targets in early 2007, the **High-tech strategy for climate protection**³⁴¹ was published. It sets out the vision to use R&I to react and adapt to climate change as well as to achieve climate protection.

³³⁸ Federal Ministry for Economic Cooperation and Development (2019). *Sonderinitiative EINEWELT ohne Hunger*. Available at: https://www.bmz.de/resource/blob/39130/acbbe75672aafca1b59778cba2df19/191122_FS_SEWoH_web.pdf

³³⁹ Deutsche Forschungsgemeinschaft (2021), available at: https://www.dfg.de/en/dfg_profile/mission/what_is_the_dfg/index.html

³⁴⁰ Federal Ministry for Education and Research (2006), *Die Hightech-Strategie für Deutschland*, available at: https://www.fona.de/medien/pdf/die_hightech_strategie_fuer_deutschland.pdf

³⁴¹ Federal Ministry for Education and Research (2007), *Die Hightech-Strategie zum Klimaschutz*, available at: http://www.cfi21.org/fileadmin/user_upload/hightech_strategie_fuer_klimaschutz.pdf

The **High-tech strategy 2020 for Germany**³⁴² from 2010 took a mission-oriented approach. It framed R&I as a vehicle to address the global challenges in the five fields of climate/energy, health/nutrition, mobility, security and communication. The strategy defines a set of “projects for the future” which pursue technological, scientific and socio-economic objectives over a period of 5-15 years. Several of these projects for the future relate to food policy, but in a fragmented way, focusing on different aspects such as nutrition or sustainable agriculture in Africa.

The new **High-tech strategy: Innovation for Germany**³⁴³ in 2014 sets thematic priorities in fields that have a high innovation drive, high promise to deliver economic growth and where solutions to global challenges can be found. These are: digital economy and society, sustainable economy and energy, innovative world of labour, healthy life, smart mobility and civil security.

The current '**High-tech strategy 2025**' (*Hightech-Strategie 2025*, HTS 2025) dates from 2018.³⁴⁴ The strategy sets out to strengthen R&I in key areas identified as challenges of the future, as well as build capacity in competencies relevant for the future and establish an open culture of innovation and risk-taking. The HTS 2025 is mission oriented, with several of these missions being of relevance to R&I in food systems, such as the objective to further the transformation to a circular economy, maintain biodiversity or reduce plastic waste.

While the HTS 2025 gives a general an overarching direction, several specific R&I strategies provide a more granular focus. Of these, a number relate to R&I in food systems.

The BMBF's **strategy for research for sustainable developments** (*Forschung für Nachhaltige Entwicklungen*, FONA³⁴⁵) implements the HTS 2025 and the German Sustainable Development Strategy (see below) and tackles the key challenges of climate change, energy revolution, resilience of ecosystems, the circular economy, sustainable mobility, and the associated social transformations.

³⁴² Federal Ministry for Education and Research (2010), *Ideen. Innovation. Wachstum: Hightech-Strategie 2020 für Deutschland*, available at: https://web.archive.org/web/20160314125451/https://www.bmbf.de/pub/hts_2020.pdf

³⁴³ Federal Ministry for Education and Research (2014), *Die neue Hightech-Strategie Innovationen für Deutschland*, available at: https://www.bmbf.de/bmbf/shareddocs/downloads/upload_filestore/pub_hts/hts_broschure_web.pdf?__blob=publicationFile&v=1

³⁴⁴ The Federal Government (2019). *Fortschrittsbericht zur Hightech-Strategie 2025*. Available at: https://www.bmbf.de/upload_filestore/pub/Fortschrittsbericht_zur_Hightech_Strategie_2025.pdf

³⁴⁵ Federal Ministry for Education and Research (2020). *Forschung für Nachhaltigkeit*. Available at : <https://www.bmbf.de/SharedDocs/Publikationen/de/bmbf/pdf/forschung-fuer-nachhaltigkeit.html> .

The BMBF's **national research strategy for the bioeconomy 2030** (*Nationale Forschungsstrategie BioÖkonomie 2030, NFSB 2030*³⁴⁶) from 2010 identified five fields of action, of which three were dealing with parts of the food systems. It built the basis and has been merged with the national Bioeconomy strategy (see below).

3 Overview of national food policy

While Germany does not have a national food policy, covering the whole of the food system, as such, there is a coherent strategic pursuit of sustainability throughout the different stages of the food system. Different national policies address various aspects of this but forming a coherent and common direction.

The **German Sustainable Development Strategy (Deutsche Nachhaltigkeitsstrategie, DNS**³⁴⁷) provides the overarching policy framework. The DNS was first developed in 2002 and has been continuously iterated since, with the latest update in 2021. Based on a holistic, integrated approach, the strategy outlines how Germany intends to implement the 17 Sustainable Development Goals as well as fulfil its commitments to the 2030 Agenda. It follows the guiding principle that policies ought to respect the needs of both current and future generations, necessitating economic development to be efficient, socially balanced as well as climate friendly. Funding R&I is set out as one of the pathways to achieve the goals set.

The DNS provides the strategic direction for other related policy areas. Food systems are a topic in a number of these:

The **Strategy for the Future: organic farming** (*Zukunftsstrategie ökologischer Landbau*³⁴⁸) from 2017, published by the BMEL, clearly states the need for R&I funding separate from existing funding streams (such as institutional funding or BMEL project funding), as well as the need for the BMEL's R&I funding to be set within the frame of improving the sustainability of agriculture.

³⁴⁶ Federal Ministry for Education and Research (2010). *Nationale Forschungsstrategie Bioökonomie 2030*. Available at : https://www.research-in-germany.org/dam/jcr:02a5a095-840f-40dd-a937-331721b332ed/Nationale_Forschungsstrategie_Bioökonomie_2030.pdf.

³⁴⁷ The Federal Government (2021). *Deutsche Nachhaltigkeitsstrategie – Weiterentwicklung 2021*. Available at: <https://www.bundesregierung.de/resource/blob/998006/1873516/3d3b15cd92d0261e7a0bcd8f43b7839/2021-03-10-dns-2021-finale-langfassung-nicht-barrierefrei-data.pdf?download=1>.

³⁴⁸ Federal Ministry for Food and Agriculture (2019). *Zukunftsstrategie ökologischer Landbau*. Available at: https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/ZukunftsstrategieOekologischerLandbau2019.pdf;jsessionid=B64AE4A85AD7FA2B50521A6EBE751F42.live832?__blob=publicationFile&v=4.

The BMEL's **legumes-strategy** (*Eiweißpflanzenstrategie*³⁴⁹), published in January 2020, seeks to strengthen German competitiveness in the production of legumes and close gaps in research. The legumes-strategy includes funding for research and innovation into production as well as use of legumes.

The **National Strategy for Food Waste Reduction** (*Nationale Strategie zur Reduzierung der Lebensmittelverschwendung*³⁵⁰) was published by the BMEL in 2019. Support for the promotion of research and development to reduce food wastage and especially making use of the potential of digital transformation are key actions outlined.

The **national Bioeconomy strategy** (*Nationale Bioökonomiestrategie*³⁵¹), adopted in 2020, sets out the national government's plan to increase the use of biological resources and climate-friendly production processes throughout the economy. R&I is identified as a key driver to achieving this sustainability transition, following on from the national research strategy.

4 Public funding available for food R&I

Two data sources were identified and used within the context of this study.

The federal funding database includes projects funded by the Federal Ministry for Education and Research (BMBF), the Federal Ministry for the Environment, Nature Conservation and Nuclear (BMU), the Federal Ministry for Food and Agriculture (BMEL), the Federal Ministry for Justice and Consumer Protection (BMJV) and the Federal Office for Agriculture and Food (BLE). An analysis of 18,693 projects funded³⁵² since 2007 by these ministries found that over this period, 5,852 food-systems related projects were funded.

The Information System for Agriculture and Food Research (*Forschungsinformationssystem Agrar und Ernährung, FISA*) also provides project level data of publicly funded R&I in food

³⁴⁹ Federal Ministry for Food and Agriculture (2020). *Eiweißpflanzenstrategie*. Available at: <https://www.bmel.de/DE/themen/landwirtschaft/pflanzenbau/ackerbau/eiweisspflanzenstrategie.html#doc10544bodyText4>.

³⁵⁰ Federal Ministry for Food and Agriculture (2019). *Nationale Strategie zur Reduzierung der Lebensmittelverschwendung*. Available at: https://www.bmel.de/SharedDocs/Downloads/DE/Ernaehrung/Lebensmittelverschwendung/Nationale_Strategie_Lebensmittelverschwendung_2019.pdf?__blob=publicationFile&v=3.

³⁵¹ Federal Ministry for Education and Research (2019). *Nationale Bioökonomiestrategie - Zusammenfassung*. Available at: https://www.bmbf.de/upload_filestore/pub/BMBF_Nationale_Bioekonomiestrategie_Langfassung_deutsch.pdf.

³⁵² Project data was downloaded from the federal funding database. The database only covers projects funded by the following ministries: the Federal Ministry for Education and Research, the Federal Ministry for the Environment, Nature Conservation and Nuclear, the Federal Ministry for Food and Agriculture, the Federal Ministry for Justice and Consumer Protection (BMJV), the Federal Ministry for Transport and Digital Infrastructure (BMVI) and the Federal Ministry for Economic Affairs and Energy (BMWi). Projects downloaded were filtered by relevant sectors.

systems. The FISA database included total of 8874 R&I projects funded since 2007. After removal of duplicate projects already included in the federal funding database, an additional 1804 food-systems related R&I project from the FISA database had been identified. However, the FISA dataset did not include information as to the source of funding or the recipient. As a result, the below analysis at times will refer only to data from the federal funding database.

Projects funded by the BMWi through its Industrial Cooperative Research programme were not included in the below analysis, as the data was not available in aggregate format. Between 2007 and 2020, 487 projects had been funded by the BMWi in the fields of food & health, food production, food quality and food safety.

Based on the available data, the total amount of public funding to food systems related R&I project amounted to EUR 2,658,961,833.

As shown in the table below, the majority of projects where information about the funding source was available were funded by the BMEL, which also proved to be the biggest funding source (52% of all relevant funding). However, while the BMBF funded fewer food-systems related projects, the average funding amount per project is significantly larger and the BMBF still accounted for 47% of all food-systems-related project funding.

Table 1: Overview of food-systems related public R&I funding, 2007-2020 per federal ministry

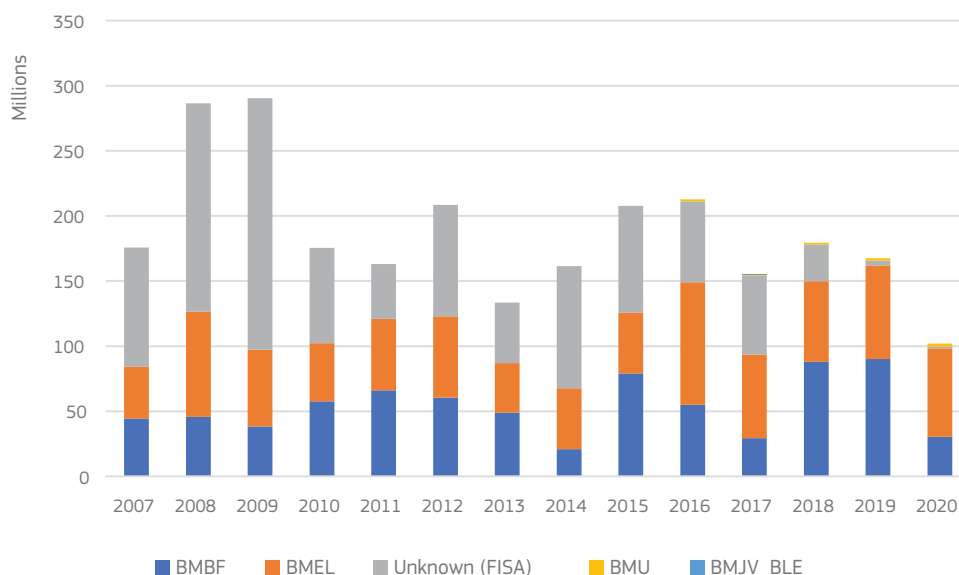
Funding organisation	Funding amount (EUR)	Number of projects funded
BMBF	769,561,721	1,629
BMEL	858,190,457	4,161
BMU	131,404	2
BMJV_BLE	8,106,645	60
FISA (funding source unknown)	1,022,971,606	1,807
BMWi	<i>unknown</i>	487

Source: Federal Funding Database and FISA database, Analysis of food-systems-related projects

Looking at the distribution of funding over the period of 2007-2020, this has remained fairly constant with a slight increase notable overall. However, two significant drops in funding are noticeable. Both the decrease in funding allocated in 2013 and 2014 as well as

the relatively low amount of funding in 2020 mirror EU funding patterns, as these coincide with the end of FP7 and Horizon 2020 respectively. Furthermore, the COVID-19 pandemic, which began in the March of that year, could likely also have been a contributing factor to the drop in food-systems related funding in 2020.

Figure 2: Funding for food-systems-related projects, 2007-2020, per funding ministry



Source: Federal Funding Database and FISA database, Analysis of food-systems-related projects

5 Main recipients of public food R&I investment

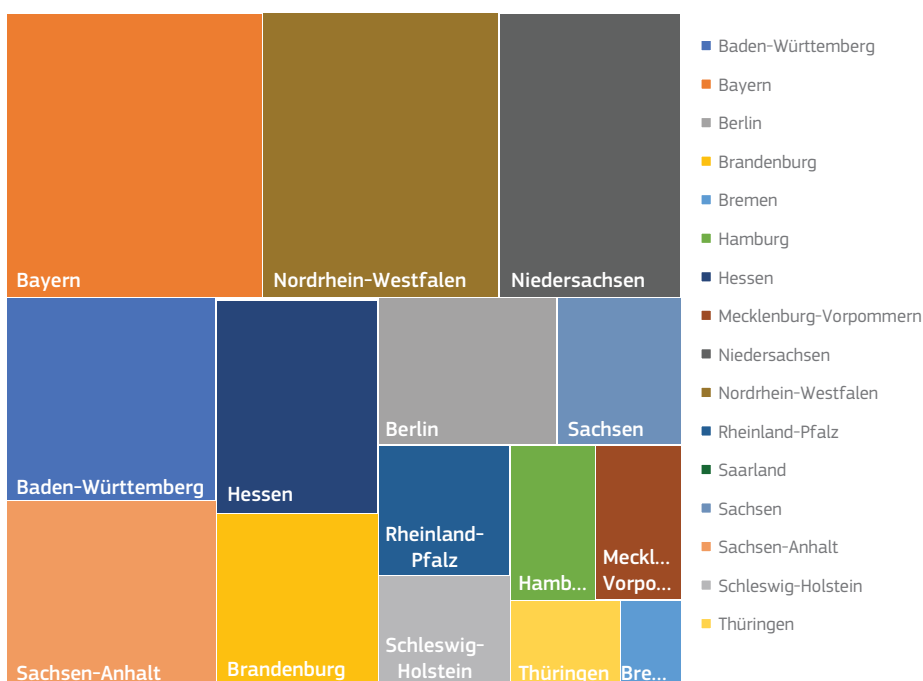
As previously stated, FISA data did not include information about funding recipients. Therefore, the analysis underneath refers solely to the projects available in the federal funding database (79% of identified projects).

Public funding for food-system-related R&I is mostly awarded to dedicated research entities: 45% of public food-systems-related funding during the period analysed was received by academic institutions (such as universities, higher learning institutions or individual academics) and 17% by research institutes or research societies. Four percent of overall

public R&I funding for food-systems related projects alone went to the Fraunhofer Society, and 7% to Federal Research Institutes. Private sector entities received 20% of funding.

Recipients of public food R&I investments seem to be geographically evenly dispersed. Looking at the spread of recipients of the projects analysed within the scope of this study, entities in Bavaria (16%) and North Rhine-Westphalia (15%) received the most food-systems related R&I funding, followed by Lower Saxony (11%) and Baden-Württemberg (9%).

Figure 3: Public funding for food-systems-related R&I 2007-2021, by recipient Bundesland

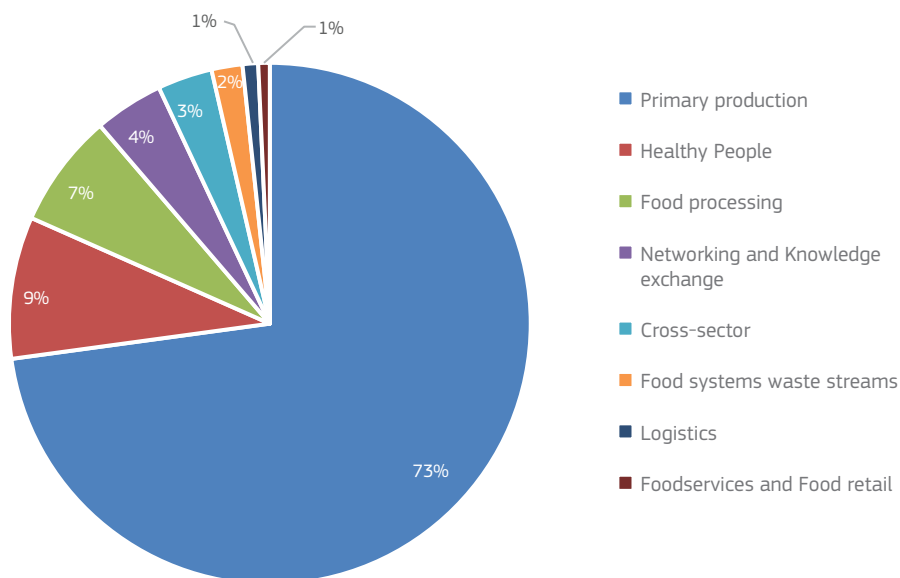


Source: Federal Funding Database, Analysis of food-systems-related projects

Funding by sector

As can be seen in Figure 4 below, almost three-quarters of public funding for food-systems R&I (73%) went to projects that targeted the primary sector. The only other sector receiving close to 10% of relevant public funding was “Healthy People”, with approximately EUR 234 million made available to support R&I.

Figure 4: Public funding for food-systems-related R&I 2007-2021, by sector



Source: Federal Funding Database and FISA database, Analysis of food-systems-related projects (values below 3% not displayed)

6 Structural Funds available for Food R&I

Over the period 2014-2020, EUR 365,143,739 were available for R&I under the European Agricultural fund for Rural Development (EAFRD). Three quarters of this (EUR 272,384,691) is EU funding, with the remaining third (EUR 92,759,048.14) national co-financing.³⁵³ The majority of this funding went to only four states: Baden-Württemberg (21%), Niedersachsen / Bremen (19%), Berlin / Brandenburg (16%) and Schleswig-Holstein (13%).

³⁵³ European Commission (2021). European Structural and Investment Funds: 2014-2020: EAFRD allocation by focus area (EU planned financing). Available at: <https://cohesiondata.ec.europa.eu/2014-2020/2014-2020-EAFRD-allocation-by-focus-area-EU-planne/6q2m-arif>.

This contrasts with the distribution of EAFRD funding overall (i.e. across all categories), which is geographically more evenly spread.

Over one-third (35%) of R&I projects co-funded by EAFRD focused on 'Farm performance'. However, these projects accounted for the majority (59%, EUR 215,681,178.6) of total project funding, of which EUR 159,289,736 was EU funding.

A further EUR 6,704,209,625 of funding (both EU and national funding together) were available for R&I under the European Regional Development Fund.³⁵⁴

7 Links to FOOD2030 priorities and pathways

As can be gathered from the overview of relevant food R&I policies outlined above, the sustainability transformation is a key aim of the German Sustainability Strategy (DNS), the guiding policy framework under which food systems fall. In its current (2021) iteration, the DNS acknowledges the need for a holistic approach to food systems, considering interlinkages and dependencies of different policy areas such as agriculture, health, and environment.

In previous iterations (as well as, to a degree, in its current form), the focus of the DNS is on environmental sustainability by reducing the negative impact of the economy on the environment, reducing emissions and contamination and reducing the use (and waste) of resources. In relation to food systems, this translates into a focus on promoting and fostering environmentally sustainable agriculture. For example, the only two specific indicators defined under the topic of "End hunger, achieve food security and better nutrition, achieve and promote sustainable agriculture" in the 2016 DNS were to reduce excess nitrogen in agriculture, and to increase the area of land that is farmed organically.³⁵⁵

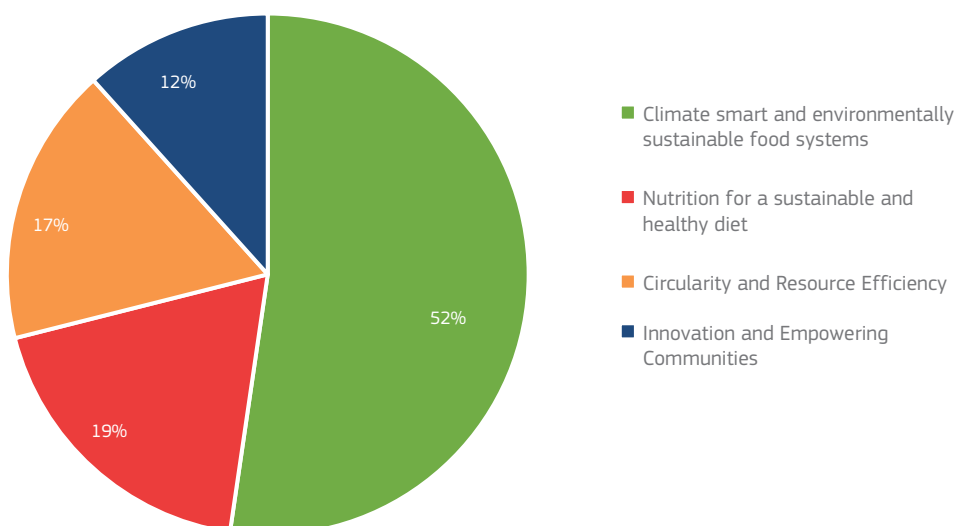
The Food 2030 Priority of "Climate smart and environmentally sustainable food systems" therefore is most aligned with German R&I policy efforts. As can be seen in Figure 5 below, of the food-systems-related project funding distributed since 2007, over half (52%) is aligned with this priority, with a little over EUR 1.39 billion of public funding awarded. The remaining relevant public funding is split relatively evenly between the nutrition (19%, over EUR 498 million) and circularity (17%, circa EUR 458 million). The priority to innovation

³⁵⁴ European Commission (2021). European Structural and Investment Funds – Country Data for: Germany. Available at: <https://cohesiondata.ec.europa.eu/countries/de>.

³⁵⁵ The Federal Government (2016). *Deutsche Nachhaltigkeitsstrategie – Neuauflage 2016*. Available at: <https://www.bundesregierung.de/resource/blob/975292/730844/3d30c6c2875a9a08d364620ab7916af6/deutsche-nachhaltigkeitsstrategie-neuauflage-2016-download-bpa-data.pdf>

and empowering communities however featured less prominently (12%, approximately EUR 309 million).

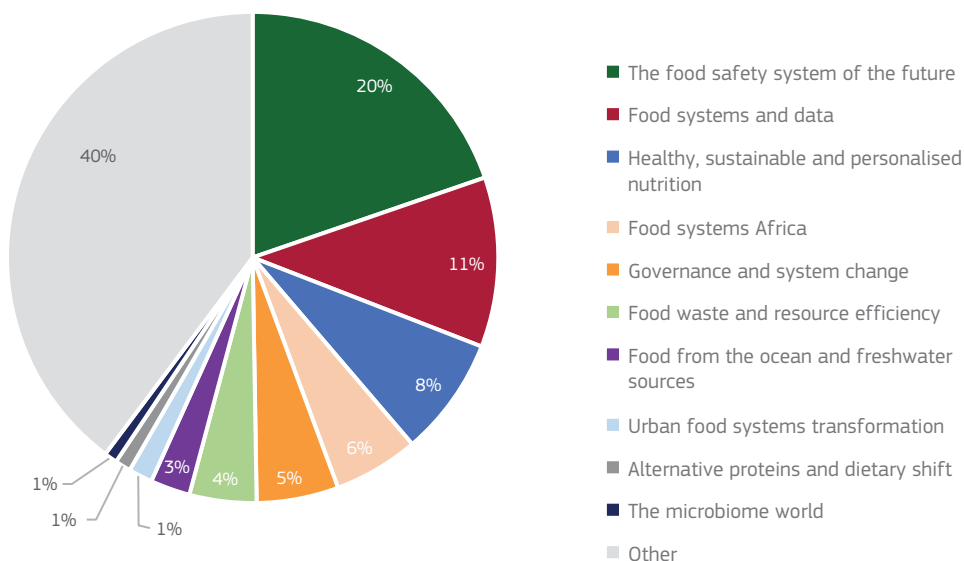
Figure 5: Public funding for food-systems-related R&I 2007-2021, by Food 2030 Priority



Source: Federal Funding Database and FISA database, Analysis of food-systems-related projects

This focus on sustainable and environmentally friendly agriculture is further reflected when considering the alignment of the projects funded with the Food 2030 pathways. 40% of all public funding (over EUR 1 billion) did not map onto one or more of the 10 Food 2030 pathways and have therefore been categorised as “other”.

Figure 6: Public funding for food-systems-related R&I 2007-2021, by Food 2030 Pathway



Source: Federal Funding Database and FISA database, Analysis of food-systems-related projects

Excluding the category of “other”, public funding was allocated to a range of projects covering all of the Food 2030 pathways. Most of these supported projects correspond to the pathway “The Food Safety System of the Future”, with EUR 524 million (20% of overall relevant funding). Projects related to the digitalisation of food systems received EUR 237 million (11% of relevant funding) and projects around healthy, sustainable and personalised nutrition over EUR 208 million (8% of relevant funding).

Interestingly, and contrasting many other countries, a comparatively significant percentage of relevant funding corresponded to the pathway “Food Systems Africa” (6%, EUR 149 million). Furthermore, not included in the data analysed above is funding from the Federal Ministry of Economic Cooperation and Development (BMZ) through the GIZ (*Deutsche Gesellschaft für Internationale Zusammenarbeit*) and the KfW (*Kreditanstalt für Wiederaufbau*).

The BMZ invests approximately EUR 2 billion yearly in projects related to food security, rural development and the protection of natural resources in developing countries, specifically in countries where malnutrition and poverty are prevalent. A third of this is allocated to

the special initiative *One World without Hunger*, which comprises ca. 300 projects, with a particular focus on smallholder farming in Africa. While no project-level data is available to determine the ratio of R&I projects within these, publicly available information reveals that under this initiative, the BMZ supports 15 green innovation centres (14 of which are in Africa) with a total of EUR 415 million between 2014-2024. The initiative also covers support to five knowledge centres on ecological farming in Africa.³⁵⁶ While the lack of detailed project data availability prevents an assessment as to how much of this funding can be classified as R&I related, it does indicate a stronger commitment to the pathway “Food Systems Africa” than visible in the analysis above.

8 Data gaps and limitations

The results of the analysis are based on interviews with relevant officials and publicly available information extracted from the Federal Funding Database and the FISA database.

The federal database only covers projects funded by the following ministries: the Federal Ministry for Education and Research, the Federal Ministry for the Environment, Nature Conservation and Nuclear, the Federal Ministry for Food and Agriculture, the Federal Ministry for Justice and Consumer Protection (BMJV), the Federal Ministry for Transport and Digital Infrastructure (BMVI) and the Federal Ministry for Economic Affairs and Energy (BMWi). The database lacks detailed abstracts explaining the content of individual projects. Classification was therefore carried out using the shorter project titles and keywords, meaning that some projects may have been misclassified or certain nuances may have been missed. The relevant national contact could not provide further data to supplement that available in the database.

Projects funded by the BMWi under its Industrial Cooperative Research programme were not included in that database and were not available in aggregate format elsewhere and thus do not form part of this analysis.

The FISA database did not provide information on recipient or funding entity. Projects appearing in only the FISA database were therefore excluded from certain analyses.

³⁵⁶ Available at: <https://www.bmz.de/de/entwicklungspolitik/ernaehrungssicherung/einewelt-ohne-hunger>

Summary of data sources: Germany

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	<p>The Federal Ministry for Education and Research (BMBF) is the biggest governmental funding entity. It is responsible for promoting basic as well as applied research and innovation in different thematic areas (such as life sciences and sustainability).</p> <p>The Federal Office for Agriculture and Food (BLE), under the responsibility of the Federal Ministry for Food and Agriculture, is a central implementing authority in the agricultural sector and (inter alia) coordinates research strategies and research funding within the agricultural domain.</p> <p>The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Ministry for Economic Cooperation and Development (BMZ) also award funding in areas overlapping with food systems.</p>	<p>https://www.bmbf.de/bmbf/de/home/home_node.html</p> <p>https://www.ble.de/EN/Home/home_node.html</p> <p>https://www.bmu.de/</p> <p>https://www.bmz.de/de</p>

Food innovation related policies	German Sustainable Development Strategy	https://www.bundesregierung.de/resource/blob/998006/1873516/3d3b15cd92d0261e7a0bcd8f43b7839/2021-03-10-dns-2021-finale-langfassung-nicht-barrierefrei-data.pdf?download=1
	Strategy for the Future: organic farming	https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/ZukunftsstrategieOekologischerLandbau2019.pdf;jsessionid=B64AE4A85AD7FA2B50521AGEBE751F42.live832?__blob=publicationFile&v=4
	Legumes-strategy	https://www.bmel.de/DE/themen/landwirtschaft/pflanzenbau/ackerbau/eiweisspflanzenstrategie.html#doc10544bodyText4
	National Strategy for Food Waste Reduction	https://www.bmel.de/SharedDocs/Downloads/DE/_Ernaehrung/Lebensmittelverschwendung/Nationale_Strategie_Lebensmittelverschwendung_2019.pdf?__blob=publicationFile&v=3
	Bioeconomy strategy	https://www.bmbf.de/upload_filestore/pub/BMBF_Nationale_Bioekonomiestrategie_Langfassung_deutsch.pdf

National R&I Strategies	High-tech strategy 2025	https://www.bmbf.de/upload_filestore/pub/Fortschrittsbericht_zur_Hightech_Strategie_2025.pdf
	Strategy for research for sustainable developments	https://www.bmbf.de/upload_filestore/pub/Forschung_fuer_Nachhaltigkeit.pdf
	National research strategy for the bioeconomy 2030	https://www.bmbf.de/upload_filestore/pub/Nationale_Forschungsstrategie_Bioeconomie_2030.pdf

Food innovation funding

	Name and description	Link
	Data bank of funding programs, without funding amount or project-level data available	https://www.foerderdatenbank.de/SiteGlobals/FDB/Forms/Suche/Expertensuche_Formular.html?submit=Suchen&filterCategories=FundingProgram&templateQueryString=nahrung&cl2Processes_Foerderbereich=forschung_innovation_themenspezifisch
	<p>The Federal Funding database covers projects funded by the following ministries: the Federal Ministry for Education and Research, the Federal Ministry for the Environment, Nature Conservation and Nuclear, the Federal Ministry for Food and Agriculture, the Federal Ministry for Justice and Consumer Protection (BMJV), the Federal Ministry for Transport and Digital Infrastructure (BMVI) and the Federal Ministry for Economic Affairs and Energy (BMWi).</p> <p>Project data was downloaded and filtered by relevant sectors.</p>	https://foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=searchmask

Available data (reports, datasets)

Source	Name and description	Link
From desk research	Project data bank with projects funded since 2007 by the Federal Ministry for Education and Research (BMBF), the Federal Ministry for the Environment, Nature Conservation and Nuclear (BMU), the Federal Ministry for Food and Agriculture (BMEL), the Federal Ministry for Justice and Consumer Protection (BMJV) and the Federal Office for Agriculture and Food (BLE)	https://www.foerderdatenbank.de/FDB/DE/Home/home.html

GREECE

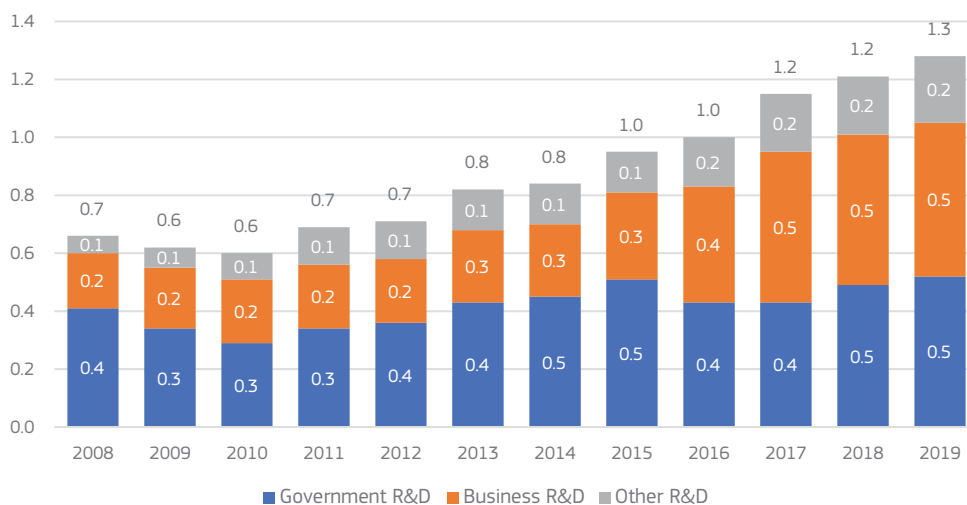
This report provides a brief overview of the public funding available for food systems R&I in Greece.

1 Overview of national R&I landscape

Figure 1 shows levels of R&I expenditure as a proportion of GDP in Greece between 2008³⁵⁷ and 2019³⁵⁸. Total R&I and innovation expenditure has risen across all sectors between 2008 and 2019, with business expenditure experiencing the greatest increase. Government expenditure has also risen steadily as a proportion of GDP over this period, from 0.4% in 2008 to 0.5% in 2019. As of 2019, total expenditure as a share of GDP is 1.3%, of which 0.5% are business resources, and 0.5% are government resources.

Greece does not have a specific food R&I policy, but R&I goals related to food systems are included in smart specialisation strategy 2015–2020.

Figure 1: Gross expenditure on R&I in Greece between 2008 and 2019 as a percentage of GDP



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

³⁵⁷ 2008 is the first year for which complete figures are available

³⁵⁸ 2019 is the last year for which complete figures are available

Main providers of Food R&I funding at national level

The **General Secretariat for Research and Innovation (GSRI)**³⁵⁹ of the Ministry of Development and Investments is the main government actor responsible for defining and coordinating the implementation of national R&I policy in Greece, in cooperation with the **National Council for Research and Innovation (NCRI)**³⁶⁰ and **Special Service for Management and Implementation of Actions in the fields of Research, Technological Development and Innovation (EYDE ETAK)**³⁶¹, of the Ministry of Development & Investment. The **Hellenic Foundation for Research and Innovation (HFRI)**³⁶² was established in 2016 and also contributes to the shaping of national R&I policy, but its primary focus is on the funding of public research organisations.

ELGO-DIMITRA³⁶³ is responsible for research, training, seed production and quality assurance of products in the field of agriculture and provides advisory services in all sectors of the agri-food chain. It also supports the Ministry of Rural Development and Food in its implementation of the Common Agricultural Policy and Common Fisheries Policy.

2 National R&I Strategy

A National Strategic Reference Framework (NSRF) was introduced for the period 2007–2013, providing guidance on restructuring the Greek economy through innovation. The document served as the strategic plan for the GSRI responsible for coordinating R&I actions and aimed to achieve economies of scale and scope at the regional, national and European level and participation in international networks³⁶⁴.

The **National Research and Innovation Strategy for Smart Specialization (RIS3)** was adopted for the period 2014 – 2020. It identified barriers to improving the effectiveness of the national R&I landscape and key national/regional priorities for policy support and investment³⁶⁵. Eight sectors were prioritised for funding based on their competitive

³⁵⁹ [General Secretariat for Research and Innovation \(GSRI\) Website](#)

³⁶⁰ [National Council for Research and Innovation \(NCRI\) Website](#)

³⁶¹ [Special Service for Management and Implementation of Actions in the fields of Research, Technological Development and Innovation \(EYDE ETAK\) Website](#)

³⁶² [Hellenic Foundation for Research and Innovation \(HFRI\) Website](#)

³⁶³ [ELGO-DIMITRA Website](#)

³⁶⁴ General Secretariat for Research and Technology, [Strategic Plan for the Development of Research, Technology and Innovation under the NSRF 2007-13](#), last accessed 14 September 2021.

³⁶⁵ General Secretariat for Research and Technology, Executive Summary, [National Research and Innovation Strategy for Smart Specialization 2014 - 2020](#), last accessed 14 September 2021.

advantage and include 1) Agrofood 2) Life Sciences & Health - Pharma 3) Information and Communication Technologies 4) Energy 5) Environment and Sustainable Development 6) Transport and Logistics 7) Materials – Construction 8) Culture - Tourism - Cultural & Creative Industries.

Key objectives and critical areas for R&I intervention in relation to food systems are outlined in RIS3. The strategy seeks to improve the competitive position of food and agricultural crop products and livestock production in international markets, create a sustainable primary production and processing system and enhance understandings of the relationship between nutrition, health and wellness and the consequences for agricultural food products. It is envisaged that the agri-food sector will also be supported by activities targeted towards the Environment & Sustainable Development field, especially through the protection of terrestrial and marine biodiversity and plant ecosystems alongside the sustainable exploitation of high added value natural products.

3 Overview of national food policy

Greek food policy comprises interventions by the Ministry of Rural Development and Food to solve social, economic, environmental and cultural issues in rural regions. The interventions focus on the primary production of safe quality food products, fair trade and the sustainable use of resources.

4 Public funding available for food R&I

From 2007 to 2013, national R&I strategies and programmes were of a mostly horizontal nature with no specific thematic focus. However, agri-food has been recognised as a thematic priority for R&I since the programming period 2014-20, where it was included as one of the 8 broad priority areas in the context of the national RIS3. In parallel, it has been identified as a priority domain in all 13 of the regional RIS3 strategies of the country. Under the broad context of food systems following an entrepreneurial discovery process, the following priorities were identified:

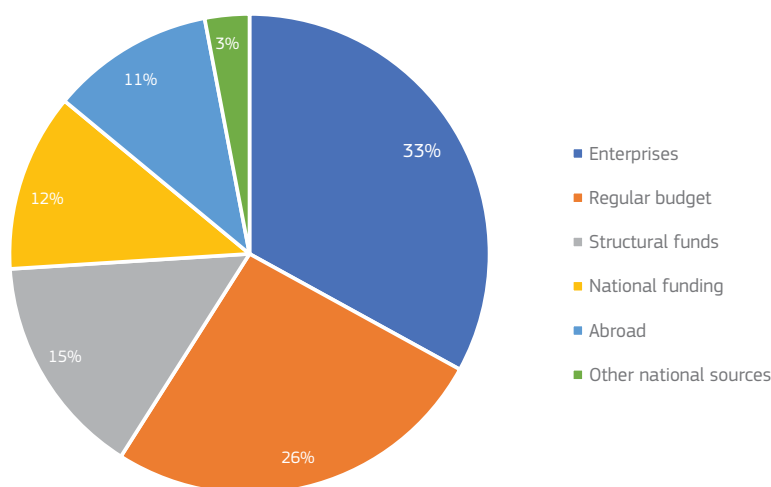
- Emphasis and improvement of the specific characteristics of Greek agricultural products;
- Inputs reduction / rational use of natural resources;

- Increase the productivity of crop and animal production products;
- Improve the quality of crop and animal production products;
- Food and health;
- Food safety;
- Processing technologies;
- Exploitation and application of new technologies in all agricultural and food production systems.

There are no specific targets in terms of R&I investment levels on food systems in Greece. National Funding for R&D (GBAORD) is classified according to the nomenclature for the analysis and comparison of scientific programmes and budgets – NABS. In 2019, GBAORD for “Agriculture” amounted to EUR 56.7 million of a total of EUR 1,288.4 million.

Figure 2 provides an estimation of the proportion of funding available from a variety of sources as outlined in RIS3 at the time of its creation. It is estimated that enterprises provide the greatest sum of funding (33%), followed by the regular budget (26%) and structural funds (15%).

Figure 2: Estimation of sources of funding for research and innovation

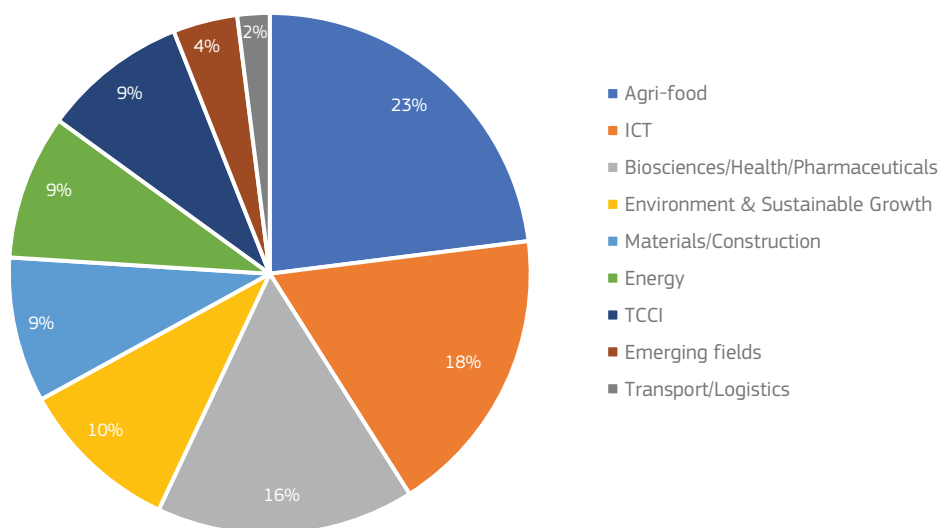


Source: National Research and Innovation Strategy for Smart Specialisation 2014 – 2020

5 Main recipients of public food R&I investment

Figure 3 provides an estimation of the distribution of combined funding sources across the nine priority sectors. The agri-food sector was estimated to receive the majority of R&I funding (23%) over the programming period 2014-20.

Figure 3: Estimation of funding allocation for research and innovation



Source: National Research and Innovation Strategy for Smart Specialisation 2014 – 2020

6 Structural Funds available for Food R&I

The **Competitiveness, Entrepreneurship & Innovation (EPANEK-Restart) programme** combines EUR 1.45 billion in national expenditure with EUR 6.58 billion EU funding from 2014 to 2020. As part of EPANEK-Restart, EUR 4.17 million Euros was allocated to address the priority sectors addressed in RIS3³⁶⁶. In addition, a **Rural Development Programme (RDP)** was in place from 2014 to 2020 with the aim of enhancing the competitiveness and sustainability of the agri-food sector. A total budget of EUR 5.64 billion was allocated to the RDP (EUR 4.7 billion contributed by the European Agricultural Fund for Rural Development combined with EUR 0.94 billion of national expenditure).

³⁶⁶ Hellenic Republic Ministry Of Development And Investment (2021), [Operational Programme: Competitiveness Entrepreneurship & Innovation for 2014 - 2020](#), last accessed 14 September 2021.

7 Links to FOOD2030 priorities and pathways

It was not possible to provide granular data with regard to national expenditure on Food 2030 priorities and pathways. However, FOOD2030 priorities '**nutrition for sustainable and healthy diets**' and '**food systems supporting a healthy planet**' are apparent in the National RIS3 thematic priorities and in particular under 'Nutrition, Health and Consumers' and 'Sustainable Food Production' respectively. The priority '**circularity and resource efficiency**' falls under the strategic theme '**Environment and Circular Economy**' covering also the food sector's priority topic: 'Development and improvement of the entire cycle of value chains', such as food, plastics, construction, materials etc.

The 'innovation and empowering communities' priority is less apparent, but can be detected under various topics (for example: 'Improvement of knowledge on consumers', 'change of consumer's behaviour towards responsible and sustainable production and consumption', relevant education and training etc).

8 Data gaps and limitations

The results of this report are based on publicly available information accessed online and data provided by the Ministry for Development and Investments (Management and Implementation Authority for RTDI Actions), which related to structural funds only. We believe that this data represents the totality of funding available in Greece over the period 2007-2020 and that no public funding was provided for food systems R&I in addition to that allocated via the Structural Funds.

Summary of data sources: Greece

Country context	Name and description	Link
Institutions responsible for funding R&I on food systems	General Secretariat for Research and Innovation (GSRI)	http://www.gsrt.gr/central.aspx?sId=119I428I1089I323I488743
Food innovation related policies	?	?
National R&I Strategies	National Research and Innovation Strategy for Smart Specialization 2014 - 2020	http://www.gsrt.gr/Financing/Files/ProPeFiles20205/Executive%20Summary-2015-09-17-v04(1).pdf
	Strategic Plan for the Development of Research, Technology and Innovation under the NSRF 2007-13	http://www.gsrt.gr/central.aspx?sId=120I512I1269I323I495292&olID=824&neID=824&neTa=119&ncID=0&neHC=0&tbid=0&lrID=2&ol-dUIID=aI824I0I120I512I1269I0I2&actionID=load
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Ad hoc document produced by GSRI.	Not public.
From interviewees	Ad hoc document produced by GSRI.	Not public.

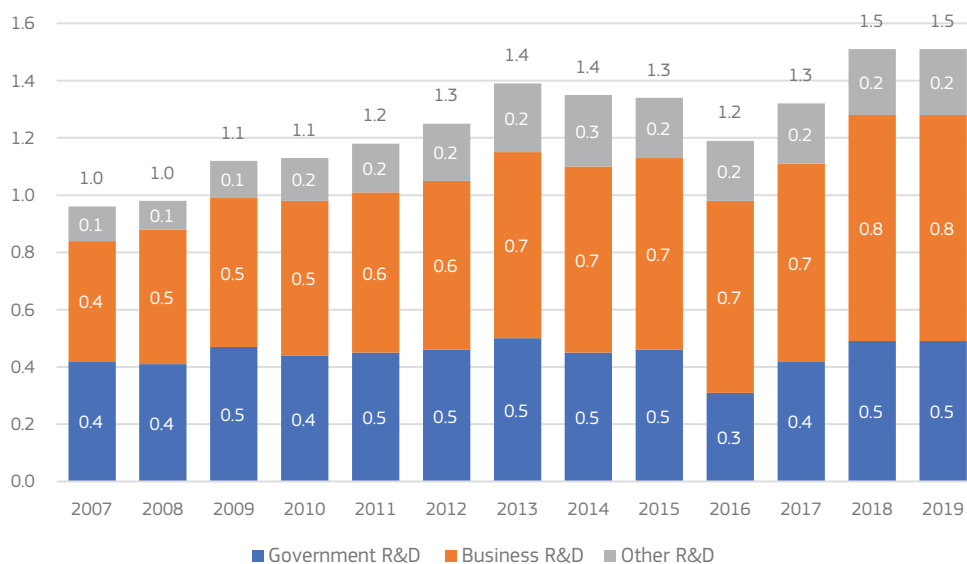
HUNGARY

1 Overview of national R&I landscape

Hungary's R&D expenditure was 1.5% of GDP in 2019. Whilst representing a substantial increase in R&D expenditure since 2008 (1.0%), this remains below the 2020 target of 1.8% (Figure 1).

Hungary has specific strategies in place related to R&I goals in food systems, including the Medium- and Long-term Development Strategy for the Food Industry (2014-2020) and national Food Chain Safety Strategy 2013-2022.

Figure 1: R&D as a percentage of GDP.



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

Main providers of Food R&I funding at national level

The main public sector coordinator of R&I in Hungary is the **National Research, Development and Innovation Office (NRDIO)**. This acts as a central government office with primary responsibility for the public funding of research, development and innovation

activities. It aims to create a stable institutional framework for the financing of domestic R&I activities, ensuring efficient and transparent use of available funds. The establishment of the NRDIO office was aimed to eliminate overlapping of competences and responsibilities related to R&I policy, as these were previously shared by several institutions. In this context, NRDIO represents a public body that coordinates all areas of domestic RDI from policy-making to the management of public R&I funds^{367,368,369}.

The **National Research, Development and Innovation Fund (NRDI Fund)** is the major funding initiative of Hungary to support exploratory (basic) research, applied research, technological development and innovation in all major areas, including food systems. The NRDI Fund is managed by NRDIO, which integrates the former Hungarian Scientific Research Fund (OTKA) and Research and Technology Fund (KTIA). The NRDI Fund provides funding at all levels of the innovation chain, including universities, public research institutions, private research institutions and businesses³⁷⁰. The fund provides support from general calls, encompassing a variety of topics with projects being selected on the basis of excellence.

Other major public bodies responsible for the R&I at the policy level include the Prime Minister's Office, Ministry of Innovation and Technology (MoIT), Ministry of National Economy, Ministry of Human Resources, Ministry of Agriculture (MoA), Ministry of Foreign Affairs and Trade, Hungarian Academy of Sciences and County Government Offices.

Looking at the Hungarian Agriculture Innovation and Knowledge System (AKIS), in 2019 SCAR reported that although elements of the Hungarian AKIS are organized and coordinated, the structure and cooperation between its different elements remained insufficient. On the governmental level the main players are the MoA and the MoIT. The MoA is responsible for agriculture, food industry, fisheries, forestry, environment, natural resources, rural development and agricultural vocational schools. The MoIT is responsible for industry, trade, climate, waste, innovation, research, higher education and vocational schools (except for agriculture). The MoIT is responsible for the NRDIO and the NRDI Fund, with the MoA not having a formalized, direct relationship with these bodies. All of the operational and some of the strategic tasks of research and innovation administration are delegated to the NRDIO³⁷¹.

³⁶⁷ <https://nkfih.gov.hu/english-2017/rdi-policy-coordination/designing-the-system-of>

³⁶⁸ <https://nkfih.gov.hu/english-2017/policy-and-strategy/strategy-making-by-the>

³⁶⁹ <https://njt.hu/jogszabaly/2014-76-00-00.6>

³⁷⁰ <https://stip.oecd.org/stip/policy-initiatives/2017%2Fdata%2FpolicyInitiatives%2F16050>

³⁷¹ https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/key_policies/documents/report-preparing-for-future-akis-in-europe_en.pdf

2 National R&I Strategy

National Development 2030 – National Development and Regional Development Concept represents Hungary’s overall long-term development plan. The document recognizes the development of R&I as one of the main drivers of growth and guarantees of resilience. Within the strategy, food systems represent an important theme and are often mentioned, with one of the main long-term national economic objectives of “export-oriented development of agriculture and the food economy, providing for the internal market, for employment and the supply of healthy foodstuffs”³⁷².

In 2021, Hungary adopted a new national Research, Development and Innovation Strategy for the period 2021-2030, replacing the previous “Investment into the Future - National Research and Development and Innovation Strategy 2020” (RDI strategy), which had been adopted in 2013. The programming period between 2007 and 2013 was governed by the Government’s mid-term (2007-2013) science, technology and innovation policy strategy³⁷³.

According to the strategy for the period 2021-2030, *“The vision of the Hungarian Government is to make Hungary one of the top five countries in Europe by 2030, where it is best to live, live and work. Our second long-term goal is to make Hungary one of the five most competitive countries in the European Union”*.

The strategy centres around research and innovation that is close to the market stage, and sets out three main objectives for the period until 2030³⁷⁴:

- To improve the practical exploitation of research results from public research institutions (research institutes and higher education institutions);
- To improve the innovation performance of domestic enterprises, especially small and medium-sized enterprises;
- To strengthen cooperation between actors in the research, development and innovation system.

To accompany the new strategy, in July 2021 Hungary adopted a new Smart Specialisation Strategy (S3) for the programming period 2021-2027. The goal is to contribute to the implementation of the EU’s “Smarter Europe” policy objective, as well as to the development

³⁷² https://regionalispolitika.kormany.hu/download/b/c9/e0000/OFTK_vegleges_EN.pdf

³⁷³ <https://nkfih.gov.hu/english/strategic-documents/the-government-mid-term-090619#>

³⁷⁴ <https://hirlevel.egov.hu/2021/07/25/magyarorszag-kutatasi-fejlesztési-es-innovációs-strategiaja-2021-2030-kfi-strategia/>

of regional economies and the strengthening of the structural adjustment to industrial transformation and digitalisation. In the S3, eight **national economic priorities** identify smart specialisation pathways where the concentration of resources and the promotion of RDI development can provide a significant competitive edge for Hungary³⁷⁵, one of which is agriculture and the food industry.

The S3 also includes two horizontal priorities which relate to the public sector, and university innovation and training and education.

With regards to the priority of agriculture and food industry, the specific objectives are set out as follows³⁷⁶:

- Developing innovative agricultural technologies in particular solutions regarding water and nutrient requirements with an objective of reducing the environmental impact of crop protection interventions;
- Improving agricultural technologies to adapt to climate change, which will contribute to the development of domestic crop and livestock production;
- Generating higher value added by agri-food businesses through the use of innovative technologies;
- Supporting the internationalisation of the food industry through more processing, and promoting the presence of domestic products on the international markets;
- Developing short supply chains, short-chain marketing, shortening transport distances;
- Promoting the production of healthy and medicinal foods;
- Developing agricultural storage and transport capacities.

Hungary has a national Infrastructure Committee, established on the initiative of the President of the NRIDO. In 2018, a national roadmap was developed within this framework, highlighting the key directions and developments for the Hungarian R&I infrastructure³⁷⁷.

³⁷⁵ <https://nkfih.gov.hu/english/national-smart-specialisation-strategy/s3-2021-2027>

³⁷⁶ <https://hirlevel.egov.hu/2021/07/25/elfogadta-a-kormany-a-nemzeti-intelligens-szakosodasi-strategiat/>

³⁷⁷ <https://nkfih.gov.hu/national-research-infrastructure-roadmap>

3 Overview of national food policy

Agriculture plays an important role in the Hungarian economy, with the total value of agriculture production at EUR 8.3 billion in 2020. The sector accounted for 4% of the Gross Value Added, significantly higher than the EU28 average of 2%. In terms of employment, the agriculture sector accounted for 3% of the total Hungarian workforce in 2020, again higher than the EU average (4%). More than half of the country's land (around 58%) is used for agriculture³⁷⁸. Similarly, over the past years, the food industry's performance has also shown a growing trend as both production and sales have significantly increased. This growth is increasingly driven by domestic sales, although direct exports have also shown strong increases³⁷⁹.

Considering the importance of food systems for the development of Hungary, it can be expected that there are a number of policies that relate to the sector. In particular, for the programming period up to 2020, Hungary implemented the **National Rural Development Strategy 2012-2020**³⁸⁰, managed by the MoA. The Strategy's focus was on the development challenges of agriculture, rural development, food sector and environmental protection. Similarly, the **Rural Development Programme for the period 2014-2020** was focused on supporting agriculture and people living in rural areas, particularly SMEs and young farmers, as well as the development of horticulture, animal husbandry and food processing sectors. The new Rural Development Programme is currently being prepared. Prior to 2014, within the National Strategic Reference Framework for 2007-2013, Hungary implemented the **New Hungary Rural Development Strategic Plan (2007-2013)**³⁸¹.

Another important policy document related to food systems is Hungary's **Medium- and Long-term Development Strategy for the Food Industry (2014-2020)**³⁸². In particular, taking into account the national approach towards food industry as a strategic sector, Hungary developed a strategy which, in addition to laying the foundations for the development area of food processing in the Rural Development Programme (RDP) 2014-2020, served as a guide for the MoA and the Government to develop and implement measures for the entire food industry chain. The Strategy also set out an objective for R&I development through supporting technology and knowledge transfer, and supporting innovation in SMEs. In addition, Hungary is implementing the national **Food Chain Safety**

³⁷⁸ https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-hu_en.pdf

³⁷⁹ <http://www.nak.hu/kiadvanyok/kiadvanyok/3049-the-hungarian-agriculture-and-food-industry-in-figures-2018/file>

³⁸⁰ <https://2010-2014.kormany.hu>

³⁸¹ <https://enrd.ec.europa.eu/sites/default/files/fms/pdf/BA7C138A-FDD7-59D3-D551-31889C39623C.pdf>

³⁸² <http://www.kormany.hu/download/f/82/60000/%C3%89FS.pdf>

Strategy 2013-2022³⁸³. As a responsibility of the MoA, this strategy encompasses topics along the entire food systems value chain, including food chain safety knowledge management, control of food chain risks and control of unknown hazards and unacceptable risks. The strategy also contains an R&I focus, particularly towards developing partnerships among R&I stakeholders and research in the field of customer preferences and the development of products and technology for sustainability and food chain safety.

Launched in 2019, the **Digital Agricultural Strategy** has the goal to increase the profitability of agri-food and agricultural production by collecting and processing information, automating and robotizing technological operations while paying attention to the efficient use of natural resources. The implementation of the strategy is expected to begin in 2021, with an estimated funding need of HUF 55 billion (EUR 155 million)³⁸⁴.

Other relevant policy documents include “FOOD FOR LIFE” Consensus Innovation Strategic Plan 2014-2029³⁸⁵ prepared by Hungarian National Food Technology Platform, Seed Sector Strategy³⁸⁶, Multiannual National Strategy Plan on Aquaculture of Hungary 2019-2022³⁸⁷ and Professional Strategy for Preservation of Plant Genetic Resources for Food Purposes 2013-2020³⁸⁸.

4 Public funding available for food R&I

According to data from the public databases, a total of 300 R&I food-related projects were developed by Hungarian organisations between 2008 and 2020, receiving a total of EUR 77.8 million in funding. A review of the number of projects approved during this period shows that 2012 and 2016 were the years with the highest number of projects approved (56 and 73 respectively). The year in which the highest funding was used for food-related projects was 2016 (EUR 26.0 million) (**Figure 2**).

³⁸³ <https://cdn.kormany.hu/uploads/document/f/f0/f0a/f0a7a2bec373d6f9e1c8f33c846f7d8ed1b12351.pdf>

³⁸⁴ https://ec.europa.eu/info/sites/default/files/2020-european-semester-national-reform-programme-hungary_en.pdf

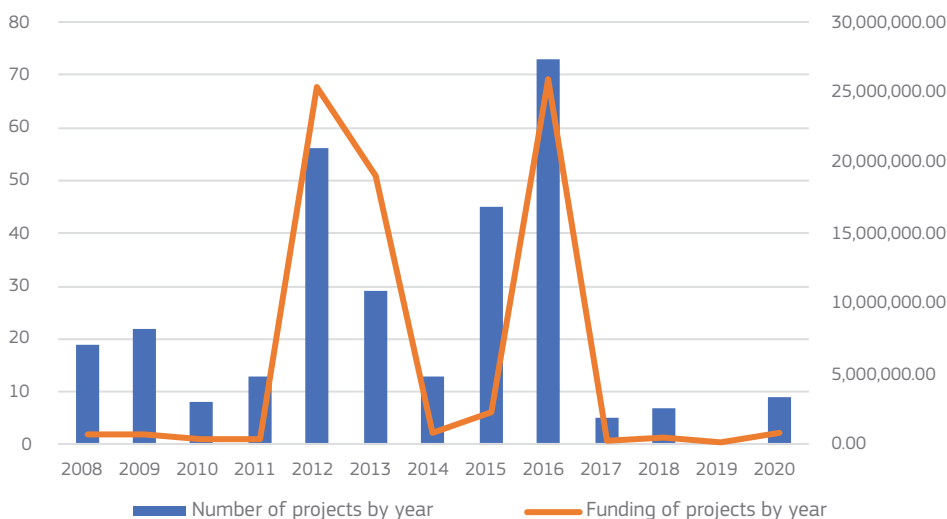
³⁸⁵ http://www.techplatform.hu/letoltes/mnetp_egveztetett_innov_strat_vegso_valtozat_ff.pdf

³⁸⁶ <http://www.vszth.hu/hu/agazati-strategia/vetomag-agazati-strategia.html>

³⁸⁷ http://halaszat.kormany.hu/download/d/f5/f0000/2015_03_30_NAS_4%201_program%25C3%25ADr%25C3%25B3i%20verzi%25C3%25B3_v%25C3%25A9lem%25C3%25A9nyez%25C3%25A9sre.pdf

³⁸⁸ http://www.biodiv.hu/hazai-genmegorzes/hazai-strategia-genetikai-eroforrasok-megorzese/elelmnovgenforras-strategia_2013-2020_final.pdf

Figure 2: R&I food related projects between 2008 and 2020.



Source: Analysis of data from public database of NKFI and the quantitative mapping database developed for the Assessment of Research and Innovation on Food Systems by European Member States (SCAR, 2018) (2021)

5 Main recipients of public food R&I investment

The databases used in this analysis often do not identify the coordinator of each project or the involved entities. It is thus not possible to identify the main recipients of funding in an accurate and consistent manner.

6 Structural Funds available for Food R&I

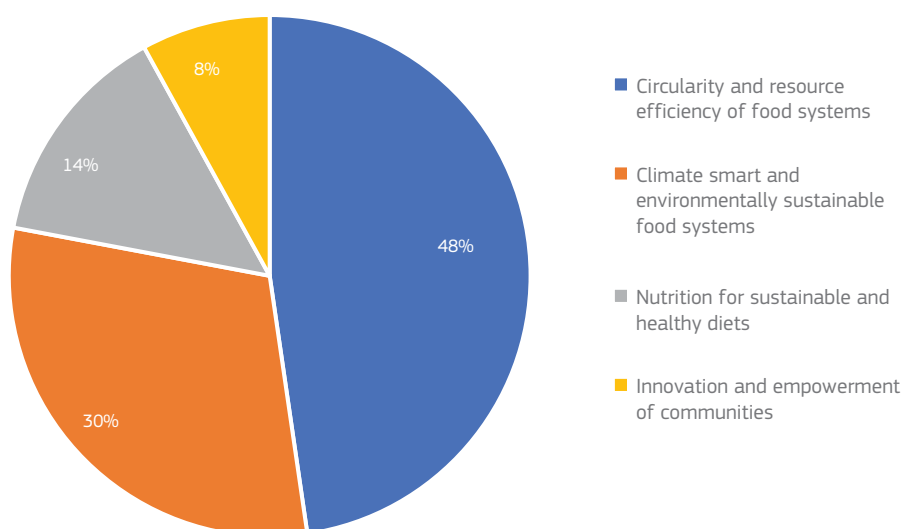
Hungary, through nine national programmes, benefits from ESIF funding of EUR 25 billion. The total budget is thus around EUR 30 billion if the national co-funding is also included. From this total of EUR 30 billion, the budget for EARDF is around EUR 4.1 billion. Regarding the EARDF, by 2021, EUR 4.5 billion of approved budget was allocated to the approved projects, with EUR 2.5 billion reported as actual expenditure from the selected projects³⁸⁹.

³⁸⁹ <https://cohesiondata.ec.europa.eu/countries/HU>

7 Links to FOOD2030 priorities and pathways

As illustrated in Figure 3, publicly funded food-related R&I in Hungary has prioritised research in Circularity and resource efficiency of food systems (48% of the total, corresponding to EUR 37.1 million). This was followed by Climate smart and environmentally sustainable food systems and nutrition for sustainable and healthy diets (30% and 14%, respectively) and Innovation and empowerment of communities (8%).

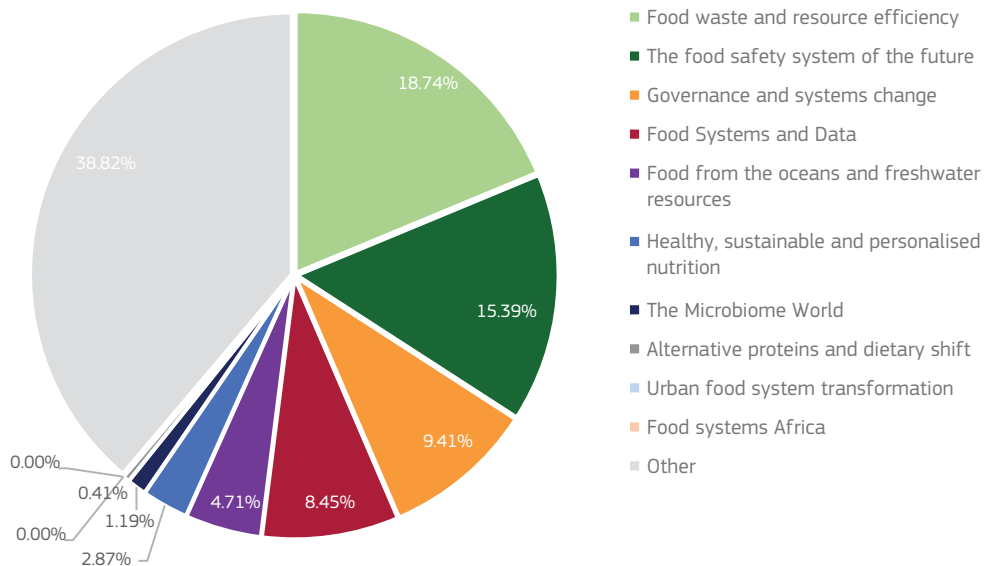
Figure 3: Distribution of funding by FOOD2030 priority



Source: Analysis of data from public database of NKFI and the quantitative mapping database developed for the Assessment of Research and Innovation on Food Systems by European Member States (SCAR, 2018) (2021)

As Figure 4 illustrates, of the FOOD2030 pathways, the largest proportion of budget was dedicated to Food waste and resource efficiency (19% corresponding to EUR 14.6 million). Following this are Food safety systems of the future (15%, corresponding to EUR 12.0 million) and Governance and system change (9%, corresponding to EUR 7.3 million). The largest proportion of spending (39%, corresponding to EUR 30.2 million) goes to projects that could not be considered against any of the FOOD2030 pathways.

Figure 4: Distribution of funding by FOOD2030 pathway



Source: Analysis of data from public database of NKFI and the quantitative mapping database developed for the Assessment of Research and Innovation on Food Systems by European Member States (SCAR, 2018) (2021)

8 Data gaps and limitations

The analysis includes data from NKFI and the quantitative mapping database developed for the Assessment of Research and Innovation on Food Systems by European Member States. Information not available in the databases includes, among others: project description, keywords, technology readiness level (TRL), publications and patents.

Summary of data sources: Hungary

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	National Research, Development and Innovation Office	The National Research, Development and Innovation Fund (NRDI Fund) https://nkfih.gov.hu/
Food innovation related policies	National Rural Development Strategy 2012-2020	http://videkstrategia.kormany.hu/
	Medium- and Long-term Development Strategy for Food Industry (2014-2020)	http://www.kormany.hu/download/f/82/60000/%C3%89FS.pdf
	Food Chain Safety Strategy 2013-2022	https://cdn.kormany.hu/uploads/document/f/f0/f0a/f0a7a2bec373d6f9e1c8f33c846f7d8ed1b12351.pdf
	Digital Agricultural Strategy	https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2019/Telecom19/3-Juhasz%20Aniko_AGMF.pdf
National R&I Strategies	National Development 2030 – National Development and Regional Development Concept represents	https://regionalispolitika.kormany.hu/download/b/c9/e0000/OFTK_vegleges_EN.pdf
	Research, Development and Innovation Strategy for the period 2021-2030	https://hirlevel.egov.hu/2021/07/25/magyarorszag-kutatasi-fejlesztési-es-innovációs-strategiaja-2021-2030-kfi-strategia/
	Smart Specialisation Strategy (S3) for the programming period 2021-2027	https://nkfih.gov.hu/english/national-smart-specialisation-strategy/s3-2021-2027

EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Hungary, through 9 national programmes, benefits from ESIF funding of EUR 25 billion. The total budget is around EUR 30 billion if the national co-funding is also counted. From the total of EUR 30 billion, the budget for EARDF is around EUR 4.1 billion. Regarding the EARDF, by 2021, EUR 4.5 billion was allocated to selected projects (decided), with EUR 2.5 billion reported as the expenditure from the selected projects (spent).	https://cohesiondata.ec.europa.eu/countries/HU
Food innovation funding		
	Name and description	Link
Specific food innovation related R&I competitions/ funding	N/A	N/A
Available data (reports, datasets)		
Source	Name and description	Link
SCAR quantitative mapping	?	N/A
NKFI Database	?	http://nyilvanos.otka-palyazat.hu/index.php?menuid=920

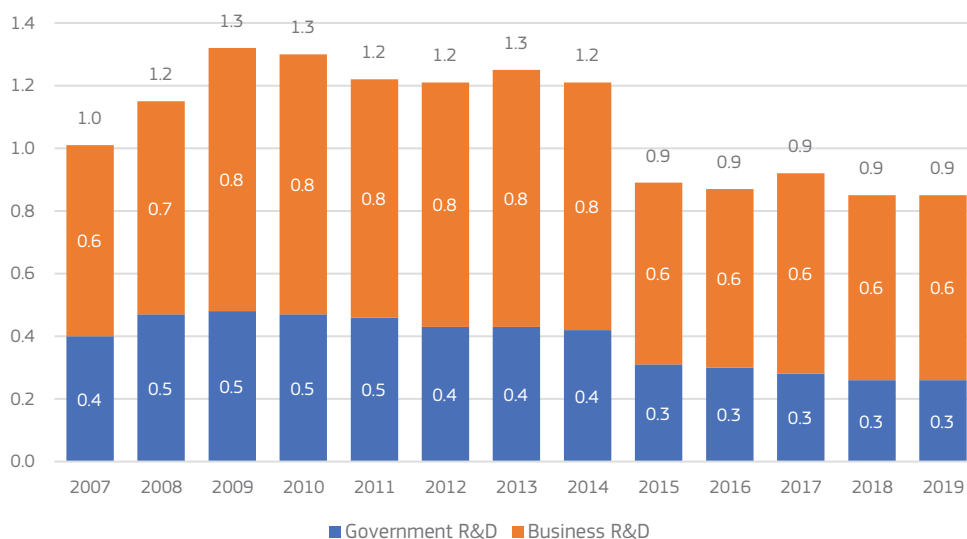
IRELAND

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Ireland from 2007 to 2019.³⁹⁰ Overall R&I expenditure increased from 2007 to 2014, largely driven by an increase in business expenditure. A notable decrease can be noted from 2015 onwards, correlated with decreases in both government and business R&I investment.

Ireland does not have a standalone food R&I policy, but food is embedded in the objectives of the strategy for science, technology and innovation.

Figure 1: R&I expenditure in Ireland as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

³⁹⁰ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Main providers of Food R&I funding at national level

The primary funding institution for food related R&I in Ireland is the **Department of Agriculture, Food and the Marine (DAFM)**. DAFM seeks to oversee an innovative and sustainable agri-food sector operating to the highest standards within its remit of serving the Irish government and Irish peoples³⁹¹. It previously operated three separate competitive research funding programmes covering agriculture (Research Stimulus Fund), food (Food Institutional Research Measure) and forestry (Programme of Competitive Forest Research for Development). The **Food Institutional Research Measure** provided funding for projects relating to the development of technologies that aimed to support a competitive food manufacturing and marketing sector. However, as of December 2020³⁹², these programmes have been replaced by five strands³⁹³: the **Thematic Research Strand, International Outreach Strand, Strategic Studies Strand, Industry Focused Strand, and Coordination and Support Activities**.

Other relevant actors

There are a number of DAFM-affiliated organisations in Ireland that develop agri-food related R&I. These include Teagasc (Ireland's agriculture and food development authority), the Marine Institute, Bord Iascaigh Mhara, Science Foundation Ireland, Sustainable Food Systems Ireland, and a litany of Ireland's research-intensive universities, namely, University College Dublin and University College Cork. **Teagasc**, in particular, provides research, advisory and training services across six categories: animals, crops, environment, food, rural economy, and education.

2 National R&I Strategy

The national R&I strategy for Ireland for 2006-2013 is described in the **Strategy for Science, Technology & Innovation (SSTI)**, which established the framework for the Irish government's investment in research and innovation during this. Following this, Ireland's desire to maintain its position as one of Europe's top innovation nations by addressing its R&I challenges and remain competitive, is outlined in its cross-Government Strategy for

³⁹¹ <https://www.gov.ie/en/organisation-information/ffeb5-about-us/>

³⁹² <https://www.gov.ie/en/publication/ce553-research/>

³⁹³ Ibid.

Research and Development, Science and Technology, **Innovation 2020**³⁹⁴. Its objectives sit within six broad enterprise themes, one of which explicitly includes food:

- ICT;
- Manufacturing and Materials;
- Health and Medical;
- Food;
- Energy; and
- Services & Business Processes.

The strategy defines 14 priority areas³⁹⁵: 1) Future Networks and Communications; 2) Data Analytics, Management, Security & Privacy; 3) Digital Platforms, Content & Applications; 4) Connected Health & Independent Living; 5) Medical Devices; 6) Diagnostics; 7) Therapeutics – Synthesis, Formulation, Processing & Drug Delivery; 8) Food for Health; 9) Sustainable Food Production & Processing; 10) Marine Renewable Energy; 11) Smart Grids & Smart Cities; 12) Manufacturing Competitiveness; 13) Processing Technologies & Novel Materials; 14) Innovation in Services and Business Processes.

The main priorities concerning the Irish agri-food sector include³⁹⁶:

- Progressing the economic development and enhancing the competitiveness of the sector, with a focus on efficiency and profitability;
- Becoming a recognised world leader in sustainable, scientifically verified food production, and capturing new market opportunities;
- Promoting and enhancing the already high standards of food safety, consumer protection, animal health and welfare, and plant health; and
- Becoming a consumer/citizen orientated industry, with incremental and significant innovations in food.

³⁹⁴ https://ec.europa.eu/ireland/news/key-eu-policy-areas/research-and-innovation_en

³⁹⁵ https://enterprise.gov.ie/en/Publications/Publication-files/Innovation-2020.pdf.,_p_24_

³⁹⁶ Ibid., p. 51.

3 Overview of national food policy

Foodwise 2025³⁹⁷ (FW) is Ireland's current (2015-2025) 10-year plan for the agri-food industry – having replaced **Harvest 2020** – and will be superseded by the **Agri-Food Strategy 2030**. Its implementation is overseen by the High Level Implementation Committee (HLIC), chaired by the Minister for Agriculture, Food and the Marine and involves senior officials from relevant Government Departments and state agencies³⁹⁸. FW also meets the guidelines and commitments of the Sustainable Development Goals (SDGs) of the United Nations, with particular emphasis on goals 2 (zero hunger) and 14 (sustainable seas, oceans, and marine resources)³⁹⁹. The plan further encompasses a range of strategic actions aligned with: Sustainability, Human Capital, Market development, Competitiveness, and Innovation, and seeks to achieve the following growth projections:

- Increasing the value of agri-food exports by 85% to €19 billion;
- Increasing the value added in the agri-food, fisheries and wood products sector by 70% to in excess of €13 billion;
- Increasing the value of primary production by 65% to almost €10 billion; and
- The creation of an additional 23,000 direct jobs in the agri-food sector all along the supply chain from primary production to high value added production to high value added product development.

At the same time, FW recognises that the environmental impact of a significant increase in food production cannot be overlooked, in particular regarding concerns over the depletion of natural resources and its potential impact on climate change⁴⁰⁰. This approach is addressed under a FW guideline stipulating that environmental protection and economic competitiveness are equal and complementary, such that one will not be achieved at the expense of the other.

Additionally, the plan highlights the strategic importance of research, development, and innovation (RDI) as key drivers of both short and long-run competitiveness. In establishing and maintaining this, FW argues that greater focus on consumer demands and insights is central to future investment in research and innovation. The development of a Centre for

³⁹⁷ <https://www.skillnetireland.ie/publication/food-wise-2025/>

³⁹⁸ <http://www.budget.gov.ie/Budgets/2017/Documents/NED/Session-6-Foodwise.pdf>, p.4.

³⁹⁹ <https://www.gov.ie/en/campaigns/a5881-food-systems-summit-2021-irelands-national-dialogues/>

⁴⁰⁰ https://sustainabledevelopment.un.org/content/documents/19382Ireland_Voluntary_National_Review_2018.pdf

Consumer Insight is recommended to achieve this in order to capture key consumer trends and insights in specific markets and inform the industry on further product innovation and development research.

In April 2021, the DAFM announced the **Agriculture Action Plan 2021**⁴⁰¹, building on FW, which outlines 75 actions to further develop a sustainable, innovative, and competitive agri-food, forestry and seafood sector. The statement of strategy sets out five strategic goals for the department:

- To promote and safeguard public, animal and plant health and welfare for the benefit of consumers, producers, the economy and wider society;
- Provide income and targeted supports to farm families and others in the agri-food sector to underpin the balanced rural economy and optimise environmental sustainability.
- Provide the optimum policy framework for the sustainable development of the agri-food sector;
- Deliver a sustainable, competitive, and innovative seafood sector, driven by a skilled workforce, delivering value added products in line with consumer demand; and
- Maintain and develop strategic, operational, regulatory, and technical capacity and capability to deliver excellent services to our customers.

In the same month, the DAFM announced the public consultation on the environmental assessment of the draft Agri-Food Strategy to 2030⁴⁰². The strategy sets forth a path for Ireland's establishment as a world leader in Sustainable Food Systems over the next decade, and as a result, significant benefits for the Irish agri-food sector itself, Irish society and the environment are expected. With these objectives in mind, four high-level missions are sought achieving:

- A Climate Smart, Environmentally Sustainable Agri-Food Sector;
- Viable and Resilient Primary Producers with Enhanced Wellbeing;

⁴⁰¹ <https://www.gov.ie/en/press-release/c1473-mcconalogue-publishes-agriculture-food-and-the-marine-action-plan-2021/>

⁴⁰² <https://www.gov.ie/en/consultation/bd894-public-consultation-on-the-environmental-assessment-of-the-draft-agri-food-strategy-to-2030/>

- Food that is Safe, Nutritious and Appealing, Trusted and Valued at Home and Abroad; and
- An Innovative, Competitive, and Resilient Sector, driven by Technology and Talent.

Origin Green⁴⁰³ was launched in 2012 by Bord Bia, the Irish Food Board, and is run in collaboration with the Irish food and drink industry. Its vision is to establish Irish food and drink as first choice globally because it is sustainably produced. The programme operates on a national scale, uniting the government, private sector, and full supply chain: from farmers and food producers to the foodservice and retail sectors. It is the world's only national food and drink sustainability programme, allowing the industry to set and achieve measurable sustainability targets that respect the environment and improve the service to local communities.

4 Public funding available for food R&I

As previously mentioned, for the period until December 2020, DAFM ran three separate research funding programmes, under which it made grant awards on a competitive basis for collaborative research projects. A spending review for the period 2010-2017 completed by the DAFM's Irish Government Economics and Evaluation Service (IGEES), estimated approximately €142.6 million was committed to projects under these programmes⁴⁰⁴. Two of particular salience are: the **Research Stimulus Fund** (RSF), which funded agriculture-related research projects, and the **Food Institutional Research Measure** (FIRM), which was aimed at food-related research projects.

FIRM was established within the **National Development Plan** 2000-2006, and designed to form part of the Research, Technological Development, and Innovation (RTDI) priority response⁴⁰⁵. It provided funding for projects aimed at developing technologies that would support a competitive food manufacturing and marketing sector, having been established as the primary national funding mechanism for food research in higher education institutions and other public research institutions⁴⁰⁶. According to IGEES, 125 projects were funded under FIRM between 2010 and 2017 at a total funding cost of €74.2 million⁴⁰⁷.

⁴⁰³ <https://www.origingreen.ie/>

⁴⁰⁴ <https://igees.gov.ie/wp-content/uploads/2020/11/DAFM-Competitive-Research-Programmes.pdf>

⁴⁰⁵ Ibid.

⁴⁰⁶ <https://www.gov.ie/en/service/d1955e-food-institutional-research-measure/#:-:text=The%20Food%20Institutional%20Research%20Measure%20provides%20funding%20for%20projects%20aimed,and%20other%20public%20research%20institutes.,p.1>

⁴⁰⁷ <https://igees.gov.ie/wp-content/uploads/2020/11/DAFM-Competitive-Research-Programmes.pdf>

The RSF was the primary national funding mechanism for food research in higher education institutions and other public research institutes, providing funding aimed at developing technologies that would support a competitive food manufacturing and marketing sector⁴⁰⁸. The projects funded under RSF were designed to complement Teagasc's mainstream research programme activity in the primary agricultural production area funded as part of DAFM's annual block grant-in-aid to Teagasc⁴⁰⁹. As such, the RSF emphasised building a knowledge economy with strong research capabilities in the primary agriculture sector. IGEES estimated that funding channelled through RSF totalled €56.9 million between 2010 and 2017, with an output of 73 total projects⁴¹⁰

In December 2020, the Minister of DAFM agreed to the amalgamation of the three aforementioned research funding programmes, forming a suite of research strands tailored to address a diverse range of challenges and opportunities in the agri-food, forest, and biobased sectors. This is expected to ensure the resilience, not just of Ireland's systems and the threats they face, but also the role they can play in enhancing biodiversity, the provision of ecosystem services, and their contributions to a sustainable circular bioeconomy⁴¹¹.

As outlined in the DAFM's funded research article⁴¹², the updated programme strands are as follows:

- The **Thematic Research Strand**, launched periodically, seeks to cover experimental research under broad thematic, cross-cutting, and mission-orientated approaches to key RDI challenges. The inclusion of 'other eligible actors' will be piloted with the aim to include the activities of 'innovation intermediaries' to support research performing organisations (RPO) with the wider stakeholder knowledge transfer/dissemination activities of the project and encourage a multi-actor engagement in the projects. Co-funding with other agencies will continue as a feature of this programme.
- The **International Outreach Strand** facilitates participation in relevant competitive calls operated trans/inter-nationally. This strand will enable researchers in Irish RPOs to leverage expertise, data, and other infrastructure not readily available in Ireland and help embed them in multi country consortia that are better placed to compete under large non-Exchequer funded Calls.

⁴⁰⁸ Ibid., p. 6.

⁴⁰⁹ Ibid.

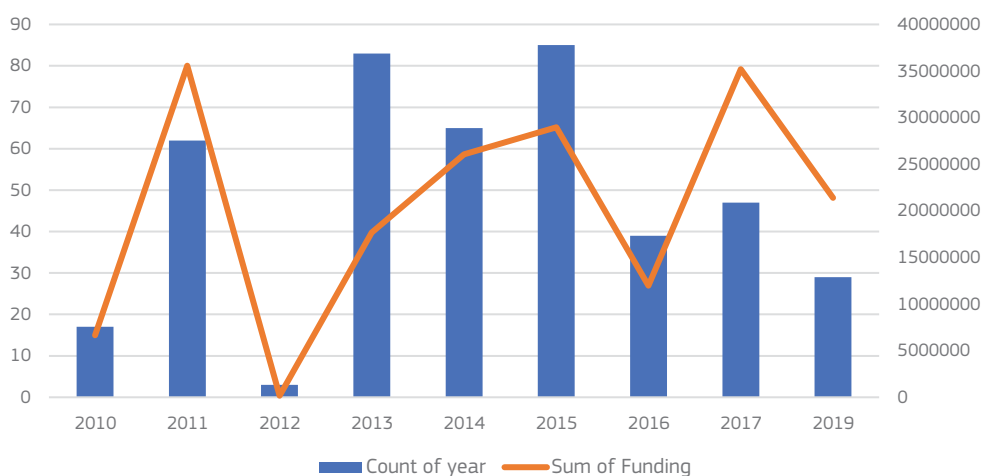
⁴¹⁰ Ibid., p. 1.

⁴¹¹ <https://assets.gov.ie/101183/a398f5cf-3305-4755-8b5e-fe0d292fa950.pdf>, p. 5.

⁴¹² <https://www.gov.ie/en/publication/ce553-research/>

- The **Strategic Studies Strand** is designed to provide a more flexible funding vehicle capable of addressing mainly policy issues more rapidly whilst still requiring scientific rigour. It is proposed that the initial Call under this programme will be run on a pilot basis early next year and, if successful, will be rolled out through smaller, more frequently open Calls based on specific topics identified by DAFM to address immediate or short- to medium-term strategic/policy needs.
- The **Industry Focused Strand** will comprise of two industry-oriented initiatives:
 - **Research Plus** aims to bring completed or near completed DAFM funded projects to a point where they are eligible for funding under programmes operated by other organisations in particular Enterprise Ireland’s Commercialisation Programme.
 - **Innovation Platform** facilitates industry-led, higher technology level (HRL), 5-year collaborative research with RPOs with a mandatory industry co-funding of 30%.
- **Coordination and Support Activities** will be used on an ongoing basis to fund relevant miscellaneous ancillary coordination and support type activities relating to research undertaken by DAFM-funded RPO based researchers as deemed appropriate.

Figure 2: R&I food related projects between 2010-2020



Source: Ipsos analysis of data provided by DAFM

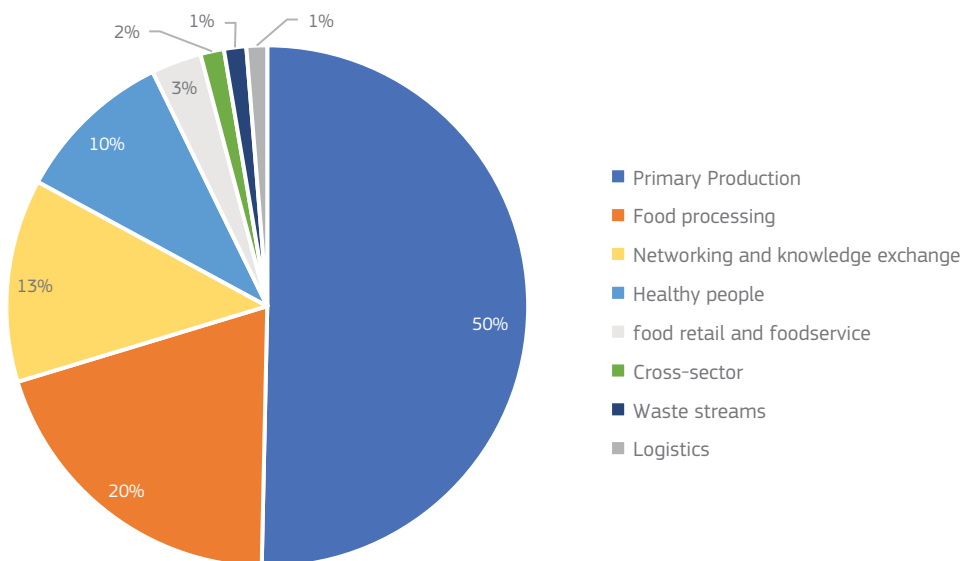
Base: 389 projects

There has been significant fluctuation in the number of food related R&I projects from 2010 to 2020, reaching a peak of projects funded in 2015 (85 projects, corresponding to EUR 29.0 million), and with the highest public expenditure in 2011 (62 projects, corresponding to EUR 35.6 million). The lowest year for both projects funded and expenditure amount was 2012 (3 projects, corresponding with EUR 0.17 million).

Funding by sector

The sector that received the highest proportion of public expenditure for food related R&I was Primary production (50%, corresponding to EUR 86.8 million), followed by Food processing (20%, corresponding to EUR 35.9 million). The smallest proportion of funding (EUR 2.1 million) was allocated to logistics.

Figure 3: Distribution of funding by sector



Source: Ipsos analysis of data provided by DAFM

Base: 389 projects

5 Main recipients of public food R&I investment

The databases used in this analysis often do not identify the coordinator of each project or the involved entities. It is thus not possible to identify the main recipients of funding in an accurate and consistent manner.

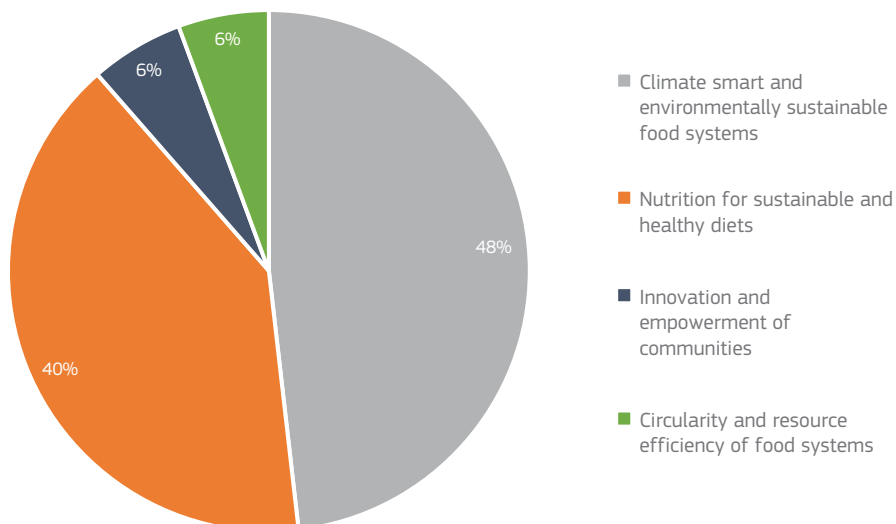
6 Structural Funds available for Food R&I

Ireland has access to the European Structural Investment (ESI) Funds, which consists of five programmes: European Regional Development Fund (ERDF); European Social Fund (ESF); Cohesion Fund (CF); European Agricultural Fund for Rural Development (EAFRD); and the European Maritime and Fisheries Fund (EMFF). Through five national and regional funds Ireland has been allocated EUR 3.36 billion of ESI funds, with a national contribution of EUR 2.27 billion, over the time period 2010-2020. This means Ireland has a total budget of EUR 6.13 billion for the time period in question, with a large majority of this arising through EAFRD (65.2%, corresponding to EUR 2.2 billion).

7 Links to FOOD2030 priorities and pathways

In terms of FOOD2030 Priorities, the largest share of public expenditure goes to the priority of Climate smart and environmentally sustainable food systems (48%, corresponding to EUR 78.7 million), followed closely by Nutrition for sustainable and healthy diets (40%, corresponding to EUR 66 million). For the priorities of Innovation and empowerment and Circularity and resource efficiency of food systems of communities they have a relatively equal share of public expenditure at 6% (Corresponding to EUR 0.95 million) and 6% (corresponding to EUR 0.92 million) respectively.

Figure 4: Distribution of the Funding by FOOD2030 Priority

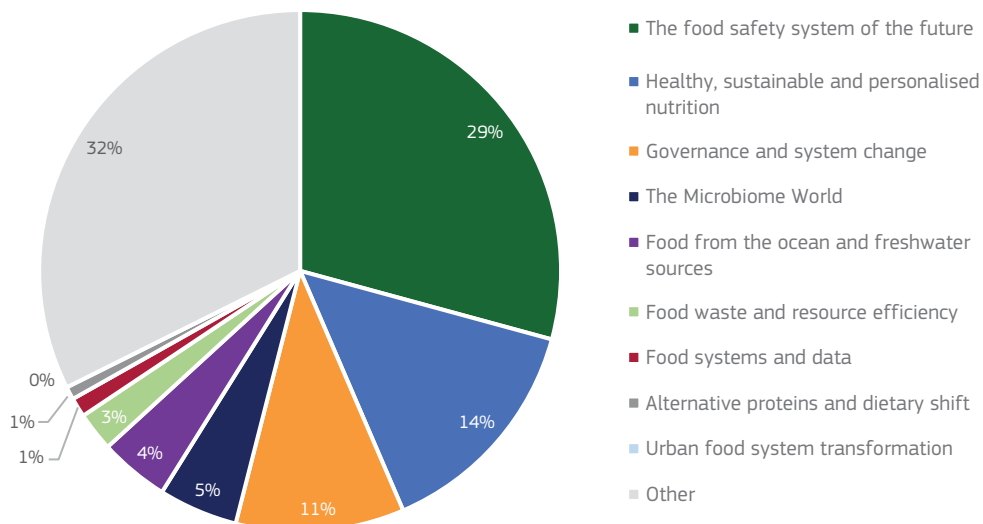


Source: Ipsos analysis of data provided by DAFM

Base: 389 projects

The majority of public expenditure identified in Ireland is spent on not solely dominated by any of the FOOD2030 pathways, with Food safety system of the future having the largest proportion of expenditure (29%, corresponding to EUR 44.4 million). This is followed by the pathways of Healthy, sustainable and personalised nutrition and Governance and system change at 14% (corresponding to EUR 21.6 million) and 11% (Corresponding to EUR 15.9 million) respectively. 4% (Corresponding to EUR 0.61 million) of public expenditure went on projects of more than one FOOD2030 pathway while Alternative proteins and dietary shift received the lowest proportion of public expenditure. Just under a third of public expenditure (31% corresponding to EUR 48.9 million) could not be assigned to any of the FOOD2030 pathways.

Figure 5: Distribution of the Funding by FOOD2030 Pathway



Source: Ipsos analysis of data provided by DAFM
Base: 389 projects

8 Data gaps and limitations

The database used only had project data for projects with start dates after 2010. Furthermore, some R&I projects have had to be excluded as the data provided did not give sufficient detail to be coded against a Food 2030 pathway or priority.

Summary of data sources: Ireland

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Department of Agriculture, Food and the Marine	https://www.gov.ie/en/organisation/department-of-agriculture-food-and-the-marine/
	Assistant Secretary General for agri-food sectoral policy and strategy development	https://www.gov.ie/en/publication/ce553-research/
	The Marine Institute	https://www.marine.ie/Home/site-area/working-us/research-administrator
	Teagasc	https://www.teagasc.ie/
	Science Foundation Ireland	https://www.sfi.ie/
	Sustainable Food Systems Ireland	https://www.sfsi.ie/expertise/
Food innovation related policies	Ireland's Department of Agriculture, Food and the Marine's current ten-year strategy for the agri-food sector is Food Wise 2025 (Food Harvest 2020 preceded this) and is to be replaced by the Agri-Food Strategy 2030.	https://www.gov.ie/en/consultation/786c25-public-consultation-on-irelands-agri-food-strategy-to-2030/ https://www.skillnetireland.ie/publication/food-wise-2025/
	Food Wise 2025 and the UN SDGs	https://sustainabledevelopment.un.org/content/documents/19382Ireland_Voluntary_National_Review_2018.pdf
	Food Systems Summit, National Dialogues – Ireland	https://www.gov.ie/en/campaigns/a5881-food-systems-summit-2021-irelands-national-dialogues/
	Agriculture Action Plan 2021 contains 75 priority actions to support a sustainable, innovation and competitive agri-food, forestry and seafood sector	https://www.gov.ie/en/press-release/c1473-mcconalogue-publishes-agriculture-food-and-the-marine-action-plan-2021/

	Various food innovation, research and technology priority areas	https://www.enterprise-ireland.com/en/start-a-business-in-ireland/food-investment-from-outside-ireland/why-ireland/food-research-and-innovation/food-innovation-research-and-technology.html
	Details on Irish agritech companies	https://irishadvantage.com/irelands-move-food-island-agritech-island/
	Food for Health Ireland, a subsidiary of University College Dublin	https://www.fhi.ie/
	Teagasc in Europe 2007-2013	https://www.teagasc.ie/media/website/publications/2014/TeagascInEurope_Final.pdf
National R&I Strategies	DAFM website outlining its research policy	https://wayback.archive-it.org/org-1444/20201125110231/https://www.agriculture.gov.ie/research/researchpolicy/
	Innovation 2020 – Ireland’s strategy for research, development, science and technology	https://enterprise.gov.ie/en/Publications/Publication-files/Innovation-2020.pdf
	COALESCE funding for a regenerative food & biobased system based on the principles of a circular bioeconomy, amongst other things.	https://research.ie/funding/coalesce/
	National sustainability programme for agriculture and food, Origin Green	https://www.origingreen.ie/https://blogs.worldbank.org/voices/focus-ireland-committing-sustainable-food-system
	Funding for Food for Health Ireland:	https://www.siliconrepublic.com/innovation/food-for-health-ireland-centre-ucd

Specific food innovation related R&I competitions/ funding	DAFM Competitive research funding spending review 2020	https://igees.gov.ie/wp-content/uploads/2020/11/DAFM-Competitive-Research-Programmes.pdf
From desk research	Teagasc has some food-related report publications	https://www.teagasc.ie/
	Research projects funded by DAFM from 2010 onwards	https://assets.gov.ie/98665/710abf64-5d5b-4f41-8d35-128b38551a71.pdf https://wayback.archive-it.org/org-1444/20201125182909/ https://www.agriculture.gov.ie/research/fundedprojects/food/

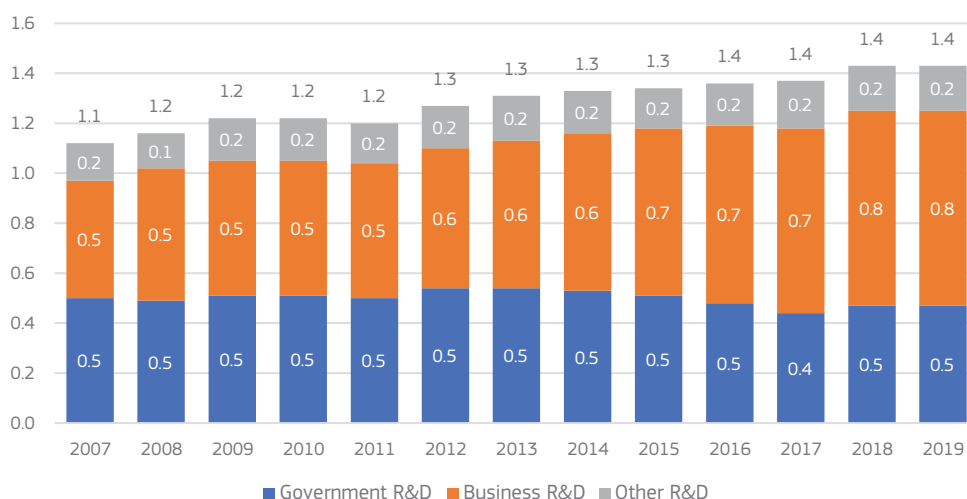
ITALY

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Italy from 2007 to 2019.⁴¹³ While overall R&I expenditure has increased steadily over this period, this has been driven primarily by increases in private sector expenditure. Government funding has remained relatively steady at approximately 0.5% of GDP.

Italy has a specific food R&I policy: the Strategic Plan for Innovation and Research in the agricultural, food and forestry sectors 2014-2020.

Figure 1: R&I Expenditure in Italy, as a % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

There are both national and regional level responsibilities for Italian R&I policy. Legislative, planning and financial aspects are regarded as national-level responsibilities, whilst promoting and financing services for businesses are dealt with at the regional level.

⁴¹³ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Main providers of Food R&I funding at national level

The national institutions include: the **Council for Agricultural Research and Economics (CREA)** (under the **Ministry for Agricultural, Food and Forestry Policies – MiPAAF**), the **National Research Council (CNR)** (under the **Ministry of Education, University and Research – MIUR, currently Ministry of Research - MUR**), the **Higher Institute for Environmental Research (ISPRA)** (under the **Ministry of the Environment and for the Protection of the Territory and the Sea**), the **National Institute of Health (ISS)** and the **Zooprofilactic Institutes in territories** (under the **Ministry of Health**), the **National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)** (under the **Ministry of Economic Development – MISE**), and the **Oversea Agronomic Institute (IAO)** (under the **Ministry of Foreign Affairs**).

The main R&I funding institutions in Italy are MUR, MiPAFF and the Ministry of Health, through the Directorate-General for Research and Innovation in Health. MUR approves the National Research Programme (see below) – which is based upon the government’s strategic priorities and lasts for three years. MUR’s budget is sourced from the Italian State budget and ESIF – and is the Managing Authority of the National Operational Programme (PON) on Research and Innovation financed by the European Regional Development Fund (ERDF). Among other investments, PON on Research and Innovation promotes agri-food R&I through national technology clusters⁴¹⁴.

MiPAFF is annually assigned resources in the agri-food sector for financing of R&I initiatives through the identification of thematic priorities. These include organic farming, agro-energies and food quality, among others. It also receives resources through specific programmes and plans such as the National Production Chains Plan. MiPAAF’s budget is also sourced from the European Agricultural Fund for Rural Development.

The Ministry of Health, through the Directorate-General for Research and Innovation in Health, has funded R&I initiatives related to the agri-food sector – annually assigned mainly through the National Announcement for Finalised Research and Young Researchers⁴¹⁵.

Other relevant actors

Regions and autonomous provinces play a key role in promoting R&I initiatives through financing projects developed by national or regional entities (mainly in the regions of Piemonte, Lombardia, Trento, Bolzano, Abruzzo and Sicilia). They also manage Rural Development Programmes (PSR) through the development of a strategy for innovation.

⁴¹⁴ <http://www.clusteragrifood.it/it/>

⁴¹⁵ https://www.salute.gov.it/portale/temi/p2_5.jsp?area=Ricerca%20sanitaria&menu=finalizzata

2 National R&I Strategy

The principles of the Italian **R&I policy for the 2014-2020 period** are described in the Partnership Agreement adopted between Italy and the European Commission. This agreement provides support to Italy from ESIF in order to foster economic, social and territorial cohesion of Italy for the period between 2014-2020.

The **National Strategy for Smart Specialisation**⁴¹⁶ (SNSI) was developed within this scope by the Department for Development and Economic Cohesion Policies (DPS) of MISE, together with MUR and the regions. The SNSI aims to create a national research and innovation chain that can drive improvements in production systems. The SNSI includes five national priorities:

1. Smart and sustainable industry, energy and the environment;
2. Health, nutrition and quality of life;
3. Digital agenda, smart communities and intelligent mobility systems;
4. Tourism, cultural heritage and the creative industry;
5. Aerospace and defence.

In addition, the SNSI defines 12 areas of regional specialisation (different between the regions): 1) Aerospace; 2) Agrifood; 3) Blue growth; 4) Green chemistry; 5) Design, creativity and made in Italy; 6) Energy; 7) Smart factory; 8) Sustainable mobility; 9) Health; 10) Smart, secure and inclusive communities; 11) Technologies for living environments; and 12) Technologies for cultural heritage.

The SNSI is linked with national R&I programmes - namely the **National Research Programme (PNR)** and the **National Plan for Research Infrastructures (PNIR)**. The PNR for the period 2015-2020 covered the full national R&I system, aiming to promote the quality of research by providing interventions to foster human capital and the competitiveness and innovation through public-private partnerships, and to improve research infrastructures in line with the PNIR. PNR and PNIR were developed by MUR.

⁴¹⁶ https://www.agenziacoesione.gov.it/wp-content/uploads/2019/06/Strategia_Nazionale_di_Specializzazione_Intelligente_Italia.pdf

The **National Programme for Research in Health (PNRS)** for the period 2017-2019, aligned with the PNR of the MUR, was part of the activities of the National Health Service (SSN)⁴¹⁷. The PNRS provided the programmatic framework for R&I in the health sector, aiming to drive innovation and improvement in health processes – including through the definition of new instruments of prevention, diagnosis and care. This also involved research aimed at improving the health of animals and maintaining high levels of food safety. Within this context, the agri-food sector was included in one of the main PNRS priorities of nutraceutical, nutrigenomics and functional foods.

3 Overview of national food policy

The **Strategic Plan for Innovation and Research in the Agricultural, Food and Forestry Sectors (2014-2020)** is the national framework for R&I actions addressing the first of the six priorities of the European regulation for rural development: “promoting the transfer of knowledge and innovation in the agricultural and forestry sector in rural areas”⁴¹⁸. The coordination and monitoring of the activities promoted within the Strategic Plan is entrusted to a committee composed of ministerial representatives together with regions, research bodies and companies, and coordinated by MiPAAF. The Strategic Plan is focused on six transversal thematic areas:

- Sustainable increase in productivity, profitability and resource efficiency in agro-ecosystems;
- Climate change, biodiversity, soil functionality and other ecological and social services of agriculture;
- Coordination and integration of supply chain processes and enhancement of the role of agriculture;
- Quality, typicality and safety of food and healthy lifestyles;
- Sustainable use of biological resources for energy and industrial purposes;
- Development and reorganization of the knowledge system for the agricultural, food and forestry sectors.

⁴¹⁷ The research in health is regulated by the d.lgs..502/92.

⁴¹⁸ <https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/9065>

The Strategic Plan also refers to the **National Plan for Fisheries and Aquaculture (2013-2015)**, which covers R&I related to: reduction of energy consumption from fishery and aquaculture; limitations on fishing capacity or effort; improvement of scientific knowledge on stock boundaries; possibilities to reduce the impacts of fisheries on the natural environment; involvement of fisheries in R&I activities; and promotion of human capital and job creation. In particular, the R&I priorities established by the National Plan most relevant to the food sector include: studies to support planning of the areas allocated to aquaculture; development of the national fishing GIS system towards mariculture; research for new candidate species to expand the production range of aquaculture; responsible and sustainable consumption through information policies; improvement of knowledge on the relationship between the various stages of the production chains and the safety, quality and shelf life of the fish products; characterisation of fishing waste and their by-products for use as food for aquaculture; and promotion of the short chain. The subsequent National Plan (period 2017-2019) also focused on these and added new priorities such as stock enhancement and sea ranching, and the production / extraction of fish pulp.

The **National Integrated Programme of Controls 2015-2019/2020-2022** aims to guide the official controls for food safety and the fight against fraud along the production chain, from the fields to the table, according to the risks. In particular, the Programme has the following priorities: protection of consumers and fair competition by maintaining a high level of protection of human health, animal health, plant health and food safety; fight against fraud and counterfeiting; and defence of agri-food production through the analysis of the life cycle of agro-industrial production chains products. In addition, the Programme has the following strategic objectives: fight against fraud and offenses to consumers and operators; protection of safety and quality of organic farming products; and protection of the safety and quality of Protected Geographical Indications (PGI).

The **National Plan Industry 4.0 2017-2020** is coordinated by MISE together with other Ministries (including MUR and MiPAAF) and representatives of regional governments. This plan is based upon strategic (innovative investments and skills) and complementary (enabling infrastructures and additional support) measures. The innovative investments include not only manufacturing, but also agri-food, bio-based economy and energy sectors. In the agri-food sector, a special focus is given to the smart agri-food digitalization, including precision agriculture, precision farming, urban farming, territorial sensors and drones.

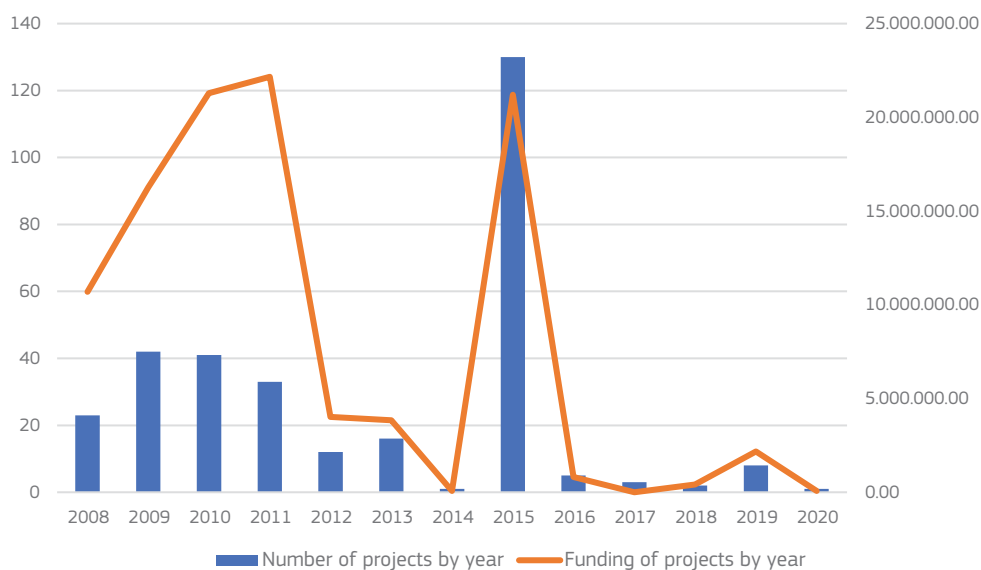
Other recent initiatives with a more holistic and integral approach to food national strategies are the **National Technology Agri-Food Cluster (CLAN)**, in which a network of different agri-food chain stakeholders (such as companies and research centres) promote R&I in

industry through platforms on technology for food safety, sustainability of food chains and promotion of consumer health.

4 Public funding available for food R&I

According to data made available by the MUR, MiPAAF and the Ministry of Health, Italian organisations developed a total of 322 R&I food-related projects between 2008 and 2020, mainly within the framework of the National Research Programme and of the Strategic Plan for Innovation and Research in the Agricultural, Food and Forestry Sectors (2014-2020) (Figure 2).

Figure 2: R&I food related projects between 2008 and 2020



Source: MiPAAF, MUR and Ministry of Health

Together these projects have mobilised a total of EUR 106.5 million of public funding⁴¹⁹. The highest number of approved projects (130) for food-related research and innovation was in 2015, with the launch by the MiPAFF of a grant selection procedure in that year

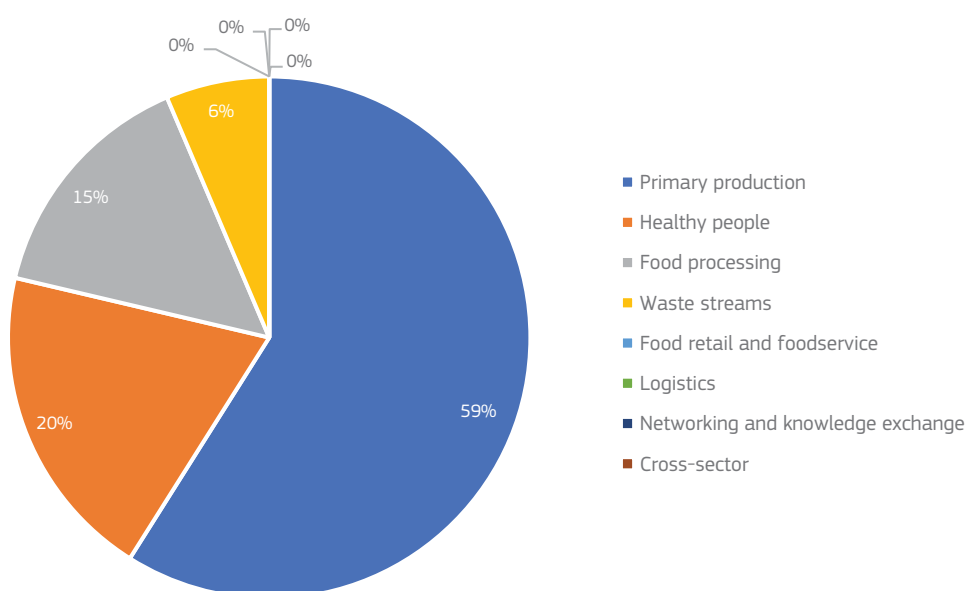
⁴¹⁹ For 123 of the projects, the budget identified corresponds to the maximum amount (EUR 160,000) that was available for each project in the call.

for special projects in agriculture, food and forestry issues⁴²⁰. From 2016 onwards there is a reduction in the number of projects and related funding shown, partly due to a lack of systematised data.

Funding by sector

The analysis of the distribution of the funding by sector for food-related R&I projects (Figure 3) shows that the majority of public funding appears to be directed to initiatives related to primary production (59%, EUR 62.7 million), with the healthy people sector coming in second (20%, EUR 21 million). Between 2008 and 2020 it is notable that logistics, food retail and foodservice had very little recorded public investment.

Figure 3: Distribution of funding by sector



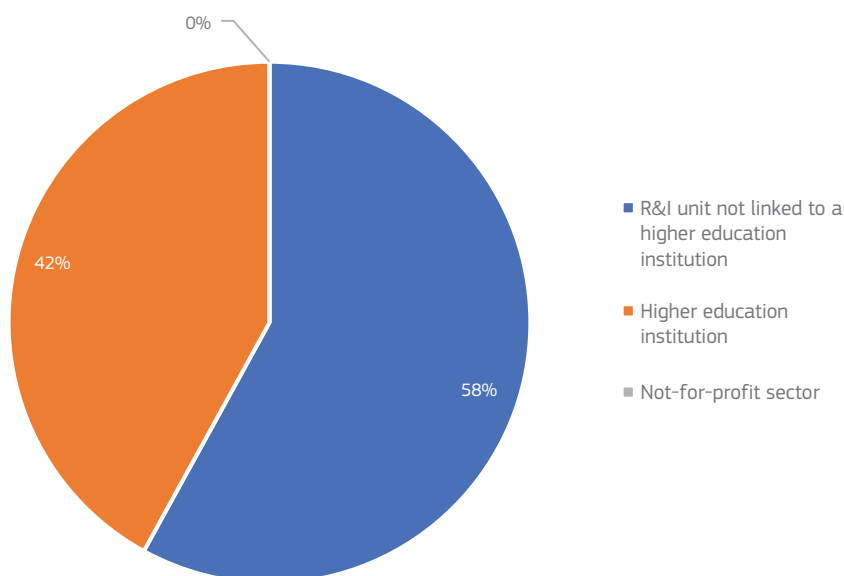
Source: MiPAAF, MUR and Ministry of Health

⁴²⁰ Ministerial Decree (D.M) n.5000/2015. Info at <https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/9077>.

5 Main recipients of public food R&I investment

The analysis of data (Figure 4) shows that Higher Education Institutions coordinated 181 projects between 2008 and 2020, while R&I Units not linked to higher education institutions coordinated 141. The projects coordinated by Higher Education Institutions received EUR 45.0 million (42% of the total), while projects coordinated by R&I Units not linked to higher education institutions received EUR 61.5 million (58% of the total). During the same period, there is no evidence of projects coordinated by organisations from the not-for-profit sector.

Figure 4: Distribution of funding by recipient



Source: MiPAAF, MUR and Ministry of Health

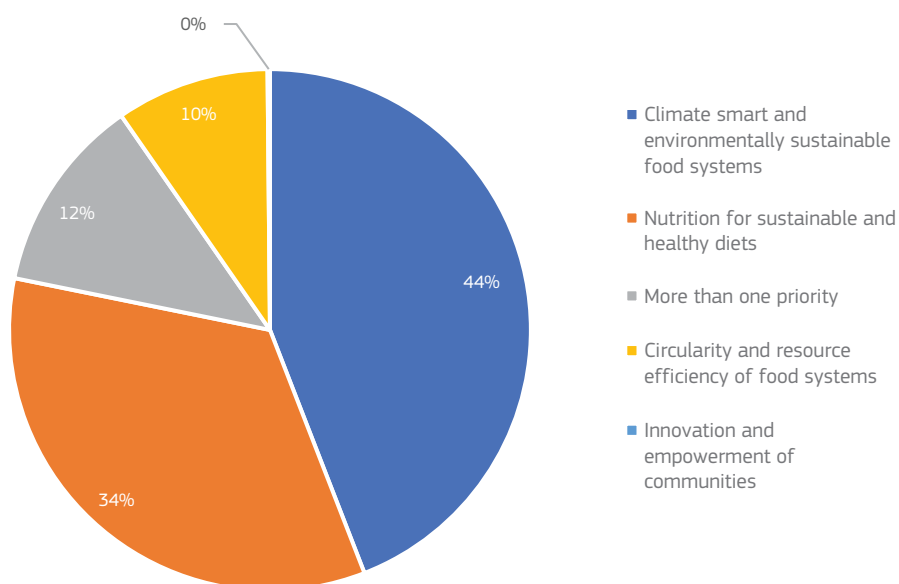
6 Structural Funds available for Food R&I

For the purposes of this report, the total amount of structural funds used for food-related R&I projects for the reference period was not found in any publicly-available report or from consultations with relevant contacts.

7 Links to FOOD2030 priorities and pathways

Publicly funded food-related R&I in Italy has prioritised research in Climate smart and environmentally sustainable food systems (44% of the total, EUR 47.0 million), followed by Nutrition for sustainable and healthy diets (34% of the total, corresponding to EUR 36.3 million. 12% (corresponding to EUR 12.9 million) of public expenditure went on projects of more than one FOOD2030 priority, while Circularity and resource efficiency of food systems received 10% of public expenditure, corresponding with EUR 10.1 million). Innovation and empowerment of communities received the lowest proportion of public funding, at 0.2% (corresponding to EUR 0.16 million) (Figure 5).

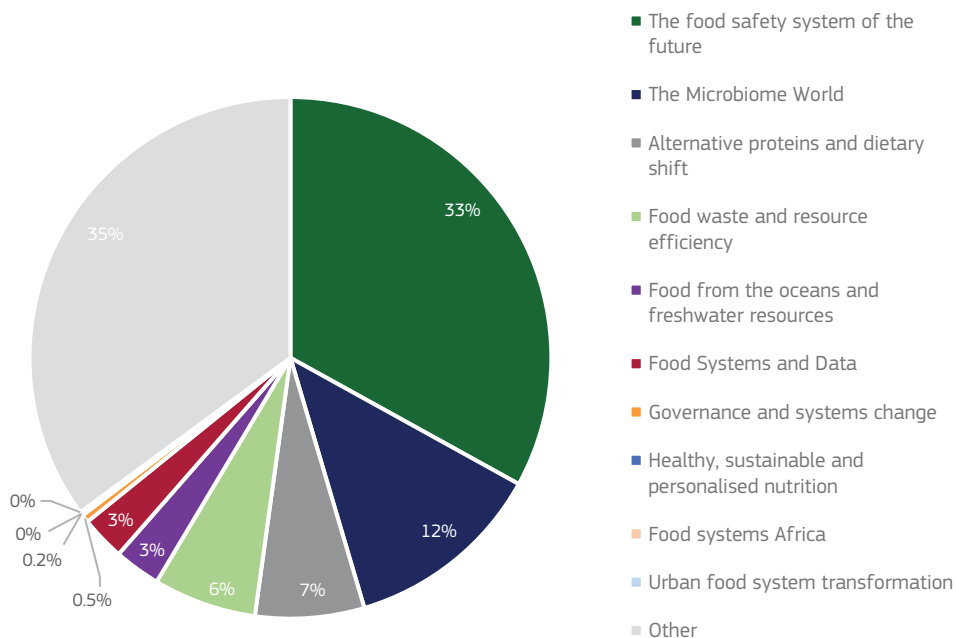
Figure 5: Distribution of funding by FOOD2030 priority



Source: MiPAAF, MUR and Ministry of Health

Regarding the distribution of funding by FOOD2030 pathways, the analysis shows that publicly funded food R&I in Italy was mainly directed to the Food safety system of the future (33% of the total, corresponding to EUR 35.2 million), followed by the Microbiome world (12%, corresponding to EUR 13.2 million). Over a third of projects funded (35%, corresponding to EUR 37.4 million) could not be characterised by any of the FOOD2030 pathways (Figure 6).

Figure 6: Distribution of funding by FOOD2030 pathway



Source: MiPAAF, MUR and Ministry of Health

8 Data gaps and limitations

The results of the analysis are based on publicly available information and data mainly from the MiPAAF, MUR and the Ministry of Health websites. Information not available on the websites includes technology readiness level (TRL), publications and patents.

Summary of data sources: Italy

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	<p>Ministry for Agricultural, Food and Forestry Policies - MiPAAF;</p> <p>Ministry of Education, University and Research – MIUR</p> <p>Ministry of Health – Directorate-General for Research and Innovation in health</p>	<p>https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/202;</p> <p>https://www.mur.gov.it/it;</p> <p>https://areapubblica.cbim.it/areapubblica/areaprogetti</p>
Food innovation related policies	<p>National Program for Research (PNR) 2015-2020;</p> <p>Strategic Plan for Innovation and Research in the agricultural, food and forestry sectors 2014-2020</p> <p>National Plan for Fisheries and Aquaculture (2013-2015)</p> <p>National Integrated Program of Controls 2015-2019/2020-2022</p> <p>National Plan Industry 4.0 2017-2020</p> <p>National program “Fruit and Vegetables in Schools</p> <p>National Technology Agri-Food Cluster</p>	<p>https://www.mur.gov.it/it/aree-tematiche/ricerca/programmazione/programma-nazionale-la-ricerca;</p> <p>https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/7801 ;</p> <p>https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/3397;</p> <p>http://www.salute.gov.it/portale/temi/p2_4.jsp?lingua=italiano&area=PNI;</p> <p>http://www.mise.gov.it/images/stories/documenti/2017_01_16-Industria_40_English.pdf;</p> <p>http://www.fruttanellescuole.gov.it/;</p> <p>http://www.clusteragrifood.it/en/.</p>

National R&I Strategies	R&I policy for the 2014-2020 period	https://eur-lex.europa.eu/legal-content/it/TXT/?uri=CELEX%3A52016DC0311
	National Program for Research (PNR) for the period 2015-2020	https://www.mur.gov.it/it/aree-tematiche/ricerca/programmazione/programma-nazionale-la-ricerca ;
From desk research	Ministry for Agricultural, Food and Forestry Policies - MiPAAF;	https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/202 ;
	Ministry of Education, University and Research - MIUR	https://www.mur.gov.it/it ;
	Ministry of Health – Directorate-General for Research and Innovation in health	https://areapubblica.cbim.it/areapubblica/areaprogetti
From interviewees	Ministry for Agricultural, Food and Forestry Policies - MiPAAF; Council for Agricultural Research and Economics (CREA)	https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/202 ; https://www.crea.gov.it/

LATVIA

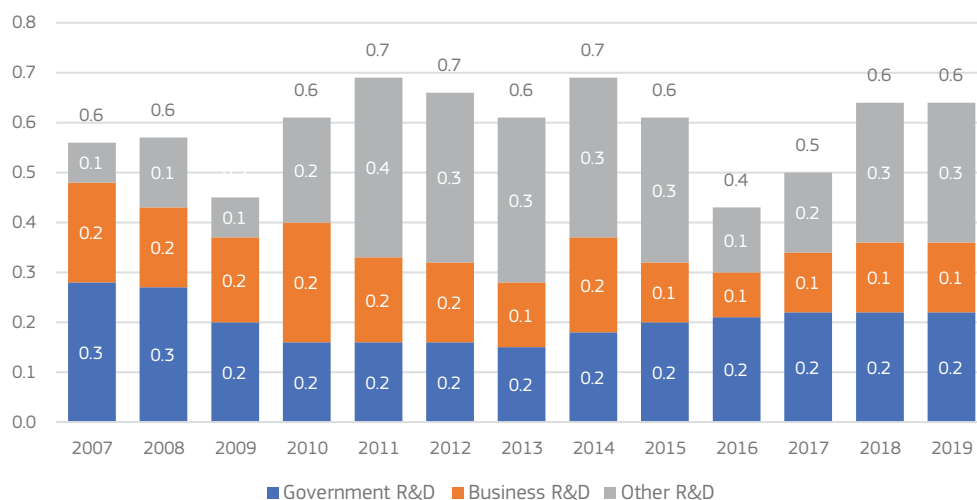
1 Overview of national R&I landscape

This report provides a brief overview of the public funding available for food systems R&I in Latvia, including a breakdown of the national public funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Latvia from 2007 to 2019.⁴²¹ Business and other R&I expenditure has fluctuated over this period, with government expenditure remaining relatively stable (excepting a decrease following the financial crisis between 2009 and 2013).

Latvia does not have a specific food R&I policy, but mentions policy goals related to R&I in food systems in the Priority Directions in Science for 2018–2021 and in its agri-food policy.

Figure 1: R&I expenditure in Latvia, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

⁴²¹ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Main providers of Food R&I funding at national level

The **Ministry of Education and Science** is the main government actor responsible for developing, coordinating, and implementing R&I policy in Latvia, in cooperation with other relevant ministries, including the **Ministry of Economy** and in consultation with relevant sectoral organisations, such as the Association of State Scientific Institutions (*Valsts zinātnisko institūciju asociāciju*)⁴²². From 2021 onwards, the Latvian Science Council will be responsible for the distribution, administration and monitoring of R&I funding.

The **Ministry of Agriculture** has overall competence on matters related to agricultural policy, forestry, and fisheries and, in partnership with **Latvia University of Life Sciences and Technologies**, leads a series of scientific centres in bio-science and in agriculture and food industry innovation. In addition to this, the **Rural Support Service**, part of the structure of the Ministry of Agriculture, oversees the allocation and disbursement of national and EU funding for agriculture.

2 National R&I Strategy

The main strategic document on R&I for Latvia is the **National Development Plan 2014-2020**⁴²³, which includes a strategic objective on ‘advanced research and innovation and higher education’. Under this objective, Latvia aimed to bring R&I investment to 2% of GDP by 2020 and sought to attract qualified human capital, improve research infrastructure, as well as facilitate collaborations between academia and the private sector and the transfer of research to business applications.

Alongside the National Development Plan, the **Science, Technological Development, and Innovation Guidelines for 2014-2020**⁴²⁴, which replaced the previous document for 2009-2013, provide an analysis of the strengths and weaknesses of the R&I landscape in Latvia and put forward a set of objectives. The guidelines seek to increase the competitiveness of the R&I sector, ensure that R&I is relevant to society and the economy, improve the governance in the R&I sphere, also through more funding from the state budget, and disseminate R&I effectively. New guidelines for the period 2021-2027

⁴²² Cabinet of Ministers (2013), Science, Technological Development, and Innovation Guidelines for 2014-2020 (*Zinātnes, tehnoloģijas attīstības un inovācijas pamatnostādnes 2014. – 2020.gadam*), pages 13-14, available at: https://www.izm.gov.lv/sites/izm/files/ztaip_2014-20201_0.pdf, last accessed 6 May 2021.

⁴²³ Cross-Sectoral Coordination Centre (2012), National Development Plan of Latvia for 2014-2020, available at: https://www.pkc.gov.lv/sites/default/files/inline-files/NDP2020%20English%20Final_1.pdf, last accessed 6 May 2021.

⁴²⁴ Cabinet of Ministers (2013), Science, Technological Development, and Innovation Guidelines for 2014-2020 (*Zinātnes, tehnoloģijas attīstības un inovācijas pamatnostādnes 2014. – 2020.gadam*), available at: https://www.izm.gov.lv/sites/izm/files/ztaip_2014-20201_0.pdf, last accessed 6 May 2021.

were approved in April 2021⁴²⁵, covering human capital, technology transfer and better coordination between research institutions, and the management of the R&I system.

The Ministry of Education and Science also published a document containing a list of **Priority Directions in Science for 2018-2021**⁴²⁶, which covers also ‘Research and sustainable use of local natural resources for the development of a knowledge-based bioeconomy’.

Lastly, R&I policy is also based on the key areas of intervention mentioned in the **Smart Specialisation Strategy**, which offers a holistic approach to R&I to foster economic growth and competitiveness. Since 2014, the bioeconomy has been one of five defined priority areas in Latvia’s Smart Specialisation Strategy. Although not all projects funded under this area are directly related to food, interviewees reported that a number of projects are included in relation to food safety, nutrition and public health (healthy people), in particular. Prior to 2014, food was not specifically mentioned as a funding priority. Interviewees reported, however, that food technologies and systems were funded through broader programmes during the 2007-2013 funding period, but no granular project-level information was available for the purposes of analysis.

3 Overview of national food policy

Latvia 2030 is the centrepiece of Latvia’s agri-food policy, modelled on the Sustainable Development Goals (SDGs). The strategy stresses the importance of creating an ‘innovative, eco-efficient and competitive economy’ where innovation and knowledge can be used for the production of healthy food⁴²⁷.

The Latvian Bioeconomy Strategy 2030 (LIBRA) is the long-term (2030) national strategy enabling a knowledge-intensive bioeconomy. LIBRA was developed by the MoA in co-operation with researchers of the Latvia University of Life Sciences and Technologies (LLU). It will deliver Latvia’s contribution to EU objectives set in flagship initiatives such as the “Innovation Union” and the “Resource Efficient Europe” under Europe 2020 and in the European Bioeconomy Strategy and its associated Action plan.

⁴²⁵ Cabinet of Ministers (2021), Directions for the development and support of science, technology, and innovation in Latvia until 2027 have been defined (*Noteikti zinātnes, tehnoloģijas un inovācijas attīstības un atbalsta virzieni Latvijā līdz 2027.gadam*), available at: <https://www.mk.gov.lv/lv/jaunums/noteikti-zinatnes-tehnologijas-un-inovācijas-attīstības-un-atbalsta-virzieni-latvija-līdz-2027-gadam>, last accessed 6 May 2021.

⁴²⁶ Cabinet of Ministers (2017), Priority Directions in Science for 2018-2021 (*Par prioritārajiem virzieniem zinātnē 2018.–2021. gadā*), available at: <http://tap.mk.gov.lv/lv/mk/tap/?pid=40438768&mode=mk&date=2017-12-12>, last accessed 6 May 2021.

⁴²⁷ Saeima of the Republic of Latvia (2010), Latvia 2030, Sustainable Development Strategy of Latvia until 2030, page 12, available at: https://www.pkc.gov.lv/sites/default/files/inline-files/LIAS_2030_en_0.pdf, last accessed 6 May 2021.

Looking forward, a key focus is full integration with EU climate neutrality goals. The EU Green New Deal was described by interviewees as a key point of reference for investments over the next 5–10 years (including with regard to sustainable food systems). This was described as a significant funding gap, which will be further developed as a specific capacity area going forward (building on the horizontal capacity building which has been the recent focus of national R&I strategy).

4 Public funding available for food R&I

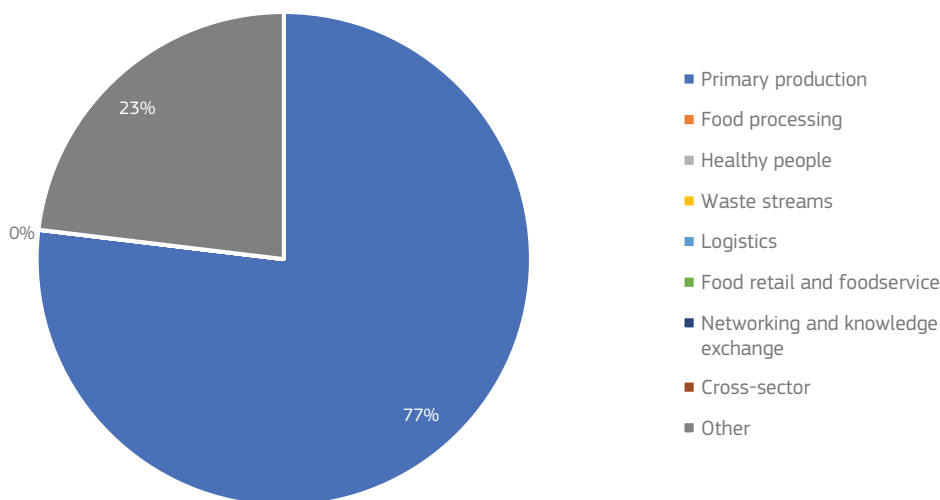
Public funding for food R&I in Latvia was relatively limited during the reference period, as many national programmes were significantly reduced or cancelled as a result of the 2008 financial crisis. Representatives from the Ministry of Agriculture confirmed that, during this period, any relevant funding was provided by the EU Structural Funds (which are not in scope of this study). Representatives from the Ministry of Research and Education provided data for programmes funded nationally between 2017 and 2020, which is analysed below. No data is available prior to this period. The majority of public funding for food R&I in Latvia is provided through European Funding (both the Structural Funds and the Framework programmes, with Horizon 2020 in particular described by one interviewee as “very important” for Latvia, constituting an estimated 10% of all research funding).

Interview feedback provided some information on obstacles to public funding food systems R&I in Latvia. Key issues raised included a lack of prioritisation at national level and the need for reform of the national R&I system. This second issue was addressed during the reference period for this study, with actions including an international evaluation to identify inefficiencies and gaps, reducing fragmentation and updating KPIs. Interview feedback suggests that there have been a number of efficiency gains in terms of public R&I investment resulting from these reforms. In terms of private sector investment, interviewees pointed to concerns related to risk and profitability as specific blockers for investment by Latvian firms in the agriculture and food sectors.

Funding by sector

Figure 2 provides a breakdown of the sectors being funded, based on project data provided by the Ministry for Education and Science. Although only four publicly funded (non-EU) food R&I projects were identified, the split of sectors funded aligns with the interview feedback provided, showing a clear focus on primary production (accounting for EUR 896,462 or 77% of projects funded).

Figure 2: National public funding by sector



Source: Ipsos analysis of data provided by the Ministry for Education and Science
Base: 4 projects

5 Main recipients of public food R&I investment

Interview feedback confirms that the majority of public funding available for food systems R&I in Latvia is directed towards universities and research institutes, with private sector innovation stimulated indirectly (through technology transfer and incentivisation of cooperation with the private sector as part of funding conditions). The majority of public funding available for private sector entities is provided through Horizon 2020.

The majority of funding is distributed to the University of Agriculture (which has a specialised faculty working in food technologies, as well as institutions working on food safety, crop selection and fruit trees). The Ministry of Economy and Science also provides funding to the University of Latvia and Riga Technical University, which carry out research in specific niche areas.

6 Structural Funds available for Food R&I

Co-funding of up to 80% is available through the EU Structural Funds for the development of new products and technologies in the food sector. A total of EUR 5.4 million was provided from 2011 to 2018, including EUR 3.2 million of ERDF funding.

From 2011 to 2013, EUR 53 million of EU structural funds were used to support the creation of six Competence Centres (VNPC) to facilitate collaboration between the research and industrial sectors - One competence centre deals with the introduction of innovations in the agriculture and food sectors – the Food competence centre of Latvia.

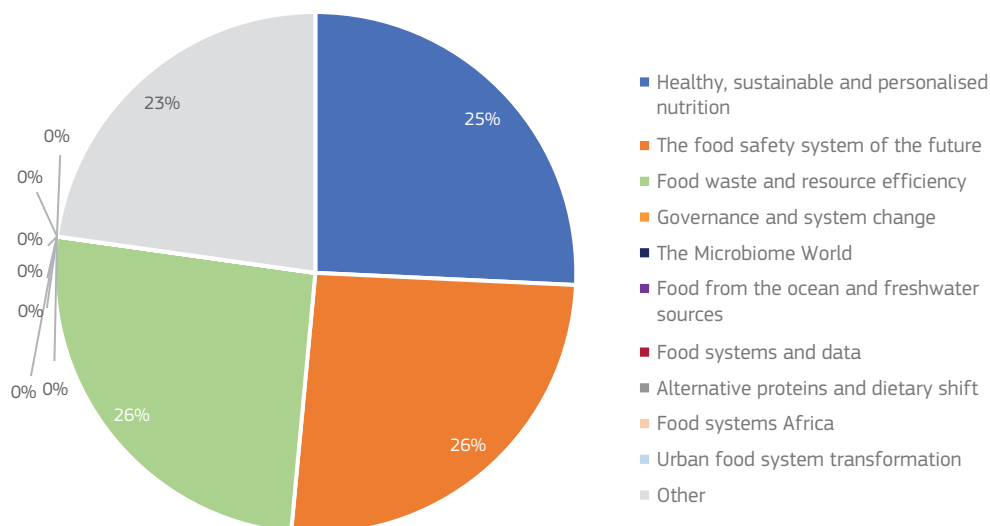
7 Links to FOOD2030 priorities and pathways

Although there are no public databases available on food systems R&I in Latvia, representatives of the Ministry of Agriculture and Ministry of Education and Science carried out searches on their internal databases using the keywords agreed for this project and identified four projects funded at national level during the reference period which aligned with the Food 2030 priorities and pathways.

All four projects align with priority two “Climate smart and environmentally sustainable food systems”, amounting to a total of EUR1,166,036 of public funding for this priority.

Figure 3 provides an overview of how this expenditure aligns with the different Food 2030 pathways. There is a relatively equal distribution of funding between three of the pathways: healthy, sustainable and personalised nutrition (EUR 300,000, or 26% of relevant funding); the food safety system of the future (accounting for EUR 299,307, or 25.7 of project funding); and food waste and resource efficiency (accounting for EUR 297,155, or 26% of project funding). The final project (accounting for EUR 269, 574, or 23% of project funding) did not align with any of the Food 2030 pathways and has therefore been marked as “other”.

Figure 3: Public spend on food-related R&I projects by Food2030 pathway



Source: Ipsos analysis of data provided by the Ministry for Education and Science
 Base: 4 projects

1 Data gaps and limitations

There was no publicly available information on R&I funding for food systems in Latvia. Therefore, the results of the analysis are based on data provided by the relevant funding entities, who cooperated with the study team to extract relevant projects. It may nonetheless be missing one or two projects which were not able to be identified as related to food systems based on the information available within the relevant databases. Information not provided by the mentioned entities includes among others: keywords, technology readiness level (TRL), publications and patents.

Summary of data sources: Latvia

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture	https://www.zm.gov.lv/en/zemkopibas-ministrija/struktura/
	Ministry of Education and Science	https://www.izm.gov.lv/en
	Ministry of Economy	https://www.em.gov.lv/en
	Latvian Association of Local and Regional Governments	https://www.lps.lv/en
	Latvia University of Life Sciences and Technologies, Institute of Agricultural Resources and Economics,	
	Latvia Rural Support Service Responsible for dispersal of EU and national funds	https://www.lad.gov.lv/en/about-us/contacts-2/contacts-1/
Food innovation related policies	The State Research Programme “Agricultural resources for sustainable production of qualitative and healthy food in Latvia” conducts internationally competitive studies in agriculture and food science.	https://www.oecd-ilibrary.org/sites/714d5aa4-en/index.html?itemId=/content/component/714d5aa4-en
	Latvian Food Bioeconomy Cluster (LFBC)	http://www.vidzeme.lv/en/latvian_food_bioeconomy_cluster_lfbc#:~:text=LATVIAN%20FOOD%20BIOECONOMY%20CLUSTER%20(LFBC)%20is%20a%20triple%2Dhelix,bioeconomy%20innovation%20hub%20in%20Latvia.

National R&I Strategies	Latvia 2030 emphasises a more efficient use and management of Latvia's natural resources capital.	https://www.oecd-ilibrary.org/sites/714d5aa4-en/index.html?itemId=/content/component/714d5aa4-en
	National Development Plan (NDP) 2020 harnesses new technologies to use natural resources more efficiently and sustainably.	
	Development of Science, Technology and Innovation for 2014-2020 sets the innovation policy objectives and action lines necessary to upgrade Latvian science, technology and innovation to a competitive level.	
	Latvian Bioeconomy Strategy 2030 (LIBRA) is the long-term (2030) national strategy enabling a knowledge-intensive bioeconomy	
From desk research	OECD paper: Innovation, Agricultural Productivity and Sustainability in Latvia	https://www.oecd-ilibrary.org/agriculture-and-food/innovation-agricultural-productivity-and-sustainability-in-latvia_9789264312524-en

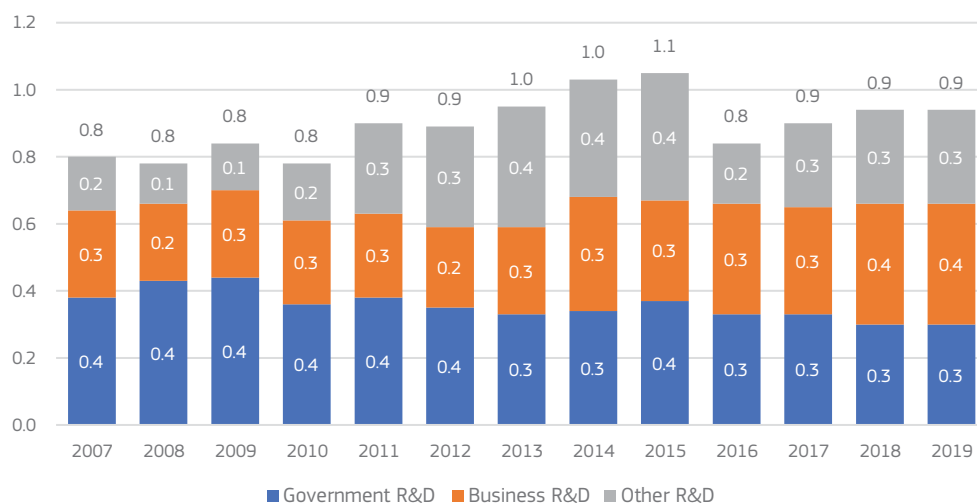
LITHUANIA

1 Overview of national R&I landscape

Figure 1 provides an overview of expenditure on R&D in Lithuania as a proportion of R&I from 2007 to 2020. With government, private sector, and investments from other sources combined, in 2019 Lithuania spent 1.0% of GDP on R&D. A steady increase in overall R&D can be noted between 2007 and 2015, with a drop-off from 2016 onwards. This appears to be largely a result on a decrease in “other” (higher education, private non-profit and “rest of the world”) investments: whilst public expenditure in percentage terms has remained overall constant since 2010, private investments have increased slightly since 2012.

Lithuania has a specific strategy for food R&I, the Programme for Research and Experimental Development of Agriculture, Food, Fisheries and Rural Development.

Figure 1: R&I expenditure in Lithuania, as % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main providers of Food R&I funding at national level

Research policy is developed and implemented by the Department of Science and Technology within the Ministry of Education and Science, in cooperation with the **Research Council of Lithuania**, which has an advisory function. The Research Council's role includes also the assessment of projects submitted for funding competitions⁴²⁸. Participation in international research programmes and projects is ensured by the Agency for Science, Innovation, and Technology. The **Ministry of Finance** is also involved in funding national research programmes⁴²⁹. As regards funding programmes for agriculture and food, responsibility lies within the **Ministry of Agriculture**.

The **Ministry of Economy and Innovation** and the **Ministry of Education and Science** are the two main institutional actors responsible for the development and implementation of R&I policy in Lithuania. Whilst the Ministry of Economy and Innovation is responsible for innovation policy, the Ministry of Education and Sciences is in charge of R&I and higher education policy.

2 National R&I Strategy

Lithuania has published a series of R&I strategies over the years; however, references to food and agriculture are not always prominent.

Since 2007, R&I policies in Lithuania have been designed in a way that follows the planning period of the EU Structural Funds. This reflects the fact that EU funding accounted for a large proportion of R&D expenditure⁴³⁰. The Economy Promotion Plan 2009-2010 was designed by the Ministry of Economy in response to the economic crisis, with the aim to support businesses affected by the downturn⁴³¹. In parallel, the government published the Lithuanian Innovation Strategy 2010-2020, which primarily sought to address coordination problems in the national innovation ecosystem, but also to focus on high value-added sectors such as the food and beverages sector⁴³².

⁴²⁸ OECD and European Commission (2020), Research Council of Lithuania, available at: <https://stip.oecd.org/stip/policy-initiatives/2019%2Fdata%2FpolicyInitiatives%2F14416>, last accessed 13 September 2021.

⁴²⁹ European Commission (2020), Country Profile Lithuania, available at: <https://trimis.ec.europa.eu/country-profile/lithuania>, last accessed 13 September 2021.

⁴³⁰ OECD (2016), OECD Reviews of Innovation Policy, Lithuania 2016, page 117, OECD Publishing: Paris, available at: <https://www.oecd-ilibrary.org/docserver/9789264259089-en.pdf?expires=1632064190&id=id&accname=ocid195751&checksum=3087165744F190B910E4D407AD9C4E0E>, last accessed 13 September 2021.

⁴³¹ *Ibid.*, page 118.

⁴³² On the Lithuanian Innovation Strategy for 2010-2020 (*Dėl Lietuvos Inovacijų 2010–2020 Metų Strategijos*), available at: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS_365849, last accessed 13 September 2021.

The Lithuanian Innovation Development Programme 2014-2020⁴³³ is the overarching strategy for R&I in Lithuania. The Programme, which is based on the EU's Plan for an Innovation Union, seeks to promote innovation and enhance competitiveness by investing in technologies, human capital, and focusing on smart specialisation, with a target of increasing investment in R&I to 2% of GDP by the end of the period. The Programme is structured around a series of four main objectives:

- **Fostering an innovative society through the development of new knowledge and its practical application:** This includes promoting research and development activities, creativity and entrepreneurship, and ensuring that students' skillsets match the need for market-ready, practical skills.
- **Increasing the innovation potential of businesses:** This is to be achieved through the promotion of investment in high-value activities, product development, and cross-sectoral collaboration for high-impact innovation.
- **Supporting the creation, development, and internalisation of value networks:** This revolves around the promotion of partnerships between businesses and research institutions and the development of innovation clusters.
- **Increasing the effectiveness of innovation-related policy-making and innovation in the public sector:** This is intended to foster a regulatory environment that is conducive to innovation, where innovation can also be used to address other socioeconomic challenges.

Alongside the Innovation Development Programme, Lithuania's R&I policy is also informed by the strategy on Priority Areas of Research and Experimental Development and Innovation⁴³⁴, which draws from Europe 2020. The strategy seeks to bring about structural changes in the economy of Lithuania through investment in R&D and innovation, and in particular it aims to:

- Develop innovative technologies, products, processes, and methods to respond to global trends and long-term national challenges;

⁴³³ On the Approval of the Lithuanian Innovation Development Programme for 2014-2020 (*Dėl Lietuvos inovacijų plėtros 2014-2020 metų programos patvirtinimo*), available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.463361>, last accessed 13 September 2021.

⁴³⁴ Regarding the adoption of the Programme for the Implementation of Priority Areas of Research and (Socio-Cultural) Development and Innovation (Smart Specialisation) (*Dėl Prioritetinių mokslinių tyrimų ir eksperimentinės plėtros ir inovacijų raidos (sumaniosios specializacijos) prioritetų įgyvendinimo programos patvirtinimo*), available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/78c68700d77c11e3b272e0e81c552d38>, last accessed 13 September 2021.

- Increase competitiveness of Lithuanian businesses in global markets also via partnership between research institutions, private actors and public organisations.

Lastly, the Parliament of Lithuania in 2016 passed a set of Guidelines for Changing Lithuanian Science and Innovation Policy, which stresses, among other topics, the need for an incentive system for innovation research targeting SMEs. In 2018, the regulatory setting further evolved with the Law on Technologies and Innovation⁴³⁵, which sets out provisions around policy-making for innovation and funding rules. On funding, the law under Article 21 specifies that innovation projects can be funded through the state budget and government programmes for technology and innovation, as well as through the Innovation Promotion Fund⁴³⁶, established in 2020, which provides funding for basic or applied research, project in experimental phases, and innovation projects.

3 Overview of national food policy

As interviewees explained, during the 2014-2020 period, Lithuania's strategy on agriculture and food (composed of a series of individual Action Plans) initially focused mainly on plant varieties and plant diseases, and then shifted towards aspects related to environment protection, bioeconomy, and resource circularity, also due to Lithuania's involvement in BioEast, a platform to share knowledge and advance cooperation in the bioeconomy sector.

Under the general Priority Areas for Experimental Research and Innovation, specific Action Plans dealing with food-related issues were developed. The most relevant for the food sector are detailed below.

- **Sustainable Agri-biological Resources and Safer Food**⁴³⁷: This action plan sought to improve safety requirements of foods via the application of innovative production and packaging technologies, from innovations to eliminate food contaminants to circularity and agri-food waste management. In total, over €670.8 were earmarked to this plan, of which €385,026 came from the national budget and €39,137 from private sector investments⁴³⁸.

⁴³⁵ Law on Technologies and Innovation (Lietuvos Respublikos technologijų ir inovacijų įstatymas), available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/3a00ca517f7d11e89188e16a6495e98c?fwid=sujolj4>, last accessed 13 September 2021.

⁴³⁶ Fund established by Law XIII-3167. For further information: Law of the Republic of Lithuania on the Innovation Promotion Fund (Lietuvos Respublikos inovacijų skatinimo fondo įstatymas), available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/4b0dc926bad011ea9a12d0dada3ca61b>, last accessed: 13 September 2021.

⁴³⁷ Ministry of Education and Science (2014), Priority sustainable agri-biological resources and safer food in the priority area of research and (socio-cultural) development and innovation (smart specialisation) agri innovation and food technologies action plan, available at: https://www.smm.lt/uploads/documents/en_smm/smartsp/safer%20food.pdf, last accessed 13 September 2021.

⁴³⁸ *Ibid.*, page 9

- **Functional Food**⁴³⁹: The action plan focuses on biotechnologies for application in agriculture and in the food industry that can be used to create functional food ingredients, both plant-based and from animal origin. The plan was allocated a budget in excess of €610.8 million, including €385,026 from national resources and €39,137 from private investors⁴⁴⁰.
- **Improvement and Processing of Biological Raw Materials (Biorefinery)**⁴⁴¹: This action plan centres around innovative raw agricultural products for application across a variety of industries, including the food sector. The plan seeks to stimulate research into biomaterials for the development of safer, more nutritious food, with a view to increasing Lithuania's food exports. The plan, mainly funded via EU Structural and Investment Funds, was expected to benefit from €692.3 million investments, including €385,000 from the national budget and €42,159 from the private sector⁴⁴².

These plans were complemented by the **National Science Programme 'Healthy and Safe Food'** launched in 2015⁴⁴³, which built on the previous Programme for Research and Experimental Development of Agriculture, Food, and Rural Development for 2007-2013, and which considers food policy in relation to well-being and quality of life. As a main objective, the programme aims to improve the quality and safety of agricultural products and raw ingredients, promote environmental efficiency, and exploit the genetic potential of plants through scientific research.

In addition to this, the **Research and Experimental Development Program for Agriculture, Food, Fisheries and Rural Development 2015-2020**⁴⁴⁴ provides funding

⁴³⁹ Ministry of Education and Science and Ministry of Economy (2014), Action plan of the priority "functional food" of the priority area of research and experimental (socio-cultural) development and innovation (smart specialization) "agri-innovation and food technologies", available at: https://www.smm.lt/uploads/documents/en_smm/smartspl/functional%20food.pdf, last accessed 13 September 2021.

⁴⁴⁰ *Ibid.*, page 8.

⁴⁴¹ Ministry of Education and Science and Ministry of Economy (2014), Action plan of the priority innovative development, improvement and processing of biological raw materials (biorefinery) of the priority area of agricultural innovation and food technologies of the scientific research and (socio-cultural) development and innovation (smart specialisation), available at: https://www.smm.lt/uploads/documents/en_smm/smartspl/biorefinery.pdf, last accessed 13 September 2021.

⁴⁴² *Ibid.*, page 8.

⁴⁴³ Ministry of Education and Science (2015), On the approval of the National Science Program "Healthy and Safe Food" (*Dėl Nacionalinės mokslo programos "Sveikas ir saugus maistas" patvirtinimo 2015*), available at: <https://www.e-tar.lt/portal/lt/legalAct/TAR.0914434AACFF/BGKBTMarCm>, last accessed 13 September 2021.

⁴⁴⁴ Ministry of Agriculture (2015), On the approval of the Research and Experimental Development Program for Agriculture, Food, Fisheries and Rural Development 2015-2020 (*Dėl Žemės, maisto ūkio, žuvininkystės ir kaimo plėtros mokslinių tyrimų ir eksperimentinės plėtros 2015–2020 metų programos patvirtinimo*), available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/99709940557711e485f39f55fd139d01?fwid=89x1tqr8w> https://zum.lrv.lt/uploads/zum/documents/files/LT_versija/Skelbimai/2_%20TAISYKL%C4%96S.doc, last accessed 13 September 2021.

for fundamental research, industrial research, pilot projects, and for feasibility studies in agriculture, fisheries, and food to be awarded to research institutions or research partnerships.

According to an interviewee, the period between 2014 and 2020 saw a considerable growth of food and agricultural projects involving partnerships with other countries, which were granted around €200,000 in funding. Other research projects were awarded grants in the region of €600,000–€700,000, and focused mainly on plant-related innovation, technologies to prevent soil degradation, and more recently, drones and satellites use in agriculture. In addition, the interviewee noted that Lithuania is increasingly aligning its R&I priorities with the EU priorities, and in particular with the Food 2030 priorities.

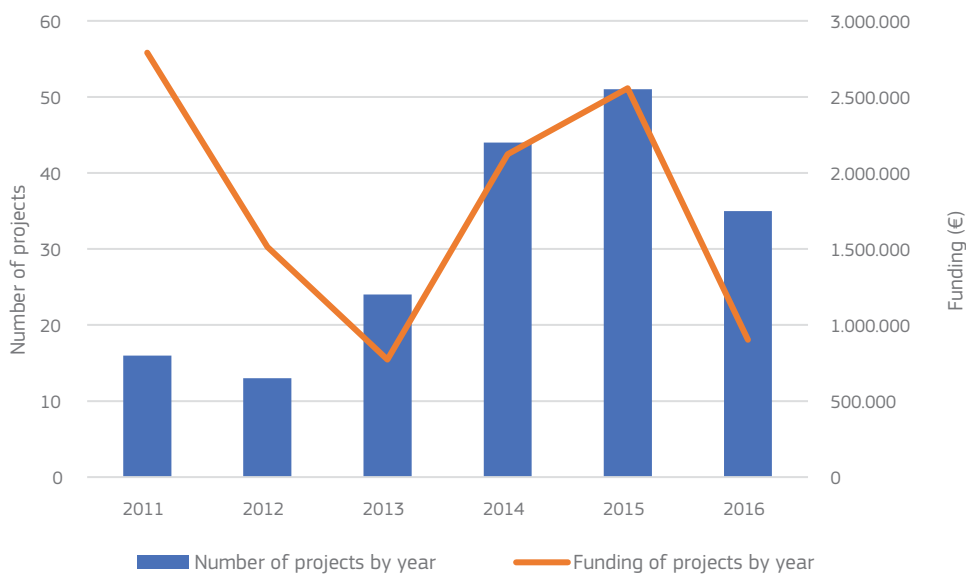
However, it was underlined during the course of a consultation with a government stakeholder that investments in R&I in Lithuania are made in parallel with other forms of financial support for farmers in order to favour more traditional investments, such as the upgrade of agricultural machinery. Furthermore, with regard to EU funding for R&I in agriculture, it was noted that Lithuania, along with other Eastern Member States, often find itself at a disadvantage when competing for research funding at EU level due to the lack of experience with funding procedures

4 Public funding available for food R&I

Data shows that there was considerable fluctuation in terms of the number of projects funded and in the size of funding for food systems R&I projects in Lithuania over the years⁴⁴⁵. Projects funded in 2011 and 2012 on average obtained larger grants; the growth in the number of projects funded from 2013 onwards was accompanied by a proportional increase in budget, which however resulted in smaller grants on average. In total, between 2011 and 2016, €10.7 million were allocated to R&I projects in food systems.

⁴⁴⁵ Data only available for years 2011-2016.

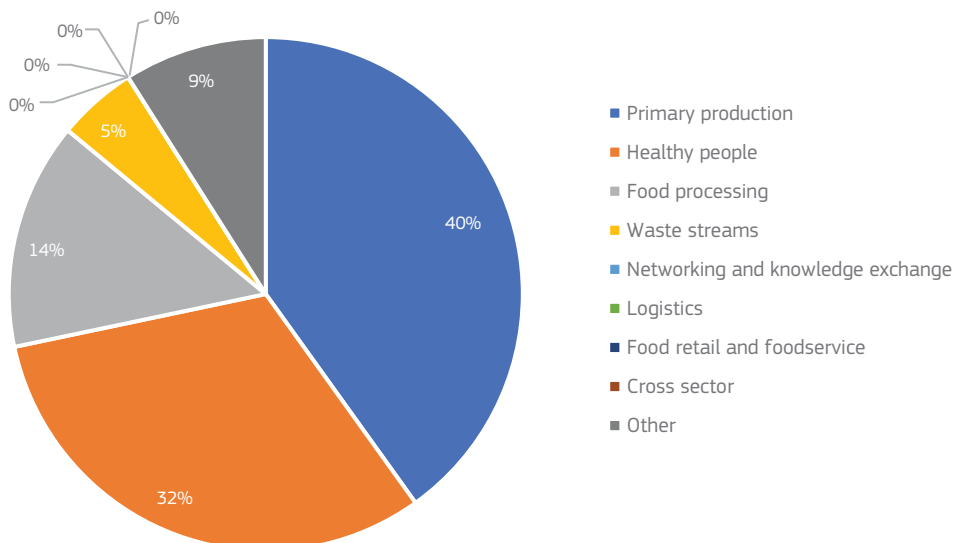
Figure 2: R&I food related projects between 2011 and 2016



Source: SCAR mapping, Lithuania

Primary production was the sector that attracted the most funding in between 2011 and 2016 (around 40%, or EUR 4.3 million). Projects relating to both food and health obtained the second-largest share of total funding (32%, or EUR 3.4 million). A non-negligible share of funding was awarded to projects related to meat production and processing (EUR 957,700).

Figure 3: Distribution of funding by sector



Source: SCAR mapping, Lithuania

5 Main recipients of public food R&I investment

The database used in this analysis does not indicate the type of organisation awarded funding.

6 Structural Funds available for Food R&I

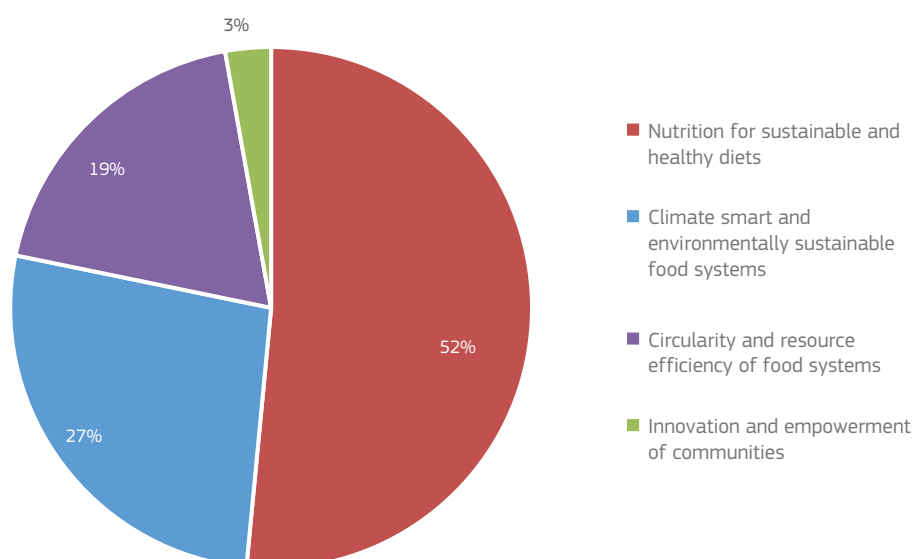
The implementation of the priorities set out in Lithuania's strategies is subject to funding from several sources, including: state budget funds, funds from scientific and education institutions; funds of private entities; and funds from the European Union's Horizon 2020 programme, as well as other international programmes. Funding from the Structural and Investment Fund and national co-funding financed projects for a combined value of over €5 billion in the 2014-2020 funding period⁴⁴⁶. A quick review of these projects suggests that less than one percent of the European Structural and Investment Funds was allocated to projects related to food systems R&I.

⁴⁴⁶ Data extracted from: <https://www.esinvesticijos.lt/en/>, last accessed 4 October 2021.

7 Links to FOOD2030 priorities and pathways⁴⁴⁷

Most of the funding was assigned to the priority of nutrition for sustainable and healthy diets and climate smart and environmentally sustainable food systems (EUR 5.5 million). Climate smart and environmentally sustainable food systems was the second most-funded priority (27%). Around 19% of all funding was allocated to projects dealing with circularity and resource efficiency, while 3% on innovation and empowerment of communities.

Figure 4: Distribution of the funding by FOOD2030 priority

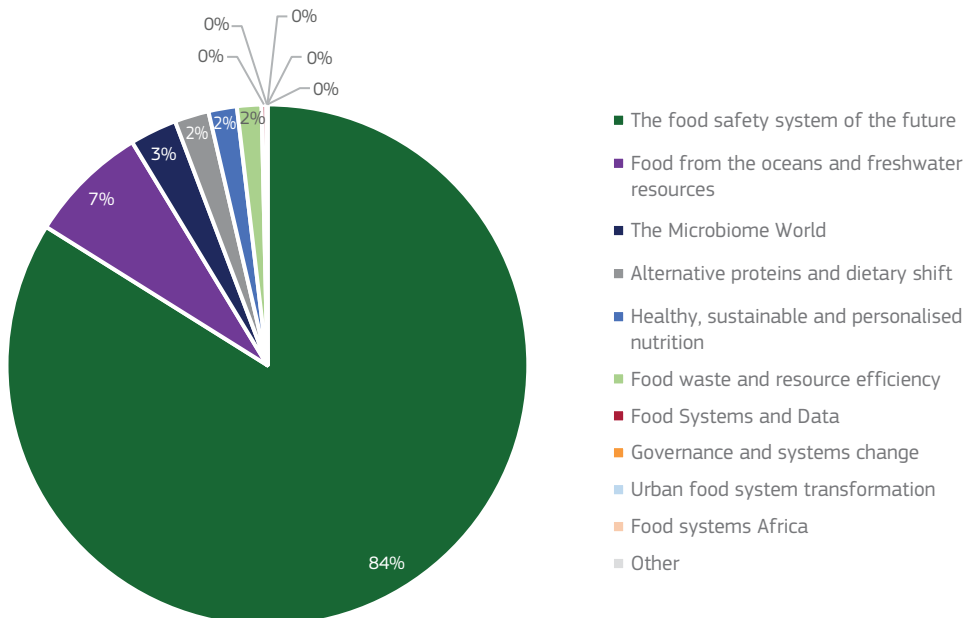


Source: SCAR mapping, Lithuania

Funding was mainly concentrated on projects dealing with food safety aspects and resilience of food systems (EUR 8.9 million). A smaller but sizeable share of funding was directed to projects centring around oceans and freshwater resources (EUR 792,000).

⁴⁴⁷ In 27 of the projects analysed it was not possible to find a correspondence between the themes of research and the FOOD2030 priorities. The total funding associated to these projects is €957,744. Similarly, there was no correspondence between these projects and the pathways. These projects are classified as 'other'.

Figure 5: Distribution of the funding by FOOD2030 pathway



Source: SCAR mapping, Lithuania

8 Data gaps and limitations

Government officials contacted with regard to national funding for food R&I were very cooperative but were not able to provide additional data on R&I funding for innovation in food systems. Therefore, this country report relies on data facilitated by the SCAR working group, but only covers projects awarded grants between 2011 and 2016.

Summary of data sources: Lithuania

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Economy and Innovation	https://eimin.lrv.lt/en/
	Minister of Education, Science and Sport	https://www.smm.lt/main/web/en/
	Research Council of Lithuania	https://www.lmt.lt/en
	Ministry of Finance	https://finmin.lrv.lt/en/
	Ministry of Agriculture	https://zum.lrv.lt/en/
Food innovation related policies	Ministry of Education and Science (2014), Priority sustainable agri-biological resources and safer food in the priority area of research and (socio-cultural) development and innovation (smart specialisation) agri innovation and food technologies action plan	https://www.smm.lt/uploads/documents/en_smm/smarts/sp/safer%20food.pdf
	Ministry of Education and Science and Ministry of Economy (2014), Action plan of the priority “functional food” of the priority area of research and experimental (socio-cultural) development and innovation (smart specialization) “agri-innovation and food technologies”	https://www.smm.lt/uploads/documents/en_smm/smarts/sp/functional%20food.pdf
	Ministry of Education and Science and Ministry of Economy (2014), Action plan of the priority innovative development, improvement and processing of biological raw materials (biorefinery) of the priority area of agricultural innovation and food technologies of the scientific research and (socio-cultural) development and innovation (smart specialisation)	https://www.smm.lt/uploads/documents/en_smm/smarts/sp/biorefinery.pdf

	Ministry of Education and Science (2015), On the approval of the National Science Program “Healthy and Safe Food” (<i>Dėl Nacionalinės mokslo programos “Sveikas ir saugus maistas” patvirtinimo 2015</i>)	https://www.e-tar.lt/portal/legalAct/TAR.0914434AACFF/BGKBTMarCm
	Ministry of Agriculture (2015), On the approval of the Research and Experimental Development Program for Agriculture, Food, Fisheries and Rural Development 2015-2020 (<i>Dėl Žemės, maisto ūkio, žuvininkystės ir kaimo plėtros mokslinių tyrimų ir eksperimentinės plėtros 2015–2020 metų programos patvirtinimo</i>)	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/99709940557711e485f39f55fd139d01?fwid=89x1tgr8w https://zum.lrv.lt/uploads/zum/documents/files/LT_versija/Skelbimai/2_%20TAISYKL%C4%96S.doc
National R&I Strategies	On the Lithuanian Innovation Strategy for 2010-2020 (<i>Dėl Lietuvos Inovacijų 2010–2020 Metų Strategijos</i>)	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.365849
	On the Approval of the Lithuanian Innovation Development Programme for 2014-2020 (<i>Dėl Lietuvos inovacijų plėtros 2014-2020 metų programos patvirtinimo</i>)	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.463361
	Regarding the adoption of the Programme for the Implementation of Priority Areas of Research and (Socio-Cultural) Development and Innovation (Smart Specialisation) (<i>Dėl Prioritetinių mokslinių tyrimų ir eksperimentinės plėtros ir inovacijų raidos (sumanosios specializacijos) prioritetų įgyvendinimo programos patvirtinimo</i>)	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/78c68700d77c11e3b272e0e81c552d38
	Law on Technologies and Innovation (<i>Lietuvos Respublikos technologijų ir inovacijų įstatymas</i>)	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/3a00ca517f7d11e89188e16a6495e98c?fwid=sujolj4

Summary of amount spent from structural funds in agriculture and food projects	Creating the future of Lithuania 2014-2020 Operational Programme for the European Union Funds Investments in Lithuania – European Social Fund, Cohesion Fund, European Regional Development Fund	https://www.esinvesticijos.lt/lt/finansavimas/paraiskos_ir_projektai
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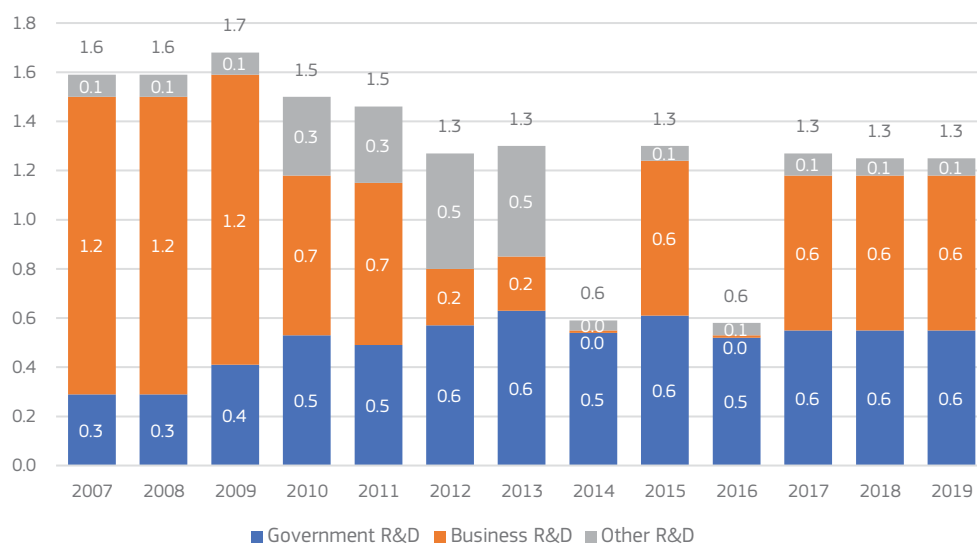
LUXEMBOURG

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Luxembourg from 2007 to 2019.⁴⁴⁸ While government funding for R&D has increased steadily over this period, overall expenditure on R&I as a proportion of GDP has decreased over this period from a peak of 1.7% in 2009 to 1.3% in 2019.

Luxembourg does not have a specific food R&I policy in place, but announced the creation of a Food Policy Council which gathers stakeholders operating within food systems in the field of research.

Figure 1: R&I expenditure in Luxembourg, as % of GDP



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

⁴⁴⁸ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Main providers of Food R&I funding at national level

In general, the main institution responsible for funding R&D in Luxembourg is the **Luxembourg National Research Fund**⁴⁴⁹. Food related R&D also receives contributions from the Ministry of Agriculture, Viticulture and Rural Development, and from the programme Luxembourg in Transition⁴⁵⁰. Relevant actors of public research are the **Luxembourg Institute of Health** (LIH), **Luxembourg Institute of Socio-Economic Research** (LISER), **Luxembourg Institute of Science and Technology** (LIST), **University of Luxembourg** and **Luxinnovation**.

2 National R&I Strategy

Luxembourg has only recently adopted a full-fledged National R&I Strategy. In 2008, the **National Plan for Innovation and Full Employment**⁴⁵¹ was implemented, focusing on innovation and employment as indivisible concepts for the thriving of an information society. The objectives laid out by the National Plan focused on innovation, full employment, high quality education and training structures, the integration of Luxembourg's economy into the European and the world economy, the maintenance of an attractive economic context, and a stable macroeconomic framework. In 2014, the **National Plan for Smart Sustainable and Inclusive Growth**⁴⁵² included a focus on the improvement of conditions for innovation and R&D, in the areas of climate change and energy, improving education levels and promoting social inclusion. Also in 2014, the **Digital Luxembourg**⁴⁵³ initiative was launched, focusing on the harnessing of digitalization for positive transformation in the areas of skills, policy, infrastructure, ecosystem and government.

Finally, in 2020 Luxembourg adopted the **National Research and Innovation Strategy**. This strategy defines research priorities for the upcoming 10 years, based on diversity and sustainability principles, and contributes to the sustainable vision of Luxembourg 2030⁴⁵⁴. This is to be achieved through coordinated governance, infrastructure and policy, and research as a driver of innovation, and anchoring science in society. The National Research and Innovation Strategy mentions resilient eco and agro-systems in the context of the sustainable and responsible development axis, which focuses on the green transition, and mentions the adoption

⁴⁴⁹ <https://researchluxembourg.lu/research-organisations/#governancebodies>

⁴⁵⁰ <https://luxembourginttransition.lu/en/>

⁴⁵¹ <https://gouvernement.lu/dam-assets/fr/publications/rapport-etude-analyse/minist-economie/observatoire-de-la-competitivite/programme-national-de-reforme/2008-pnr-luxembourg/2008-pnr-luxembourg-en.pdf>

⁴⁵² <https://gouvernement.lu/dam-assets/fr/publications/rapport-etude-analyse/minist-economie/observatoire-de-la-competitivite/programme-national-de-reforme/2014-pnr-luxembourg-2020/2014-pnr-luxembourg-en.pdf>

⁴⁵³ <https://gouvernement.lu/en/dossiers/2014/digital-letzebuerg.html>

⁴⁵⁴ <https://chronicle.lu/category/environment/35387-luxembourg-unveils-3rd-national-plan-for-sustainable-development>

of technology to monitor ecological systems and biodiversity⁴⁵⁵. The priority areas aim to guarantee sustainable development and wellbeing of the population, especially in regards to health, the environment and education. It is also relevant to note the MoU signed in 2021 between the Luxembourg National Research Fund and the Ministry of Agriculture, Viticulture and Rural Development on Sustainable and Resilient Agriculture and Food Systems⁴⁵⁶.

3 National Food Policy

In 2018, Luxembourg adopted its 2018-2023 **Accord de Coalition**. This initiative announced the creation of a **Food Policy Council** in order to link agriculture and civil society. The Council gathers stakeholders operating within food systems in the following fields: production, transformation and retail; policy and administration; and research and civil society⁴⁵⁷. Furthermore, the Accord promotes education for sustainable development with emphasis on food education, and the reduction of food waste and the development of intelligent and resilient agriculture in order to promote food sovereignty.

Luxembourg has several waste reduction and sustainability strategies which touch upon food systems. In 2014, recommendations for purchasing with respect for the environment were published under the guide “Catering – Service de la Restauration” in order to promote sustainability criteria amongst purchasers⁴⁵⁸. References to sustainable development and minimized environmental impact are also present in the Recommendations for Public Market Supply of Foodstuffs⁴⁵⁹. In 2018, the country adopted the **Waste Prevention Strategy**, based on the circular economy concept with the main objective of reducing waste, including food waste, and managing resources responsibly⁴⁶⁰. Additionally, in 2020, Luxembourg adopted the **3rd National Plan for Sustainable Development** which promotes sustainable consumption and production, by proposing to develop models based on circular economy principles and the reduction of waste⁴⁶¹. The Plan presents the following ten priorities:

1. Social inclusion and education;

⁴⁵⁵ <https://researchluxembourg.lu/national-research-and-innovation-strategy/>

⁴⁵⁶ <https://www.fnr.lu/fnr-and-ministry-of-agriculture-sign-mou-and-launch-joint-call/>

⁴⁵⁷ <https://food.uni.lu/projects/research-projects/food-policy-council/>

⁴⁵⁸ <https://bit.ly/3gBxnb6>

⁴⁵⁹ http://nobe.lu/uploads/pdfs/Examples/Alimentation/Plateforme%20MDDI%20March%C3%A9s%20publics%2020170508_final.pdf

⁴⁶⁰ <https://luxembourg.public.lu/en/society-and-culture/sustainable-development/hull-offall-strategie-waste-prevention-strategy.html>

⁴⁶¹ https://environnement.public.lu/fr/publications/developpement_durable/pnnd-2021.html

2. Healthy population;
3. Sustainable consumption and production;
4. Inclusive economy;
5. Coordination of land use;
6. Sustainable mobility;
7. Climate and natural resources;
8. Sustainable energy;
9. Eradication of poverty;
10. Sustainable finances⁴⁶².

In the context of the national policies discussed above, regional initiatives have been set up. For example, 92 municipalities of Luxembourg participate in an anti-food waste solidarity pact, under the “**Anti Gaspillage Initiative**”⁴⁶³, and sustainable practices in food systems are promoted by public procurement law, which was revised in 2018 in order for it to become a tool for innovation and a political strategy in the social and environmental fields by providing measures to help prevent conflicts of interest and favouritism⁴⁶⁴. Additionally, the NoBe online tool enables sustainable food procurement through labelling schemes⁴⁶⁵. Finally, currently, there is a new proposed sustainable label bill for Luxembourg concerning the approval of quality certification systems of agricultural products⁴⁶⁶, which aims to establish trust between consumers and producers, and to support regional producers by offering fair remuneration.

⁴⁶² <https://chronicle.lu/category/environment/35387-luxembourg-unveils-3rd-national-plan-for-sustainable-development>

⁴⁶³ <https://antigaspi.lu/>

⁴⁶⁴ <https://www.espon.eu/public-procurement-luxembourg>

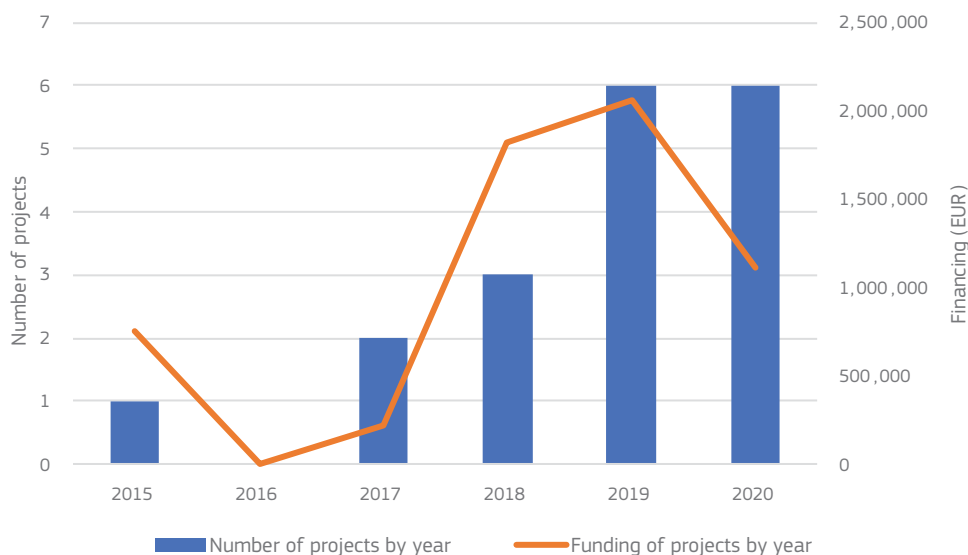
⁴⁶⁵ <https://nobe.lu/>

⁴⁶⁶ <https://csdd.public.lu/fr/actualites/2020/agrementproduits-agricoles.html>

4 Public funding available for food R&I

According to data made available by the Ministry of Agriculture, Viticulture and Rural Development and the Ministry of Economy, a total of 18 R&I food-related projects were developed by Luxembourgish organisations between 2015 and 2020, receiving a total of EUR 5.9 million in funding⁴⁶⁷. A review of the number of projects approved during this period shows that 2019 and 2020 were the years with most projects approved (6). In 2019, the year registering the largest funding amount, public funding spent in food-related research and innovation was EUR 2.1 million (Figure 2). The Ministries did not have data for projects funded prior to 2015, explaining that there is very limited activity on food systems R&I in Luxembourg.

Figure 2: R&I food related projects between 2005 and 2020.



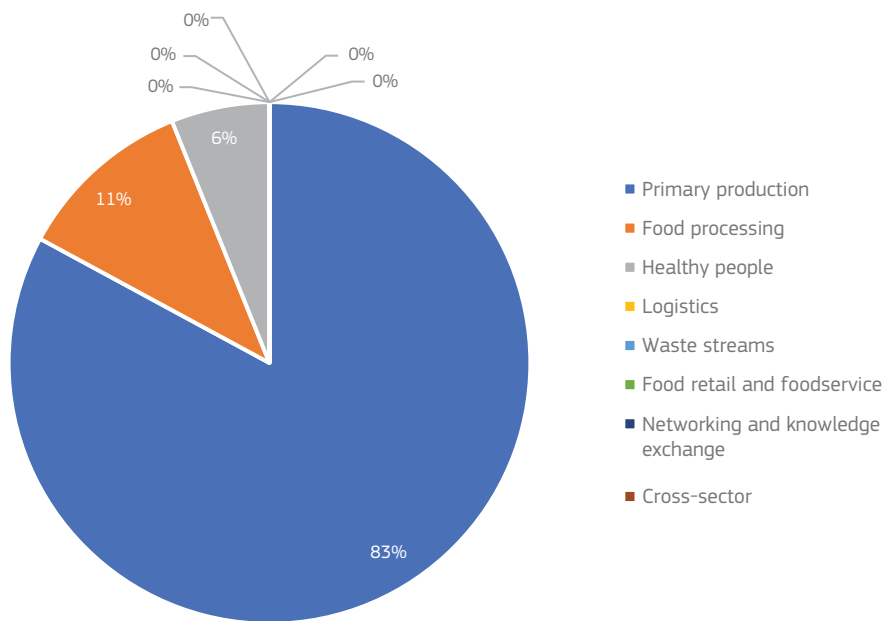
Source: Ministry of Agriculture, Viticulture and Rural Development and Ministry of Economy of Luxembourg

Funding by sector

When analysing the sectors receiving funding for food-related R&I projects, the majority of public funding appears to be directed towards projects and/or actions related to primary production (83%).

⁴⁶⁷ No projects were developed between 2008 and 2014.

Figure 3: Distribution of the funding by sector

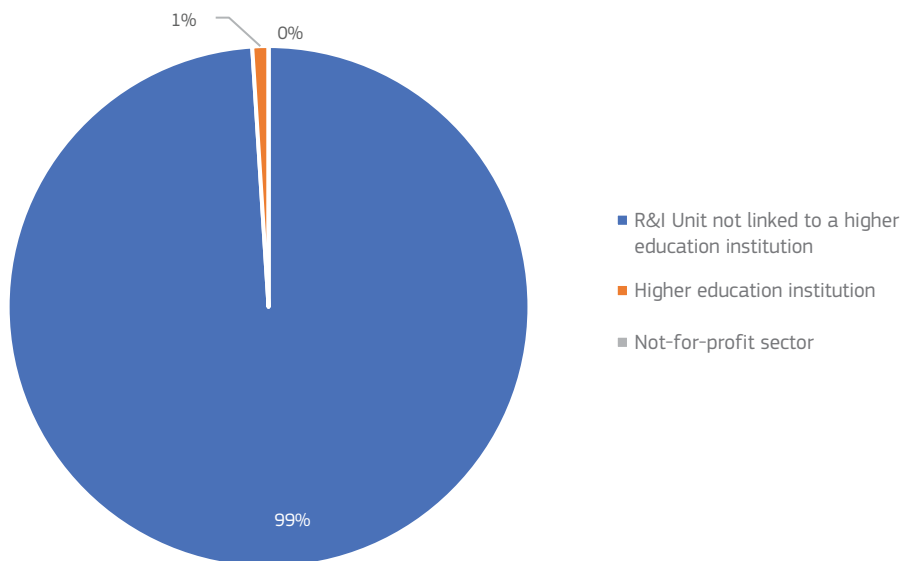


Source: Ministry of Agriculture, Viticulture and Rural Development and Ministry of Economy of Luxembourg

5 Main recipients of public food R&I investment

A review of the data shows that R&I Units not linked to Higher Education Institutions received the highest amount of food R&I funding (EUR 5.8 million, corresponding to 99% of the total funding), followed by Higher Education Institutions (EUR 74,750, or 1% of the total). R&I units not linked to Higher Education Institutions coordinated 17 projects between 2005 and 2020, whereas Higher Education Institutions only 1 (Figure 4).

Figure 4: Distribution of the funding by recipients



Source: Ministry of Agriculture, Viticulture and Rural Development and Ministry of Economy of Luxembourg

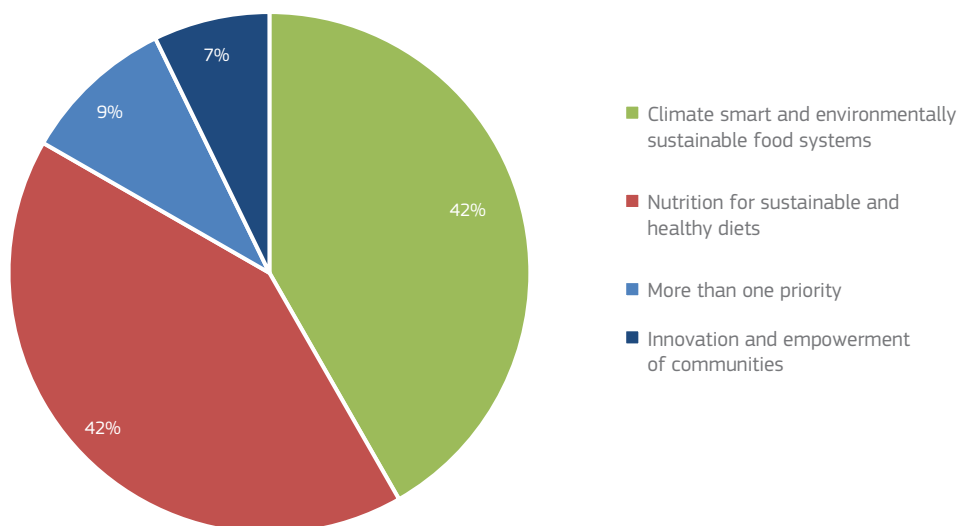
6 Structural Funds available for Food R&I

In the 2008-2020 period, no structural funds were identified as contributing to food R&I in Luxembourg.

7 Links to FOOD2030 priorities and pathways

According to an internal analysis of the funding data, publicly funded food-related R&I in Luxembourg has prioritised research in Climate smart and environmentally sustainable food systems (45% of the total, corresponding to EUR 2.31 million). The second FOOD2030 priority in Luxembourgish research is Climate smart and environmentally sustainable food systems (43%, corresponding to EUR 2.308 million).

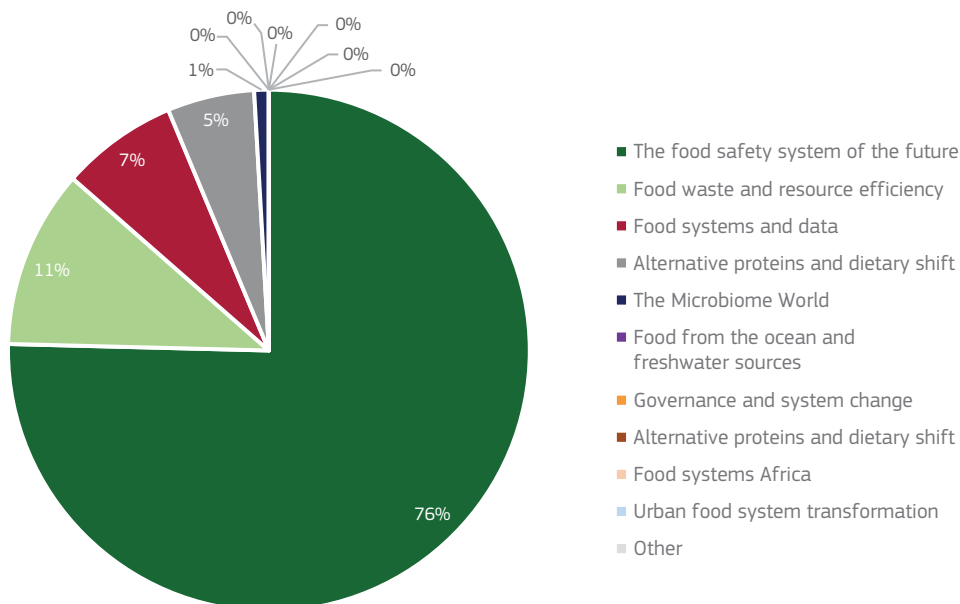
Figure 5: Distribution of the funding by FOOD2030 priorities



Source: Ministry of Agriculture, Viticulture and Rural Development and Ministry of Economy of Luxembourg

With regards to FOOD2030 pathways, publicly funded food R&I in Luxembourg assigns a large share to Food safety systems of the future (76%, corresponding to EUR 4.2 million), followed by Food waste and resource efficiency (11% corresponding to EUR 0.6 million). This was then followed by Food systems and Data and Alternative proteins and dietary shifts, at 7% (corresponding to EUR 0.4 million) and 5% (corresponding to EUR 0.2 million) respectively. The Microbiome world received the smallest proportion of public contribution at 1%, corresponding to EUR 0.05 million. It is also worth noting that given the small size of funding projects, some of the other FOOD2030 pathways, including Food systems Africa, Governance and system change and Urban food systems, received no public funding. Further details can be observed in Figure 6.

Figure 6: Distribution of the funding by FOOD2030 pathways



Source: Ministry of Agriculture, Viticulture and Rural Development and Ministry of Economy of Luxembourg

8 Data gaps and limitations

The results of the analysis are based on an interview with the Ministry of Agriculture, Viticulture and Rural Development of Luxembourg, and correspondence with the Ministry of Economy, who provided information regarding the relevant projects they were aware of. Information not available includes technology readiness level (TRL), publications and patents.

Summary of data sources: Luxembourg

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture, Viticulture and Rural Development of Luxembourg	https://ma.gouvernement.lu/en.html
Food innovation related policies	World-class Food Innovation Towards 2030	https://lf.dk/-/media/lf/aktuelt/publikationer/lf/2017/foedevarestrategi-pixi-2017-web.pdf
National R&I Strategies	National Research and Innovation Policy	https://researchluxembourg.lu/national-research-and-innovation-strategy/
Specific food innovation related R&I competitions/funding	CORE	https://www.fnr.lu/funding-instruments/core/
	Luxembourg in Transition	https://luxembourgtransition.lu/en/

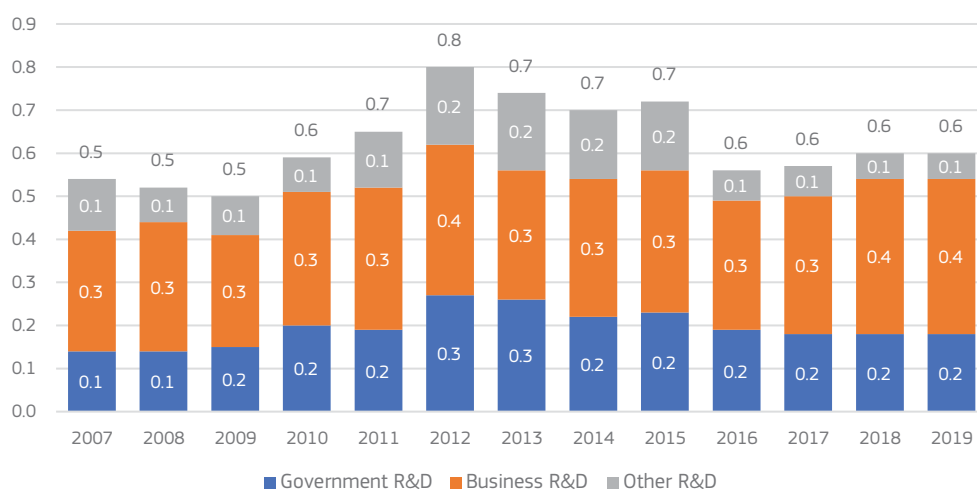
MALTA

1 Overview of national R&I landscape

The main public sector actor in R&I in Malta is the Malta Council for Science and Technology (MCST), a government body responsible for research policy coordination, promotion of scientific research, and management of funding programmes. Innovation activity is also carried out by the Ministry for Agriculture, Fisheries, Food and Animal Rights, which also participates in funding calls issued by the MCST.

Malta does not have a specific food R&I policy. The country's R&I policy started to focus on the agri-food sector only relatively recently, particularly since 2016. Aquaculture is presented as one of the key focus areas in the National R&I Strategy.

Figure 1: R&I expenditure in Malta, as % of GDP



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

2 National R&I Strategy

Malta's R&I landscape is underpinned by the National R&I Strategy 2020⁴⁶⁸, which builds on the previous 2007-2010 strategy⁴⁶⁹ and addresses R&I in an integrated fashion through the links between academia, industry, and human capital. The strategy centres around innovation and research that is close to the market and sets out three main objectives:

- **Building a comprehensive R&I support ecosystem**, by expanding and improving existing schemes to ensure seamless support throughout all the innovation phases;
- **Developing a stronger knowledge base**, investing in human capital and infrastructure to continue the transformation towards a knowledge-based economy; and
- **Promoting smart, flexible specialisation** following some of the Horizon 2020's societal challenges, establishing clear priorities based on Malta's unique selling points.

The **National R&I Action Plan 2020**⁴⁷⁰ identifies the concrete measures and instruments to put into practice the Strategy, alongside with a series of monitoring indicators.

3 Overview of national food policy

Malta recognised the need to better support R&I in the agri-food sector only relatively recently⁴⁷¹, with the Malta Council for Science and Technology playing a leading role in supporting innovation programmes involving actors from the private sector, the public sector, and academia.

⁴⁶⁸ Malta Council for Science and Technology (2014), National Research and Innovation Strategy 2020, available at: <http://mcst.gov.mt/wp-content/uploads/2017/02/National-RI-Strategy-2020-June-2014.pdf>, last accessed 13 April 2021.

⁴⁶⁹ Malta Council for Science and Technology (2007), The National Strategy for Research and Innovation for 2007-2010, available at: https://www.researchgate.net/publication/275019047_The_National_Strategy_for_Research_and_Innovation_for_2007-2010, last accessed 13 April 2021.

⁴⁷⁰ Malta Council for Science and Technology (2014), National Research and Innovation Plan 2020, available at: <http://mcst.gov.mt/psi/national-research-innovation-strategy/#1552547149862-62c70f5e-9e98>, last accessed 13 April 2021.

⁴⁷¹ Stakeholder interview.

Malta's food and nutrition policy is based on the **Food and Nutrition Policy and Action Plan for Malta 2015-2020**⁴⁷², a document developed by the Health Promotion and Disease Prevention Directorate Parliamentary Secretariat for Health, with the contribution of different government departments and agencies. The action plan aims to address a wide range of issues related to nutrition and food security, with the ultimate goal of improving dietary habits for health and well-being. The document identifies the need to develop capacity for research in the area of food and nutrition as one of its priority action areas, namely to ensure the development of a knowledge base in the field of nutrition research.

The National R&I Strategy underlined the importance of balancing 'a fully-fledged R&I support system with the need to focus its resources on a reduced set of priority niche areas selected on the basis of unique selling points'⁴⁷³. Aquaculture is presented as one of the key focus areas in the National R&I Strategy given Malta's expertise and the strength of public-private partnerships in the field.

Malta's **Rural Development Programme 2014-2020**⁴⁷⁴ mentions innovation in agriculture as a driver of cooperation among farming communities and of more integration between agriculture, food production, environmental management, and research. The measures proposed under the Rural Development Programme cover human capital, as well as increased sustainability, productivity, and resilience of the agri-food sector by investing in 'innovation partnerships' to pilot research project to address specific problems that affect the agricultural sector.

More recently, Malta published its **National Agricultural Policy for the Maltese Islands 2018-2028**⁴⁷⁵, which builds on previous reviews and economic analysis of Malta's agricultural sector and seeks to provide directions and recommendations to address future trends in agriculture. The plan identified six key objectives, ranging from food labelling and traceability to sustainability and resilience to climate change. In particular, the document recognised the critical role of R&I in the agricultural sector to spur productivity and integration into international markets, whilst acknowledging that the application of R&I

⁴⁷² Health Promotion and Disease Prevention Directorate Parliamentary Secretariat for Health (2014), Food and Nutrition Policy and Action Plan for Malta 2015-2020, available at: https://deputyprimeminister.gov.mt/en/strategy-development-and-implementation-unit/Documents/Strategies_and_Policies/Food_and_Nutrition_Policy_and_Action_Plan_for_Malta.pdf, last accessed 13 April 2021.

⁴⁷³ *Ibid.*, page 14.

⁴⁷⁴ European Commission (2014), Malta – Rural Development Programme (National), available at: [https://eufunds.gov.mt/en/EU%20Funds%20Programmes/European%20Agricultural%20Fund/Documents/RDP%202014-2020/Programme_2014MT06RDNPO01_5_2_en%20\(1\).pdf](https://eufunds.gov.mt/en/EU%20Funds%20Programmes/European%20Agricultural%20Fund/Documents/RDP%202014-2020/Programme_2014MT06RDNPO01_5_2_en%20(1).pdf), last accessed 13 April 2021.

⁴⁷⁵ Parliamentary Secretary for Agriculture, Fisheries, and Animal Rights (2018), National Agricultural Policy for the Maltese Islands 2018-2028, available at: https://agrikultura.gov.mt/en/agricultural_directorate/Documents/nationalAgriculturalPolicy/napFinal.pdf, last accessed 13 April 2021.

to the agricultural sector had been limited due to the fact that most businesses in the sector are small and cannot afford to fund R&I investments⁴⁷⁶. Furthermore, the document stresses the importance of ensuring that innovation is tailored to the needs of Maltese agriculture, even in the case of international collaborations.

Furthermore, aquaculture was identified as a key area in the draft Smart Specialisation Strategy for 2021-2027⁴⁷⁷. The draft strategy recognised the contribution of the aquaculture industry to primary food production, in addition to the industry's role in terms of exports. The draft strategy proposed to focus on research, technology testing, as well as production of knowledge-intensive supply materials such as feeds, vaccines, and seeds⁴⁷⁸. In order to achieve higher levels of investment in aquaculture, the draft strategy points to the need to leverage both public and private investment capacity to ensure the commercial application of research results⁴⁷⁹.

The National Agricultural Policy also recommends the creation of 'idea incubators' to encourage profitable, market-oriented farm businesses⁴⁸⁰. To this extent, the Ministry of Agriculture launched the **Agricultural Research and Innovation Hubs** (AGRIHUB). This initiative seeks to strengthen the links between the research community and farmers by providing opportunities for innovators to demonstrate the practical functioning and the benefits of their projects in real-life settings.

4 Public funding available for food R&I

National funding of R&I projects in the agri-food and aquaculture sector has been available since 2017. According to data made available by MCST specifically for this study, between 2017 and 2020 a total of EUR 749,653 from the national budget was allocated to fund six different R&I projects in the agri-food and aquaculture sectors, as illustrated in .

Figure . Over two-thirds of the budget was awarded in 2018 and 2019, and mainly focused on technologies applied to aquaculture. The two projects funded in 2018 are both part of

⁴⁷⁶ *Ibid.*, page 204.

⁴⁷⁷ Malta Council for Science & Technology (2020), Draft for Public Consultation October 2020 Malta's Smart Specialisation Strategy, available at: http://mcst.gov.mt/wp-content/uploads/2020/10/Malta-RIS3-2021-2027_DRAFT-PUBLIC-CONSULTATION-Oct2020.pdf, last accessed 19 October 2021.

⁴⁷⁸ *Ibid.* page 51.

⁴⁷⁹ *Ibid.* page 52.

⁴⁸⁰ Parliamentary Secretary for Agriculture, Fisheries, and Animal Rights (2018), National Agricultural Policy for the Maltese Islands 2018-2028, page 208, available at: https://agrikultura.gov.mt/en/agricultural_directorate/Documents/nationalAgriculturalPolicy/napFinal.pdf, last accessed 13 April 2021.

the flagship programme Partnership for Research and Innovation in the Mediterranean Area (PRIMA)⁴⁸¹ and focus on fish and crop production.

This is part of the government’s commitment to R&I funding, represented in the table below.

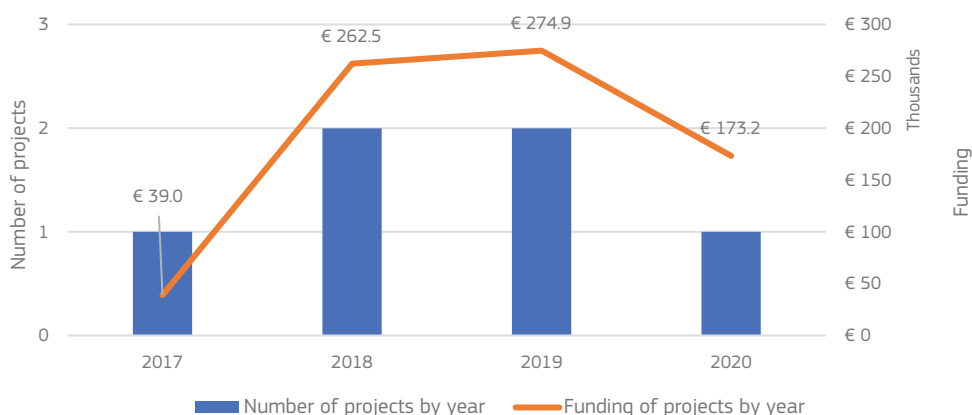
Table 1: Government commitments for R&I funding

Year	Amount (EUR thousands)
2018	500
2019	755
2020	1,200
2021	800

Source: Stakeholder interview

Figure does not account for a number of projects that were awarded funding as information was not available by the time the study was completed. These projects would bring the total amount of funding awarded in 2020 to EUR 1,157,749⁴⁸².

Figure 2: R&I food related projects between 2008 and 2020



Source: Analysis of data compiled for this study by Malta Council for Science and Technology (2021)

Note: Funding amounts accounted for based on project award date. Funding is disbursed in stages throughout the project lifetime.

⁴⁸¹ PRIMA seeks to devise new approaches to R&I for water availability and sustainable agriculture. More information is available at: <https://prima-med.org/about-us/prima-in-brief/> (last accessed 13 April 2021).

⁴⁸² Additional information provided by MCST.

Funding by sector

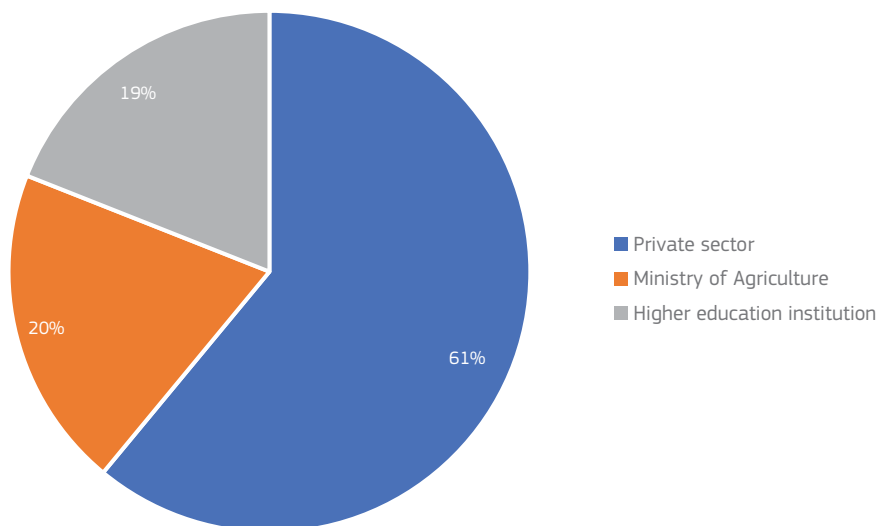
All the funding awarded relates to primary production – from fish farming to crop harvesting innovations.

5 Main recipients of public food R&I investment

A majority of the funding was awarded to projects developed by the private sector (61%, equal to EUR 460,656), with the remaining funding almost equally shared between the Ministry of Agriculture (20%, or EUR 149,997) and universities (19%, or EUR 139,000), as reported in Figure 3.

It is foreseen that with new grant agreements in 2020 the total funding awarded to private sector beneficiaries should stand at EUR 744,148, for universities EUR 448,857, and for the Ministry of Agriculture EUR 502,144⁴⁸³.

Figure 3: Distribution of the funding by recipient



Source: Analysis of data compiled for this study by Malta Council for Science and Technology (2021)

⁴⁸³ Additional information provided by MCST.

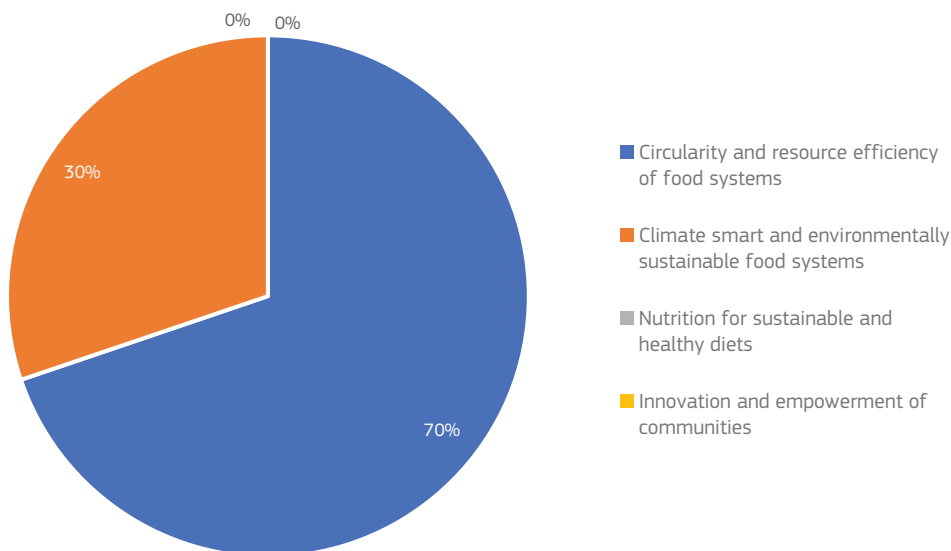
6 Structural and Investment Funds available for Food R&I

Data from MCST shows that four additional projects (not included in the previous analysis) received funding from Horizon 2020 and one was financed under the Interreg programme Italy-Malta. Structural and Investment Funds in Malta are mainly spent on heritage conservation and restoration, as well as on projects aiming to promote energy efficiency and renewable energy⁴⁸⁴.

7 Links to FOOD2030 priorities and pathways

National funding for R&I in the field of agri-food and aquaculture mainly targeted projects that sought to address challenges linked to resource efficiency and circularity – these accounted for almost 70% of all the funding, or EUR 523,155. The remaining funding (30%, or EUR 226,499) aimed to support technologies and innovations related to climate and the sustainability of food systems. This is shown in Figure 4.

Figure 4: Distribution of the funding by FOOD2030 priority

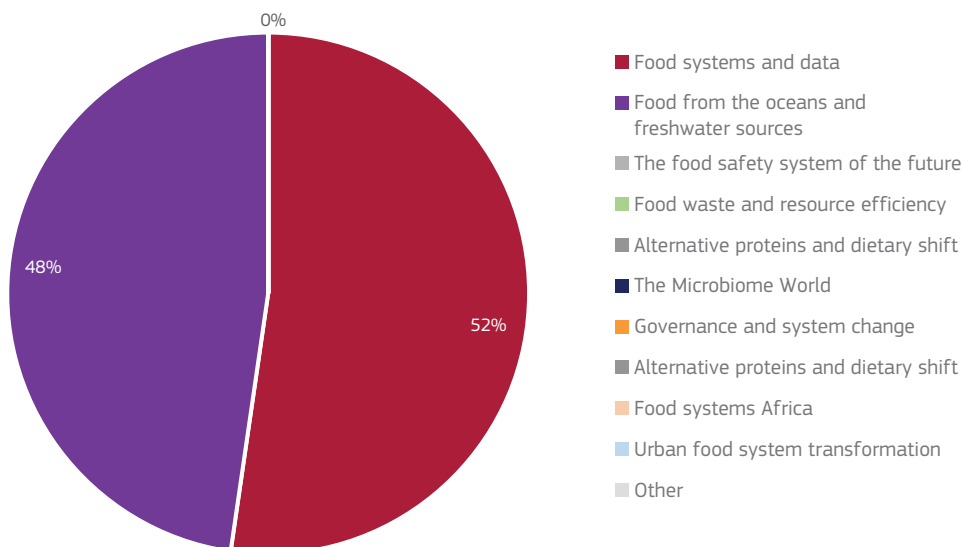


Source: Analysis of data compiled for this study by Malta Council for Science and Technology (2021)

⁴⁸⁴ For a list of projects, please refer to: <https://eufunds.gov.mt/en/Operational%20Programmes/Programming%20Period%202014%20-%202020/Operational%20Programme%201/Pages/Operational-Programme-I.aspx> (last accessed 19 October 2021).

As Figure 5 illustrates, the funding was split almost equally between two FOOD2030 pathways: on one side, projects related to the theme Food systems and data attracted slightly more than half of all funding (52%, corresponding to EUR 326,412), whilst projects in the Food from the ocean and freshwater sources pathway were granted 48% of the funding (EUR 298,243).

Figure 5: Distribution of the funding by FOOD2030 pathway



Source: Analysis of data compiled for this study by Malta Council for Science and Technology (2021)

8 Data gaps and limitations

The relatively recent addition of the agri-food and aquaculture sector to the thematic portfolio of R&I funding in Malta may explain the lack of publicly available information on projects financed in this specific area. However, the funding data presented in this case study is believed to be comprehensive, as it has been compiled for the purpose of this study by the MCST after careful involvement of other government departments.

Summary of data sources: Malta

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Malta Council for Science and Technology	http://mcst.gov.mt/
Food innovation related policies	Health Promotion and Disease Prevention Directorate Parliamentary Secretariat for Health (2014), Food and Nutrition Policy and Action Plan for Malta 2015-2020	https://deputyprimeminister.gov.mt/en/strategy-development-and-implementation-unit/Documents/Strategies_and_Policies/Food_and_Nutrition_Policy_and_Action_Plan_for_Malta.pdf
National R&I Strategies	Malta Council for Science and Technology (2014), National Research and Innovation Strategy 2020	http://mcst.gov.mt/wp-content/uploads/2017/02/National-RI-Strategy-2020-June-2014.pdf
	Malta Council for Science and Technology (2014), National Research and Innovation Plan 2020	http://mcst.gov.mt/psi/national-research-innovation-strategy/#1552547149862-62c70f5e-9e98
	Malta Council for Science & Technology (2020), Draft for Public Consultation October 2020 Malta's Smart Specialisation Strategy	http://mcst.gov.mt/wp-content/uploads/2020/10/Malta-RIS3-2021-2027_DRAFT-PUBLIC-CONSULTATION-Oct2020.pdf
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Ad hoc document produced by MCST.	Not public.

Food innovation funding		
	Name and description	Link
Specific food innovation related R&I competitions/funding	Ad hoc document produced by MCST.	Not public.

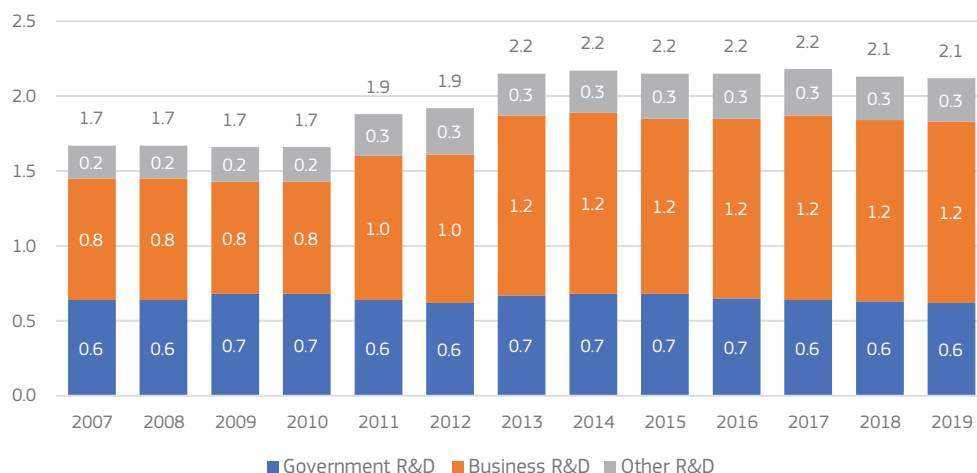
THE NETHERLANDS

1 Overview of national R&I landscape

This report provides a brief overview of the public funding landscape for food systems R&I in the Netherlands, including a breakdown of the national public funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.

The specific strategy on food R&I in the Netherlands can be found in the TKI Agri&Food innovation agenda (covering the period 2016–2019) which focuses on investments in research and innovation that meet the main goals for the agri-food sector.

Figure 1: R&I expenditure in the Netherlands as a % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main Providers of R&I funding at national level

The main policy actors in the Netherlands in relation to R&I are the **Ministry of Agriculture, Nature and Food Quality (ANF)**, **Ministry of Economic Affairs and Climate (EAC)** and the **Ministry of Education, Culture and Science (ECS)** and the **Ministry of Foreign Affairs (FA)**, who share the responsibility for innovation policy. Despite R&I policy making becoming more regionalised and R&I becoming more prominent in the EU Structural Funds,

the main financing body remains the central government.⁴⁸⁵ There are three main types of R&I funding from the central government:⁴⁸⁶

- Direct R&D expenditure, including innovation-relevant
- Direct expenditure on innovation not classified as R&D
- Indirect fiscal support (tax aid) for R&D

The largest part of total public support for R&I is in the form of direct expenditures on R&D, while a small part goes to direct expenditures on innovation (not R&D). A growing share is expenditure in the form of indirect tax aid for R&D.⁴⁸⁷ This is not often used in the 'green' domain.

Other relevant actors

The main R&I policy implementation bodies are the **Netherlands Organisation for Scientific Research** (NWO), which redistributes funding from the Ministry of Education, Culture and Science through competitions, the **Royal Netherlands Academy of Arts and Sciences** (KNAW)⁴⁸⁸, acting as a s a management body for national research institutes and advisory body for the Dutch Government, and the **Netherlands Enterprise Agency** (RVO), operating under the Ministry of Economic Affairs and Climate Policy and providing support to entrepreneurs, NGOs, knowledge institutes and organisations. The **federation of applied research institutions** (TO2) plays a central role in the development, dissemination and exploitation of knowledge in the Netherlands and abroad. They cooperate with companies, government bodies and other knowledge institutions, including through public-private partnerships. The knowledge institutes for applied research united in the TO2 federation consist of Deltares, Marin, NLR, TNO and Wageningen-Research (formerly DLO). **Wageningen University & Research** is one of the main research performers in the field of food systems and one of the leading international universities in the fields of agriculture. Other institutes such as the Netherlands **Institute of Ecology** (NIOO-KNAW) and **Westerdijk Fungal Biodiversity Institute** also play a relevant role in research in this area.

⁴⁸⁵ JRC RIO report

⁴⁸⁶ Rathenau Institut <https://www.rathenau.nl/en/science-figures/investments/summary-total-investment-research-and-innovation-twin-2015-2021>

⁴⁸⁷ RIO report

⁴⁸⁸ However, KNAW is not so relevant for the green or food related domains.

2 National R&I Strategy

The Netherlands has a target of reaching a gross domestic expenditure on R&D (GERD) as a share of GDP of 3% (it was 2% in 2019). In the Enterprise and Innovation policy launched by the Dutch government in 2010, the **mission-driven top sectors and innovation policy**, science policy, education policy, regional economic policy and the policy areas focused on well-being and societal challenges. In addition to the reduction of regulatory burdens, funding for SMEs funding R&D tax schemes, the policy also included the **'Topsector approach'**.⁴⁸⁹ At the heart of this approach lie nine key sectors with strategic importance for the Dutch economy, with the aim of enterprises and knowledge institutes working together with the government in the so called golden triangle to strengthen their innovation systems, competitiveness and address societal challenges through the **Top Consortia for Knowledge and Innovation (TKIs)**.⁴⁹⁰ The Agri & Food sector⁴⁹¹ and the Horticulture and Starting Materials sector⁴⁹² have been considered by Dutch government as top sectors, and have a portion of the R&I budgets assigned to public and public private research to develop alternative sustainable food initiatives amongst which:⁴⁹³

- Alternative proteins
- Fostering consumer knowledge, consumer habits and information, appreciation of sustainably produced food
- Reducing food waste.

The **National Reform Programme**, published in 2019, outlines as one of the main pillars of the Dutch innovation policy the 'Mission-Oriented Innovation Policy', targeted specifically to societal challenges and key technologies. The policy reinforces the goal of public-private partnerships through establishing Knowledge and Innovation Agendas (KIAs) for social themes and key technologies (beyond the top sectors), setting out the allocation of public funds (EUR 1.1 billion in 2019) and implementing them via the TKIs.⁴⁹⁴ Among the key

⁴⁸⁹ The nine top sectors are: Horticulture and propagation materials; Agri-food; Water; Life sciences and health; Chemicals; High tech; Energy; Logistics; Creative industries. <https://www.government.nl/topics/enterprise-and-innovation/encouraging-innovation>

⁴⁹⁰ JRC RIO report

⁴⁹¹ [Home - Topsector Agri & Food \(topsectoragrifood.nl\)](#)

⁴⁹² [Flyer A5 Topsector losse pagina's EN.pdf \(topsectortu.nl\)](#)

⁴⁹³ TKI agenda 2016-2019

⁴⁹⁴ National Reform 2019

societal challenges for which a KIA has been drafted, there are Agriculture, Water and Food, and the Circular economy.⁴⁹⁵

For the area 'Agriculture, Water and Food', a four year agenda has been developed (to be renewed in 2023), with the Topsectors Agri&Food, Horticulture and Starting Materials, and Water & Maritime). As part of its mission-driven Top Sectors and Innovation Policy, the government has set out its ambitions for a number of major social themes. The following six missions cover the areas of agriculture, water and food⁴⁹⁶:

- A. Circular agriculture
- B. Climate-neutral agriculture and food production
- C. Climate-proof rural and urban areas
- D. Healthy, safe and appreciated food
- E. Sustainable and safe North Sea, oceans and inland waters
- F. The best protected and liveable delta in the world

Mission D (Appreciated, healthy and safe food) is the one with a larger focus on food systems, but there are other missions that are related to food in other ways (Mission A4: Protein supply from plant sources; C2: Climate adaptive agriculture and horticulture systems, and E1: - Sustainable North Sea). The agenda involves both publicly funded research and public-private partnership programs and projects, and includes the following main knowledge and innovation themes:

- Increasing the appreciation of food and greenery and the way it is produced
- Encouraging the production and consumption of healthy and sustainable food
- Developing safe, sustainable production systems without risk to the environment
- Developing a substantially more sustainable and safer food chain

⁴⁹⁵ For the full list of KIAs: <https://www.nwo.nl/en/researchprogrammes/perspectief/current-perspectief-round/knowledge-and-innovation-agendas-kias>

⁴⁹⁶ <https://topsectoragrifood.nl/wp-content/uploads/2020/03/TOAF1910-Kennisagenda-A5-landscape-English-1.pdf>

In addition to this, the government has published the **Dutch National Research Agenda** (NWA) in 2015, which identified 140 fundamental scientific questions through a consultation process involving members of the public, knowledge institutes, businesses and civic organisations. The plan is for the government to invest up to EUR 130 million in the NWA with effect from 2020, to encourage relevant research for society and facilitate interdisciplinary knowledge sharing. The NWA research programme will be realised by the NWO on behalf of the Ministry of Education, Culture and Science, and is also largely focused on societal challenges, among which climate change, cybersecurity, the circular economy, sustainable food, water, health, conflict mediation and unequal opportunities.⁴⁹⁷ One of the NWA routes is **'Sustainable production of safe and healthy food'**, which is being led by a collaboration between three of nine top sectors: Agri & Food, Horticulture & Starting Materials, and High-Tech Systems & Materials.⁴⁹⁸

Among the more recent developments, the **Netherlands Organisation for Scientific Research** (NOW) signed the **Knowledge and Innovation Covenant** (KIC) for the period 2020–2023, initiating collaborations and establishing connections between scientists, public and private parties. The investment of more than 100 million EUR annually as part of the KIC is available for fundamental and practice-oriented research, carried out by scientists in collaboration with companies.

3 Overview of national food policy

The Dutch agri-food sector has an annual EUR 73 billion turnover and is one of the most important sectors of the Dutch economy. The sustainability of food has been a key priority for the Dutch Government since 2009, when the aim to make food systems more sustainable was made clear from the Ministry of Agriculture, Nature and Food Quality.⁴⁹⁹ In 2014, the Netherlands Scientific Council for Government Policy (WRR) published a report advising the government to shift from an agricultural policy towards a comprehensive food policy, to address the global challenge of climate change and take the new context of the food system into account. This meant designing policies considering not only the role of agriculture, but also the different values associated with food, the interdependence of food production and consumption, and the changing power relations in the food system.⁵⁰⁰ The Food agenda: for safe, healthy and sustainable food of 2016 responded to this advice and

⁴⁹⁷ National Reform 2019

⁴⁹⁸ NWA <https://2.wetenschapsagenda.nl/wp-content/uploads/2018/01/NWA-brochure-Sustainable-production-of-safe-and-healthy-food-final.pdf>

⁴⁹⁹ [Parliamentary Document 31532, no. 18 | Overheid.nl > Official announcements \(officielebekendmakingen.nl\)](#)

⁵⁰⁰ [file:///C:/Users/Elena.Mastrogregori/Downloads/R093-Towards-food-policy%20\(1\).pdf](file:///C:/Users/Elena.Mastrogregori/Downloads/R093-Towards-food-policy%20(1).pdf)

included an additional research and innovation budget of approximately EUR 20 million per year. Before then, the R&I programming on food was scattered over different R&I programs, without a clear label of food related research.

In 2018, the Ministry of Agriculture, Nature and Food Quality published a **Vision for 2025 on agriculture, nature and food**, which outlines the Netherlands' strategy for a transition to circular agriculture.⁵⁰¹ The Government intended the Vision to function as a benchmark that will help decision-makers, and outlines the main nine criteria according to which policy intentions, plans and proposals should be assessed (besides food safety and quality that are considered baseline conditions):

1. Do they help to close cycles, to reduce emissions and to reduce biomass wastage throughout the food system?
2. Do they contribute to sustainable fish stock management without damaging the natural environment?
3. Do they strengthen the socio-economic position of the farmer in the supply chain?
4. Do they contribute to the climate task for agriculture and land use?
5. Do they enhance the appeal of the countryside and contribute to a thriving regional economy?
6. Do they benefit ecosystems, biodiversity and the natural value of the farming landscape?
7. Has animal welfare been considered?
8. Do they contribute to the recognition of the value of food and to strengthening the relationship between farmers and citizens?
9. Do they strengthen the position of the Netherlands as a developer and exporter of integrated solutions for climate-smart and ecologically sustainable food systems?

⁵⁰¹ Vision for 2025 Ministry Agriculture

The **Topsector Agri&Food innovation agenda** (covering the period 2016–2019) also focuses on investments in research and innovation that meet the three main goals for the agri-food sector:⁵⁰²

- **More with less:** innovations in sustainable food systems with less use of raw material per kilogram of product and lower emissions of greenhouse gasses.
- **Higher added value:** developing high-quality food with the focus on health, flavour and convenience.
- **International leadership** through the export of products, expertise and technology.

The key research themes of TKI Agri & Food are: Circular agriculture; Climate-neutral production; Climate-proof areas; Valued, healthy and safe food; Sustainable and safe waters; The best protected delta; Key enabling technologies.⁵⁰³

Also relevant to mention here is the topsector Tionbouw en Uitgangsmaterialen, which has its main focus on agriculture but is relevant for the food domain as well.⁵⁰⁴

Based on the mission-driven approach, qualitative targets are developed by the Ministry of Agriculture, Nature and Food Quality on the basis of the main tasks and goals. Each mission has developed a Theory of Change, which describes the mission, vision, output and activities.⁵⁰⁵ There are no specific quantitative targets for research and innovation with only the focus on food. The budget for 2021 as illustrated below could give an indication of the targets, however it concerns wider themes rather than food only:

Topsector budget (covering all themes relevant for the Ministry of Agriculture, Nature and Food Quality, so not specifically for food systems): EUR 62 million.

Fundamental research budget (not specifically food only): EUR 32 million

Policy support research budget: EUR 40 million (LNV)

Research for applied sciences budget (covering all themes): EUR 2.8 million per year by the Ministry of Agriculture and the taskforce for applied research combined

⁵⁰² TKI Agri&Food agenda 2016–2019

⁵⁰³ <https://topsectoragrifood.nl/kringlooplantbouw-projectoverzicht/>

⁵⁰⁴ [TKI Tuinbouw & Uitgangsmaterialen - Topsector Tuinbouw & Uitgangsmaterialen](#)

⁵⁰⁵ The theory of change for mission D can be found on: [Schemas-Theory-of-Change.pdf \(kia-landbouwwatervoedsel.nl\)](#)

WOT budget (legal obligation to support Wageningen University and Research financially, not only specifically for food related research): EUR 50 million

One of the main challenges identified in the Netherlands concerns the lack of a clear governance on food systems and clear responsibilities among different actors. Sectors in the food chain have very different structures (primary production and industry and retail, for example), making it challenging for public-private partnerships to be established across the whole food system, including both the value chain and all related stakeholders. The government of the Netherlands' attempt to address this issue lies in the Topsector approach, bringing together public and private interests through comprehensive programmes aligned with the KIA agenda.

4 Public funding available for food R&I

According to data available on the TKI Agri& Food website, a total of **476 R&I food-related R&I projects** were funded by Dutch national authorities between 2013 and 2020⁵⁰⁶, receiving a total of **EUR 148 million** in funding. The databases were searched using the relevant keywords⁵⁰⁷ and filtering by the related discipline.⁵⁰⁸ The projects have also been filtered by funding programme, excluding from our analysis projects that were part of co-financing schemes or using EU Structural Funds.⁵⁰⁹

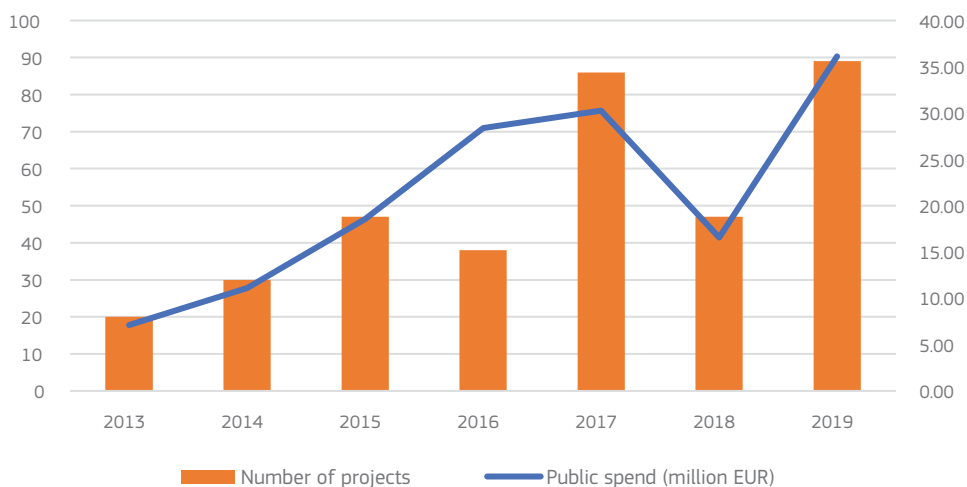
⁵⁰⁶ Note: year the call was launched.

⁵⁰⁷ Keywords used: *food; agriculture; fisheries; agri-tech; agri tech; precision farming; soil; food production; food processing; packaging; nutrition; food waste; foodwaste; water; food safety; food systems; supply chains; sustainability; eco-innovation; environmental impact;*

⁵⁰⁸ Fields: Agricultural sciences, Biomaterials, Ecotoxicology and environmental impacts, Environmental research, Environmental science, Food engineering, Food sciences, Industrial processes

⁵⁰⁹ We have assumed that other funding programmes did not make use of EU funds

Figure 2: R&I food related projects between 2013 and 2020



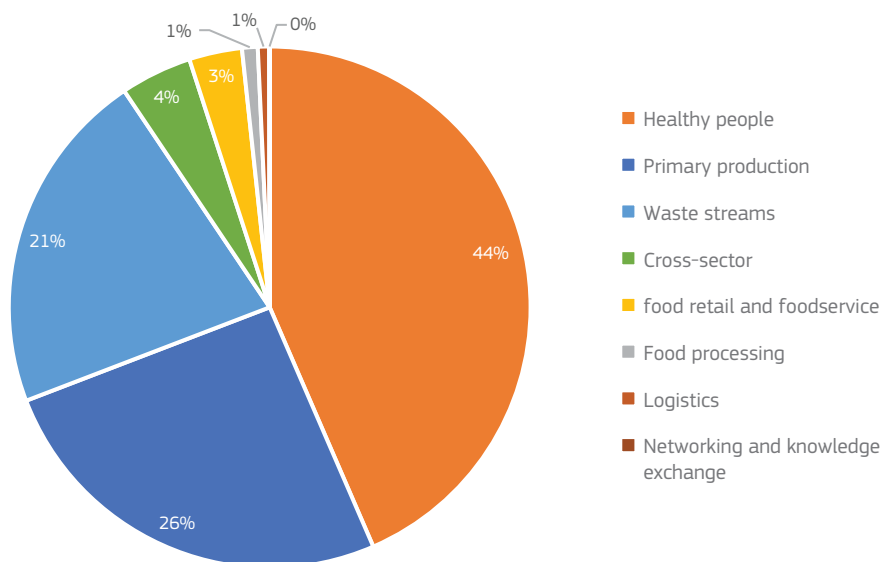
Source: Ipsos analysis of publicly available data from TKI Agri& Food, NWO, RVO
 Base: 476 projects

Figure 2 shows the relationship between projects funded and public contribution in the time period of 2013 to 2020. Funding was highest in 2019 with 89 projects funded, corresponding to EUR 36.1 million. Data for the year 2020 has been excluded from this analysis as there were gaps in funding amount in the data provided.

Funding by sector

When analysing the sectors receiving funding for food-related R&I projects, more than a third of the considered projects appear to be focused on Healthy people (44%, corresponding with EUR 64.6 million). This is followed by Primary production (26%, corresponding to EUR 38.1 million) and Waste streams (21%, corresponding to EUR 31.8 million).

Figure 3: National public funding by sector



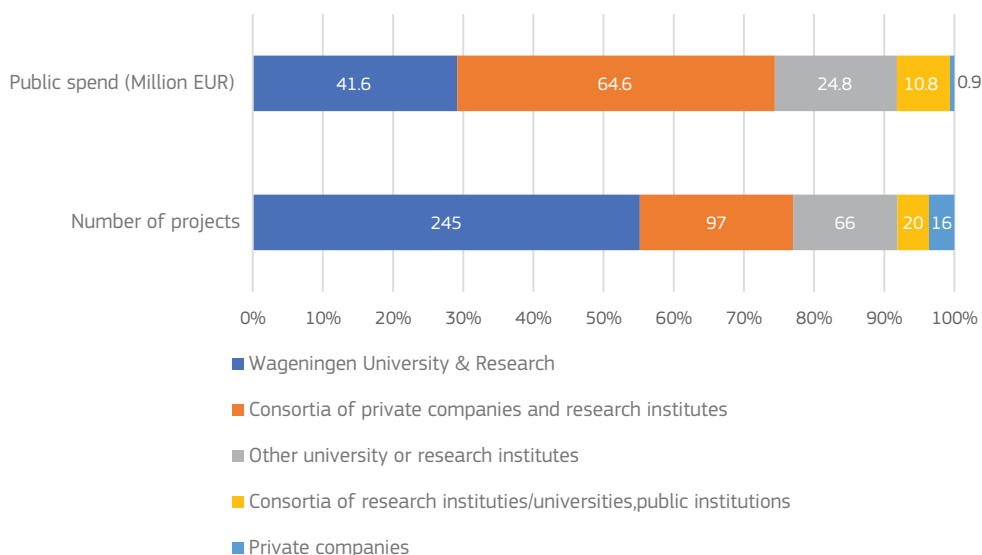
Source: Ipsos analysis of publicly available data from TKI Agri& Food, NWO, RVO

Base: 476 projects

5 Main recipients of public food R&I investment

The primary recipients of public food R&I investments in the Netherlands among the projects considered are **universities and research institutions** (70% of the projects). The single largest recipient of public funds among universities and research organisation is **Wageningen University & Research**, accounting for about a third of the total public funding among the analysed projects. As shown in Figure 4, a large share of the funding (43% or EUR 65 million) was granted to groups consisting of private companies in the field of food and nutrition and universities or research institutes (in the majority of cases Wageningen University), and only a small proportion to private companies only. Public R&I funding for **other research institutes** (such as the University of Amsterdam or TNO) accounts for 24% of the total spend.

Figure 4: Number of projects and funding by recipient organisation



Source: Ipsos analysis of publicly available data from TKI Agri& Food, NWO, RVO

Base: 444 projects

6 Structural Funds available for Food R&I

Over the period 2014-2020, the Netherlands have been allocated EUR 1.72 billion from ESI Funds (with a minimum national contribution of 1.85 billion), for the areas of research and innovation, environmental protection, resource efficiency, low carbon economy and social inclusion. One of the main priorities for the use of ESI funds in the Netherlands has been to improve the **environmental sustainability of the agricultural sector**, by investing in measures to restore, preserve and strengthen ecosystems affected by agricultural activities, as well as **making fisheries and aquaculture more sustainable and resource efficient**.

The structural funds in the Netherlands for the period 2014-2020 were divided as follows:

- **ERDF:** the Netherlands received EUR 507 million from the EU to implement ERDF programmes over the period 2014-2020. Over the period 2014-2020 the Netherlands mainly used the ERDF funding for two purposes: **innovation** and a **low-**

carbon economy (with a focus on renewable energy and more efficient energy use). The money is mainly intended for small and medium-sized businesses.⁵¹⁰

- **EAFRD**: EUR 607 million were received through the European Agricultural Fund for Rural Development, managed nationally through one **Rural Development Programme** (RDP).⁵¹¹
- **ESF**: EUR 507 million were received through the European Social Fund, targeted at two related objectives: **increasing the overall employment level** to 80% of the working age population, and **reducing the number of workless households** by 100 000 by the end of the funding period in 2020.⁵¹²
- **EMFF**: EUR 101 million were received through the European Maritime and Fisheries Fund, to support the Dutch fisheries sector in becoming innovative, sustainable and economically independent.⁵¹³

7 Links to FOOD2030 priorities and pathways

National funding for R&I in the field of food systems mainly targeted projects that sought to address challenges linked to the FOOD2030 priority **Nutrition for sustainable and healthy diets** – these accounted for 60% of the funding considered, or EUR 89 million. This encompasses mostly projects related to food safety in the primary production sector, as well as encouraging healthier eating habits, especially among the youngest. Projects targeted at addressing **Circularity and resource efficiency** constituted 25% the food-related public funding. Projects in this category were mainly focused on circular agriculture and the reduction of waste during processes by adopting more efficient techniques. The remaining funding aimed to support technologies and innovations related to **Climate smart and environmentally sustainable food systems** (13%), and only a small proportion of the public funding (2%) was categorised as and **Innovation and empowerment of communities**. The first three priorities are reflected in Dutch policies in this field, being closely connected to the national priorities laid down in the Climate Agreement, the vision of our Minister on circular agriculture,⁵¹⁴ and in the strategy on reduction of food waste, under

⁵¹⁰ <https://www.government.nl/topics/european-grants/european-structural-and-investment-funds-esi-funds/european-regional-development-fund-erdf>

⁵¹¹ https://enrd.ec.europa.eu/country/thenetherlands_en

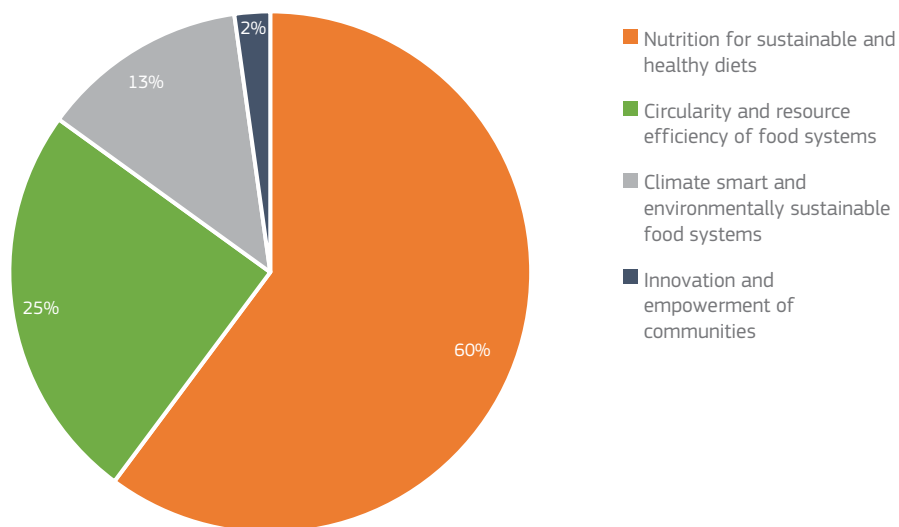
⁵¹² <https://ec.europa.eu/esf/main.jsp?catId=392>

⁵¹³ <https://www.government.nl/latest/news/2013/07/15/the-netherlands-can-remain-focused-on-sustainable-fisheries>

⁵¹⁴ [Vision Ministry of Agriculture, Nature and Food Quality | Ministry of Agriculture, Nature and Food Quality | Government.nl](#)

the programs of the mission D of the Knowledge and Innovation Agenda.⁵¹⁵ On innovation and empowering communities, there are specific programs targeted at youth education on healthy and sustainable food⁵¹⁶ and a program on improving the green and sustainable economy⁵¹⁷ (also part of mission D of the KIA LWV: Appreciated, healthy and safe food).

Figure 5: Public spend on food-related R&I projects by Food2030 priority



Source: Ipsos analysis of publicly available data from TKI Agri& Food, NWO, RVO

Base: 476 projects

As shown in figure 6, the Netherlands' R&I funding on food systems between 2013 and 2020 mainly corresponded to the pathway Food safety system of the future (129 projects accounting for 25% of the funding). Projects related to the pathway Food waste and resource efficiency also accounted for almost a quarter (22%) of the funding, with 130 projects. Healthy, sustainable and personalised nutrition represented 17% of the funding. Projects funded under the pathway alternative proteins and dietary shift accounted for 11% of the total spend, while only a limited number of projects related to Governance and systems change (4%), Food systems and data (3%), and Food from the oceans and freshwater resources (2%). Projects on the Microbiome world represented 1% of the funding, while R&I

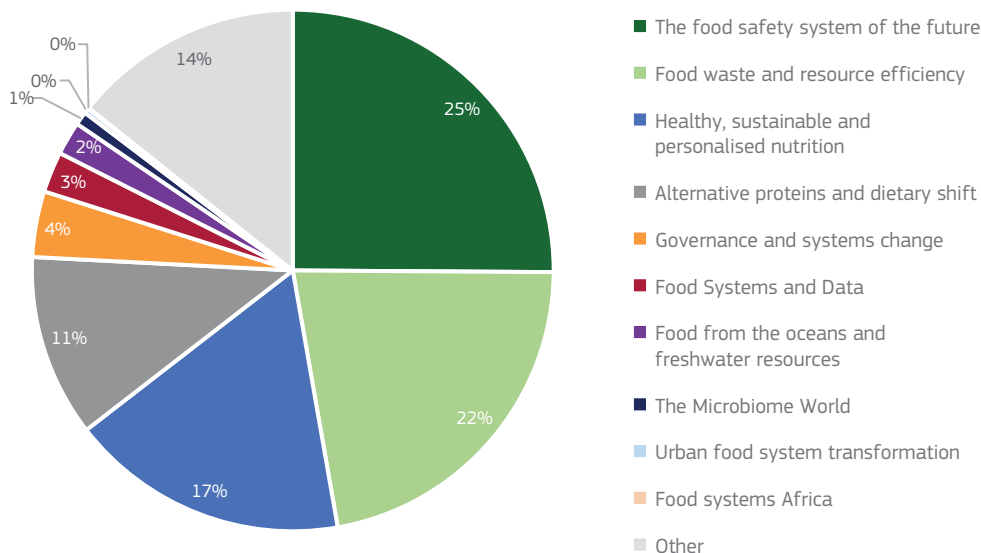
⁵¹⁵ A4: Protein supply from plant sources; C2: Climate adaptive agriculture and horticulture systems and E1: - Sustainable North Sea

⁵¹⁶ <https://www.jonglereneten.nl/>

⁵¹⁷ <https://www.duurzaamdoor.nl/>

projects focused on Food systems Africa and urban food system transformation accounted for less than 1% of the funding.⁵¹⁸

Figure 6: Public spend on food-related R&I projects by Food2030 pathway



Source: Ipsos analysis of publicly available data from TKI Agri& Food, NWO, RVO
 Base: 476 projects

8 Data gaps and limitations

The results of the analysis are based on publicly available information from the TKI Agri& Food, NWO, and RVO databases, covering the period from 2013 to 2020 (prior data was not available). Publicly available databases were searched by relevant keywords contained in the project title and project description.⁵¹⁹ Information not available on the database includes technology readiness level (TLR), publications and patents. In several instances, the granted amount was not specified and could not be included in the analysis.⁵²⁰ It should also be noted that there are projects on the NWO website that could not be included in

⁵¹⁸ However, more projects related to the Food systems Africa pathway could be found in the field of development cooperation, executed by the Netherlands Enterprise Agency and funded by the Ministry of Foreign Affairs, contained in the following database: [Project Database | Development Cooperation \(rvo.nl\)](#)

⁵¹⁹ Keywords used: *food; agriculture; fisheries; agri-tech; agri tech; precision farming; soil; food production; food processing; packaging; nutrition; food waste; foodwaste; water; food safety; food systems; supply chains; sustainability; eco-innovation; environmental impact;*

⁵²⁰ 190 projects did not specify the granted amount in the TKI Agri&Food database.

our analysis due to the lack of a list or database format that would allow us to extract the data. The Kennis Online Database from Wageningen University and Research⁵²¹ was also consulted, but it did not have the right level and format of data for our analysis.

⁵²¹ [Search results Kennisonline - WUR](#)

Summary of data sources: Netherlands

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture, Nature and Food Quality	https://www.rijksoverheid.nl/ministeries/ministerie-van-landbouw-natuur-en-voedselkwaliteit
Food innovation related policies	Vision for 2025 on agriculture, nature and food	https://www.government.nl/ministries/ministry-of-agriculture-nature-and-food-quality/documents/policy-notes/2018/11/19/vision-ministry-of-agriculture-nature-and-food-quality---english
	Topsector Agri&Food innovation agenda	https://topsectoragrifood.nl/wp-content/uploads/2017/08/Facts-figures-ambitions-2016-2019_ENG.pdf

National R&I Strategies	National Reform Programme	https://ec.europa.eu/info/sites/default/files/2019-european-semester-national-reform-programme-netherlands_en.pdf
	Dutch National Research Agenda (NWA)	https://2.wetenschapsagenda.nl/wp-content/uploads/2018/01/NWA-brochure-Sustainable-production-of-safe-and-healthy-food-final.pdf

EU Structural funds on agri-food projects

	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Structural funds in the Netherlands	https://www.government.nl/topics/european-grants/european-structural-and-investment-funds-esi-funds/european-regional-development-fund-erdf https://enrd.ec.europa.eu/country/thenetherlands_en https://ec.europa.eu/esf/main.jsp?catId=392 https://www.government.nl/latest/news/2013/07/15/the-netherlands-can-remain-focused-on-sustainable-fisheries

Available data (reports, datasets)

Source	Name and description	Link
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From desk research	TKI Agri&Food project information	https://topsectoragrifood.nl/kringlooplandbouw-projectoverzicht/
	NWO project information	Search NWO https://www.nwo.nl/en/calls?input=food&f%5B0%5D=calls_bw_call_status%3A1867
	Projects supported by RVO	Supported projects by RVO RVO.nl National

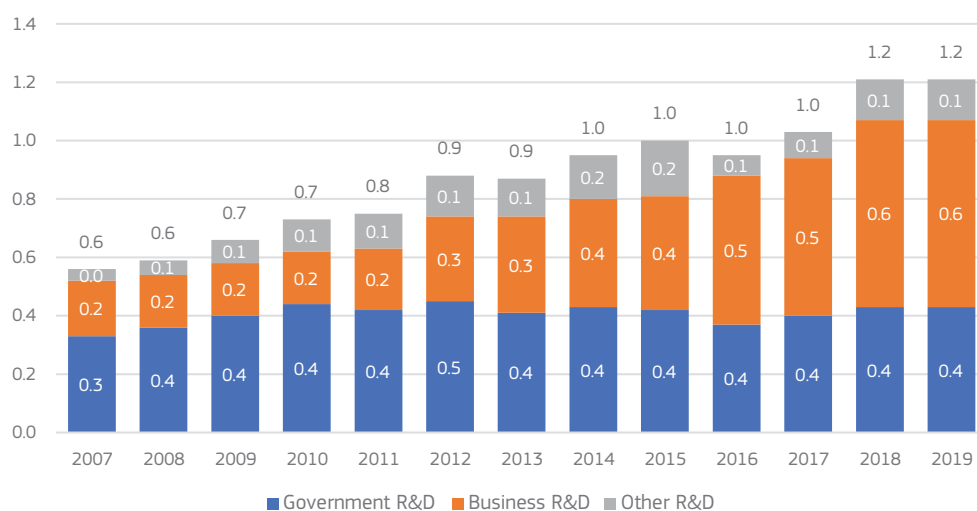
POLAND

1 Overview of national R&I landscape

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Poland from 2007 to 2019.⁵²² Although investment in R&I has remained relatively low as a proportion of GDP, a steady increase can be noted in terms of both private and public sector expenditure over the course of the reference period. In particular, private sector investment shows two marked increases: one in 2012 and one in 2018.

Poland has food related objectives in the Strategy for Responsible Development until 2020 and a R&I focus in the 2030 Strategy for Sustainable Rural Development, Agriculture and Fisheries.

Figure 1: R&I as a proportion of GDP in Poland 2007-2020



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

⁵²² 2019 is the last year for which complete figures are available

Main providers of Food R&I funding at national level

The main institution responsible for funding R&D in Poland is the **National Centre for Research and Development (NCBR)**. NCBR is managed by the Ministry of Education and Science (MEiN). The **National Science Center (NCN)** is responsible for funding basic research and it is also managed by the MEiN. The **Foundation for Polish Science (FNP)** is the relevant NGO supporting Polish science. The **Polish Development Fund (PFR)** and the **Polish Agency for Enterprise Development (PARP)** also provide funding for innovation. PARP supports enterprises, business environment institutions and innovation investments. The Ministry of Agriculture and Rural Development manages actions of the **Agency for Restructuring and Modernisation of Agriculture (ARiMR)**.

2 National R&I Strategy

In **2013**, Poland adopted the **Strategy for Innovation and Efficiency of the Economy “Dynamic Poland 2020”**⁵²³. The strategy did not make special references to food systems innovation.⁵²⁴

In **2017**, the Polish government adopted the **Strategy for Responsible Development until 2020 (with a perspective until 2030)**⁵²⁵. The strategy is based on individual territorial potential, investments, innovations, development, exports and highly processed products, and aims to **change the structure of the economy in order to make it more innovative**. Food related objectives include:

- Structural transformations in order to enhance the competitiveness of **Polish farmers and agri-food producers**;
- Lower corporate income taxes (CIT) rate (15%) for micro and small enterprises in order to support **agricultural holdings and agri-food producers**;
- Public interventions in order to develop the offer of regional and ecological products, local processing, direct trade as well as non-agricultural function of agricultural holdings, and modernised agricultural counselling system;

⁵²³ <https://sip.lex.pl/akty-prawne/mp-monitor-polski/strategia-innowacyjnosci-i-efektywnosci-gospodarki-dynamiczna-polska-17952754>

⁵²⁴ Before 2013, concerns regarding R&I were also included in the National Strategy for Regional Development 2001-2006, and the National Development Plan 2004-2006

⁵²⁵ <https://www.gov.pl/web/fundusze-regiony/informacje-o-strategii-na-rzecz-odpowiedzialnego-rozwoju>

- A system of promotion for **Polish food** to ensure an increased share of Polish food products in trading with foreign markets, through the enhanced recognizability of their brand and competitiveness.

Finally, the **2014-2020 National Smart Specialisation Strategy**⁵²⁶ contains 7 specialisations which reference food system innovations. These are:

- NSS⁵²⁷ 1. Healthy Society
 - Research and Development of Innovative Food Supplements and Foods for Particular Nutritional Uses
 - Manufacture of Biological, Biosimilar, Innovative, Generic Medicinal Products and Medical Devices, Food Supplements, and Foods for Particular Nutritional Uses
- NSS 2. Innovative Technologies, Processes and Products of the Agriculture and Food and Forest Based Sector
 - Innovations in the Agri-Food and Forestry and Wood Sectors
 - Biological Progress in Plant and Animal Production
 - Technology of Plant and Animal Production
 - Agricultural Machinery and Equipment
 - Organic and Mineral Fertilisers, Plant Protection Products and Growth Regulators
 - Production and Storage
 - Processing of Agricultural Crops and Animal Products
 - Food and Consumers

⁵²⁶ https://smart.gov.pl/images/pdf/Opis-KIS---ENG_FINAL-2019.pdf

⁵²⁷ National Smart Specialisation

- NSS 3. Biotechnological and Chemical Processes, Bioproducts and Products of Dedicated Chemistry and Environmental Engineering
 - Development of (Bio)Technological Processes to Produce Innovative (Bio) Products
 - Advanced Biomass Processing for Dedicated Chemical Products
 - Bioproducts and Products of Dedicated Chemistry
 - Modern Biotechnologies in the Environmental Protection
- NSS 8. Multifunctional Materials and Composites with Advanced Properties, Including Nanoprocesses and Nanoproducts
 - Advanced Materials and Nanotechnologies for Medical Purposes and Health Care and Hybrid Materials Involving Living Tissues and Cells⁵²⁸
 - Multifunctional Layers and Protective Antiwear Nanolayers and Spatial, Layered and Self-Repairing Composites and Nanocomposites⁵²⁹
- NSS 9. Sensors (including biosensors) and Smart Sensor Networks
 - Horizontal (Cross-Section) Notions in Sensor Technologies⁵³⁰
- NSS 10. Smart Networks, Information and Communication Technologies and Geoinformation Technologies
 - Innovative Applications of Geoinformation⁵³¹
- NSS 11. Printed, Organic and Flexible Electronics
 - Flexible Sensors⁵³²

⁵²⁸ Refers to “technologies and nanotechnologies of special-purpose surface and nanostructural layers for products used for medical instrument system and medical and dental implants, as well as in food sector equipment”

⁵²⁹ Refers to “new nanotechnologies for processing of anti-bacteria surfaces (...) in water treatment systems, textiles, packaging, storing food (...)”

⁵³⁰ Refers to “sensors and sensor networks supporting agriculture, forestry and agri-food industry”

⁵³¹ Refers to precision agriculture and smart forestry

⁵³² Refers to “temperature sensors intended for use in monitoring of food products” (e.g., defrostation during transport)

3 Overview of national food policy

The core document in the area of food policy is **the 2030 Strategy for Sustainable Rural Development, Agriculture and Fisheries**⁵³³, which includes directions of intervention such as:

1. New models for the organization of production and markets, short market chains and fair competition;
2. Food quality and safety;
3. Development of innovation, digitization and industry 4.0. in the agri-food sector;
4. Risk management in the agri-food sector.

The overall ambitions of the strategy are the improvement of the quality of life in rural areas and an efficient use of their resources and potential, including that of agriculture and fisheries, for sustainable development of the country. The 2030 Strategy for Sustainable Rural Development, Agriculture and Fisheries focuses on the following specific objectives:

Objective 1. Improvement of the quality of human and social capital, employment and entrepreneurship in rural areas;

Objective 2. Improvement of living conditions in rural areas and improvement of their spatial accessibility;

Objective 3. Food safety;

Objective 4. Increase in productivity and competitiveness of the agri-food sector;

Objective 5. Environmental protection and adaptation to climate change in rural areas.

There is also a R&I focus in the Strategy, with the following intervention measures:

1. Developing research for sustainable development of the agri-food sector;
2. Developing advisory services and disseminating market information in the agri-food sector;

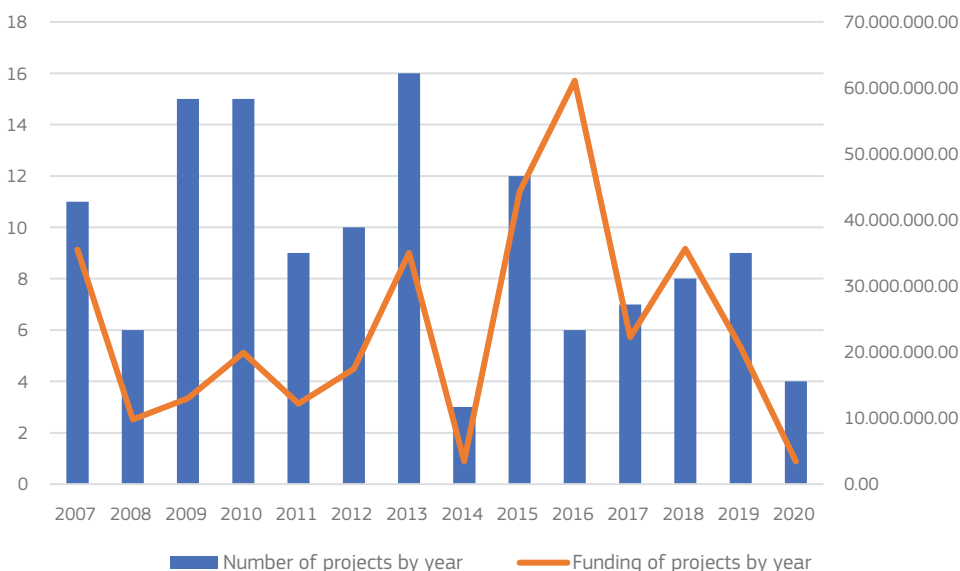
⁵³³ <https://www.gov.pl/attachment/0a17c5b6-235a-4bff-a690-95478a62671b>

3. Increasing the participation of research and development centres in international research projects;
4. Developing and improving R&D infrastructure as the source of efficient innovative solutions and progress.

4 Public funding available for food R&I

According to data made available by the NCBR, a total of 131 R&I food-related projects were developed by Polish organisations between 2007 and 2020, receiving a total of PLZ 333.7 million (EUR 73.9 million) in funding. A review of the number of projects approved during this period shows that 2014 was the year with less projects approved (3) and 2013 was the year with most projects approved (16). The year in which the least funding was used for food-related projects was 2020 (PLZ 3 million / EUR 763,559). In 2016, the year registering the largest funding amount, public funding spent in food-related research and innovation was PLZ 61 million (EUR 13.5 million) (**Figure 2**).

Figure 2: R&I food related projects between 2007 and 2020

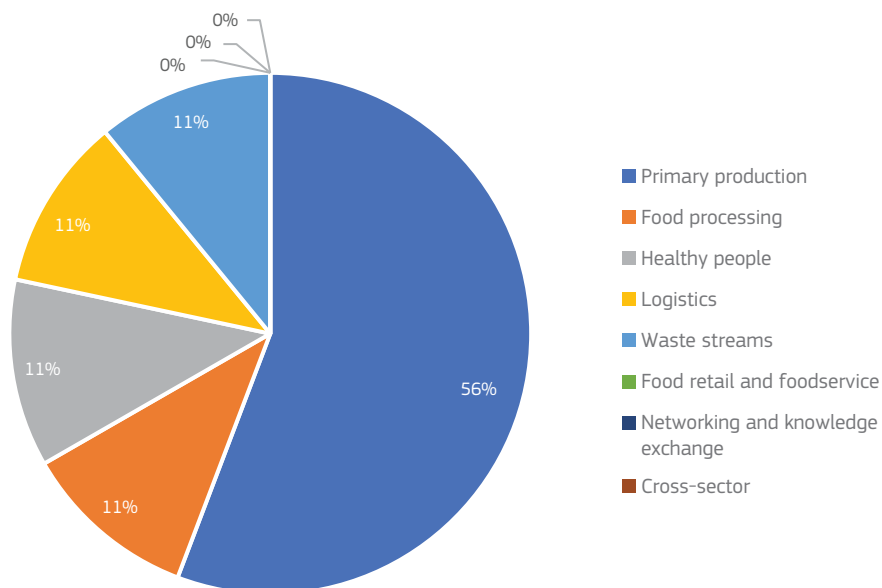


Source: NCBR

Funding by sector

When analysing the sectors receiving funding for food-related R&I actions, the majority of public funding appears to be directed towards projects and/or actions related to primary production (56%) (**Figure**).

Figure 3: Distribution of the funding by sector



Source: NCBR

5 Main recipients of public food R&I investment

The data made available for this study corresponds to only one institution involved in food systems R&I, NCBR. Thus, the review of the data shows R&I Units not linked to Higher Education Institutions as receiving the full amount of Food R&I funding (EUR 73.9 million, corresponding to 100% of the total funding).

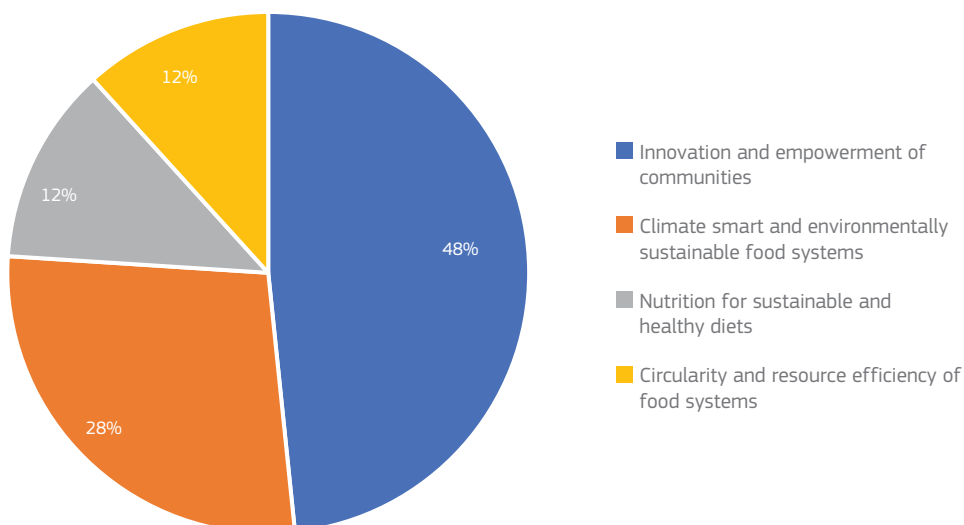
6 Structural Funds available for Food R&I

In the 2008–2020 period, 172 projects on food R&I were carried out with an EU contribution of EUR 29.3 million⁵³⁴.

7 Links to FOOD2030 priorities and pathways

According to an internal analysis of the funding data, publicly funded food-related R&I in Poland has prioritised research in innovation and empowerment of communities (48% of the total, corresponding to PLZ 161 million/ EUR 35.8 million). The second FOOD2030 priority in Polish research is climate smart and environmentally sustainable food systems (28% and PLZ 91 million/ EUR 20.4 million). Nutrition for sustainable and healthy diets and circularity and resource efficiency of food systems reflect the lowest research interest (12% and 12% respectively) (Figure 4).

Figure 4: Distribution of the funding by FOOD2030 priority

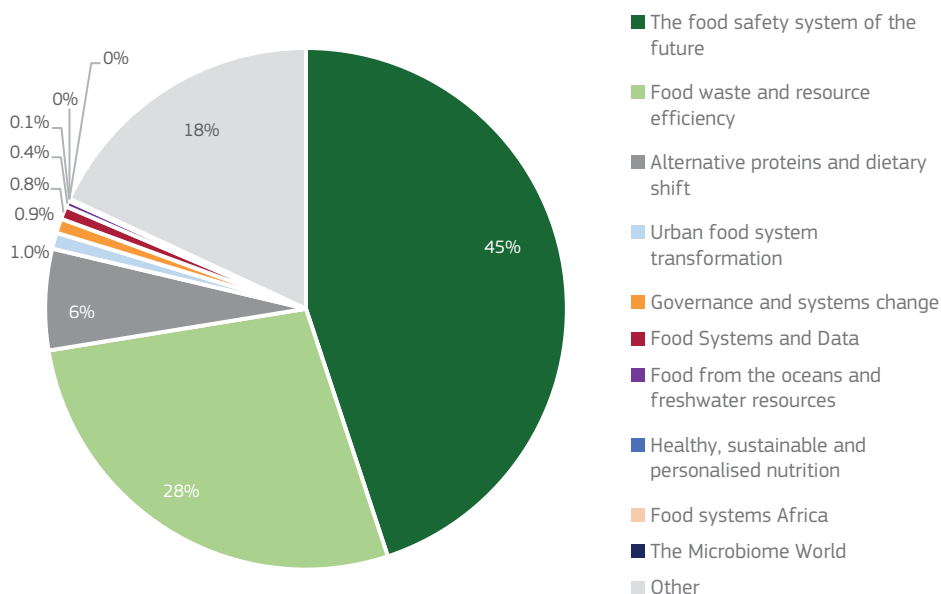


Source: NCBR

⁵³⁴ <https://mapadotacji.gov.pl/projects/?lang=en&search-s=food&search-voivodeship=all&search-county=&search-fund=&search-program=&search-number-name-activity=&search-beneficiary=&search-title-of-project=&search-theme=106&search-years=526>

With regards to FOOD2030 pathways, publicly funded food R&I in Poland assigns a large share to Food safety systems of the future (45%, corresponding to PLZ 150.0 million/ EUR 32.6 million), followed by Food waste and resource efficiency (28% and PLZ 91.8 million/ EUR 20 million). Further details can be observed in Figure 5.

Figure 5: Distribution of the funding by FOOD2030 pathway



Source: NCBR

8 Data gaps and limitations

The results of the analysis are based on information provided by the NCBR. Information not available includes project descriptions, technology readiness level (TRL), publications and patents.

Summary of data sources: Poland

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Science and Higher Education	?
Food innovation related policies	2030 Strategy for Sustainable Rural Development, Agriculture and Fisheries	https://www.gov.pl/attachment/0a17c5b6-235a-4bff-a690-95478a62671b
National R&I Strategies	Strategy for Innovation and Efficiency of the Economy Dynamic Poland 2020	https://sip.lex.pl/akty-prawne/mp-monitor-polski/strategia-innowacyjnosci-i-efektywnosci-gospodarki-dynamiczna-polska-17952754
	Strategy for Responsible Development until 2020 (with a perspective until 2030)	https://www.gov.pl/web/fundusze-regiony/informacje-o-strategii-na-rzecz-odpowiedzialnego-rozwoju
	National Specialisation Strategy (2014-2020)	https://smart.gov.pl/images/pdf/Opis-KIS---ENG_FINAL-2019.pdf
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	EUR 29.3 million	https://www.funduszeuropejskie.gov.pl/strony/o-funduszach/projekty/lista-projektow/lista-projektow-realizowanych-z-funduszy-europejskich-w-polsce-w-latach-2014-2020/
Food innovation funding		
	Name and description	Link
Specific food innovation related R&I competitions/ funding	BIOSTRATEG	https://bioagra.pl/en/biostrateg/
	GOSPOSTRATEG	https://stat.gov.pl/en/experimental-statistics/gospostateg/

PORTUGAL

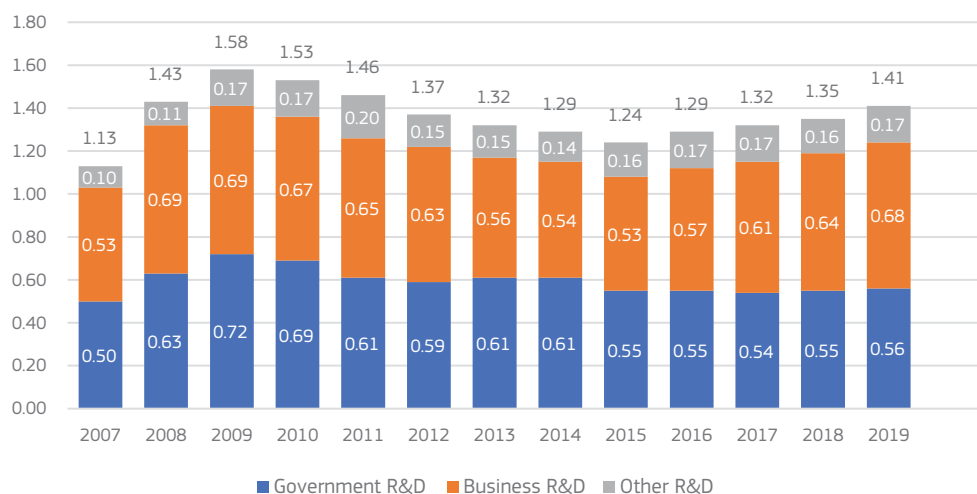
1 Overview of national R&I landscape

This report provides a brief overview of the public funding available for food systems R&I in Portugal, including a breakdown of the national public funding allocated to the Food 2030 priorities and pathways between 2007 and 2020.

Figure 1 below provides an overview of national expenditure on R&I as a percentage of GDP in Portugal from 2007 to 2019.⁵³⁵ While overall R&I expenditure has fluctuated over this period, a slight increase in 2007 levels can be noted in 2017. This fluctuation can be seen in both government and private sector expenditure. While government expenditure has decreased overall from a high point in 2009, business expenditure had increased to almost the same levels seen in 2008-9 levels following a steady decrease between 2010 and 2015.

Portugal has a specific strategy for R&I in the food sector, the Agenda for Innovation in Agriculture 2020-2030.

Figure 1: R&I as a proportion of GDP in Portugal 2007-2020



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

⁵³⁵ 2019 is the last year for which complete figures are available. Data for 2008, 2018 and 2019 is inferred from previous years investments.

Main providers of Food R&I funding at national level

The main public funding institution for R&I in Portugal is **FCT, the Foundation for Science and Technology**. FCT is the Portuguese public agency that supports science, technology and innovation, in all scientific domains. It is under the remit of the Ministry for Science, Technology and Higher Education. The budget of FCT encompasses funds from the Portuguese State budget and European structural funds. The funding provided by FCT is in the form of 100% government grants, with no match funding required.

Other relevant funding agencies are **IAPMEI, the Agency for Competitiveness and Innovation; ANI, the National Agency for Innovation;** and **AICEP, the Portuguese Agency for Investment and Foreign Trade**. The funding provided by these agencies, however, is financed through the EU Structural Funds and is not in scope for this study. The analysis in this paper therefore focuses on funding provided by FCT.

The main organisation in the country specifically for agri-food related R&I is **INIAV, the National Institute for Agricultural and Veterinary Research**. INIAV develops R&I actions in the following areas: environment and natural resources, agricultural systems, plant health, forestry systems, animal health, food safety, agri-food and forestry industry, markets and consumers. Other important actors in the Portuguese food sector include: CONSANP, the National Council for Food Security and Nutrition; FIPA, the Federation of the Portuguese Agri-food Industries; AJAP, the Association of Young Farmers in Portugal; CAP, the Portuguese Farmers' Confederation; CAN, the National Confederation of Agriculture; CONFAGRI, the National Confederation of Agricultural Cooperatives and Agricultural Credit; CNJ, the National Confederation of Young Farmers and Rural development; and APA, the Portuguese Association of Aquaculture Producers.

2 National R&I Strategy

The principles of the Portuguese **R&I policy for the 2014-2020 period** are described in the Partnership Agreement adopted between Portugal and the European Commission (Portugal 2020). This Partnership Agreement brings together investment under the European Structural and Investment Funds for the economic, social and territorial development of Portugal for the period between 2014-2020. More than a billion euros was earmarked for science from a total of EUR 25 billion allocated to the country under this Partnership Agreement. Of this, a total investment of EUR 538.8 million and co-funding of EUR 306.3 million was allocated to food and agricultural projects. The **National Research**

and Innovation Strategy for Smart Specialisation (ENEI, in the Portuguese acronym) was developed within this scope. Its objectives are formulated in four pillars:

- Digital Economy;
- Portugal – country of science and creativity;
- Intensifying the industrial technological capacity;
- Valorise the differentiating endogenous resources.

The strategy defines 15 priorities⁵³⁶: 1) Energy; 2) Information and communication technologies; 3) Raw materials; 4) Production technologies and product industries; 5) Production technologies and process industries; 6) Automotive, aeronautics and space; 7) Transports, mobility and logistics; 8) Agri-food; 9) Forest; 10) Sea economy; 11) Water and environment; 12) Health; 13) Tourism; 14) Cultural and creative industries; and 15) Habitat.

National funding for food and agricultural R&I is provided by FCT in the form of grants. This is analysed in further detail below. In parallel to the aforementioned R&I policy, a **National Science and Technology Plan for the period between 2017-2020** was developed and is being implemented by the Ministry of Science, Technology and Higher Education. FCT ensures the development of R&I in specific thematic areas defined by this plan. One of these thematic areas targets is the agri-food sector, forests and biodiversity (see below).⁵³⁷

3 Overview of national food policy

The **Agenda for Innovation in Agriculture 2020-2030**⁵³⁸ is the Portuguese strategy for meeting the national challenges in the agri-food sector for the current decade.⁵³⁹ The Agenda is aligned with the priorities set out in the Government's programme and focuses on the following challenges: climate change adaptation, social inequality reduction,

⁵³⁶ <https://www.ani.pt/media/5238/enei-2014.pdf>

⁵³⁷ Since 2000, R&I policy in Portugal has been guided by programmatic documents. As this analysis covers R&I agri-food related projects from 2007 to 2020, one should note that other reference programmes were running previously to the ones mentioned in this section: the Technological Plan 2005-2011 and the Strategic Programme for Entrepreneurship and Innovation (+E+I), which started in 2011.

⁵³⁸ <https://dre.pt/web/guest/home/-/dre/145102353/details/maximized>

⁵³⁹ Previously, R&I in the agri-food sector was guided by the Strategy of the Ministry of Agriculture and Sea for Agri-Food and Forestry R&I 2014-2020, focused on the following strategic axes: food production, plant genetic resources and biotechnology, sustainability and competitiveness in forest ecosystems, soil (conservation, water, fertilisation and mineral nutrition), plant breeding and animal protection. More information is available through the following link: <https://bit.ly/3sthHcu>

demographic transformation and the urbanisation of communities, and digital transition. The Agenda is also aligned with the European Green Deal, specifically with the Farm to Fork Strategy, and the ambition to ensure a sustainable production of safe and high nutritional food at affordable prices, for internal and external consumers. Moreover, the Agenda aims to improve farmers' income and stimulate economic growth, support the achievement of EU climate objectives, strengthen the socio-economic fabric of rural areas, and promote innovation in farming practices and food logistics. The Agenda also meets the guidelines and commitments of the Sustainable Development Goals (SDGs) of the United Nations, with particular emphasis on goals 2 (zero hunger), 3 (good health and well-being), 8 (decent work and economic growth), 9 (industry innovation and infrastructure), 10 (reduced inequalities), 12 (responsible consumption and production), 13 (climate action) and 15 (life on land).

The Ministry of Agriculture, Forestry and Rural Development is responsible for implementing this Agenda. The coordination and monitoring of the Agenda involves a number of other ministries, including the Ministries of Economy, Finances, Foreign Affairs, Health, Environment, Education and Science. The beneficiaries of the Agenda are identified in four groups: citizens, territory agents, producers and public policy agents. These link with the four pillars that underpin the Agenda: society, territory, value chains and the State. From a structural point of view, the Agenda defines 15 flagship initiatives: Healthy food; One health; Climate change mitigation; Climate change adaptation; Circular agriculture; Sustainable territories; Revitalization of rural areas; Agriculture 4.0; Portuguese agri-food products promotion; Excellent production organisation; Agro-energy transition; Promotion of research, innovation and capacity building; Innovation network; Single Agriculture Portal; and Reorganize. The Agenda and its 15 flagship initiatives are a result of the collective work of the government and the various agri-food sector agents in the country, including producers, business people, local authorities and non-governmental agencies. Resulting from the open consultations with these groups, five objective goals have been set:

- More health (increase the level of adherence to the Mediterranean Diet by 20%);
- More inclusion (locate 80% of new young farmers in low density territories);
- More income (increase the value of agri-food production by 15%);
- More future (ensure more than half of the agricultural area are in recognized sustainable production regimes);
- More innovation (increase investment in research and development by 60%).

The **Integrated Strategy for the Promotion of Healthy Eating**⁵⁴⁰ (**EIPAS**) is an intersectoral strategy that presents 51 measures to promote healthy eating in the country. Seven different ministries work in its implementation and monitoring, including the Ministries of Health and Agriculture, Forestry and Rural Development. The strategy was published in 2017 and is developed in conjunction with the **National Programme for the Promotion of Healthy Eating** (**PNPAS**). The mission of PNPAS is to ensure that information on healthy food and cooking practices are available to all, to encourage the production of foods that are both healthy and capable of boosting employment, balanced land-use planning and local economies, to encourage local consumption and production methods that reduce impacts on the environment, inequalities in the demand and access to nutritionally adequate foods, and to improve the qualifications of professionals who can influence the population's food consumption. Another relevant national food strategy is the **National Strategy to Fight Food Waste**⁵⁴¹ (**ENCDA**) which aims to mitigate food waste along the food value chain, from the producer to the consumer. It integrates three strategic objectives: prevention, mitigation and monitoring. Its action plan presents 14 measures to fight food waste. Various ministries, including those of Environment and Agriculture, Forestry and Rural Development, local authorities and non-profit organisations were involved in the implementation of the plan.

4 Public funding available for food R&I

Under the **National Science and Technology Plan** for the period between 2017-2020, FCT ensured the development of 15 thematic agendas for research and innovation, including those of **Agri-food, Forests and Biodiversity**⁵⁴²; Climate Change; Circular Economy; Industry and Manufacturing; Sea; Sustainable Energy Systems. Specifically, the R&I agenda on Agri-food, Forests and Biodiversity includes terrestrial, aquatic and marine ecosystems, as well as interface zones. Key objectives of this thematic agenda included: more efficient use of resources, biotechnologies and conventional breeding techniques, integrated protection strategies, production support strategies, valorisation of bioproducts, environmental and socio-economic valorisation, monitoring and analysis of the impacts of several crises in food/nutritional security. Key issues and challenges that the R&I in this thematic agenda aimed to address include:

- Improve response mechanisms of plants and animals to biotic and abiotic factors;
- Obtain improved varieties adapted to the climatic conditions of the country;

⁵⁴⁰ <https://dre.pt/application/conteudo/114424591>

⁵⁴¹ <https://www.gpp.pt/images/MaisGPP/Iniciativas/CNCDA/ENCDA.pdf>

⁵⁴² <https://www.fct.pt/agendastematicas/agroflorbiod.phtml.en>

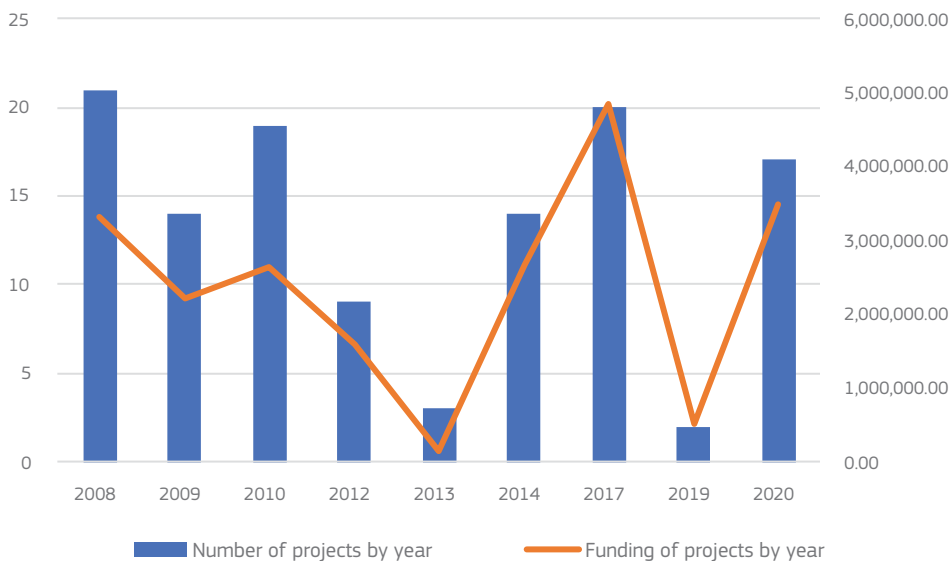
- Develop regulation processes (biomass, primary and secondary metabolism, aromas and flavours);
- Mitigate problems related with intensive and extensive livestock farming (animal welfare, antimicrobial resistance, gas emissions, better breeds, pasture and forage);
- Guarantee sustainability of intensive fisheries and aquaculture (including macroalgae and bivalves);
- Support product valorisation taken into account consumers' preferences;
- Analyse well-founded risk-benefit to support decision making.

According to data made available by FCT⁵⁴³, a total of 119 R&I food-related actions were developed by Portuguese organisations between 2008 and 2020⁵⁴⁴, receiving a total of EUR 21.4 million in funding. A review of the number of actions approved during this period shows that 2019 was the year with less actions approved (2) and 2008 was the year with most projects approved (21). The year in which the least funding was used for food-related projects was 2013 (145,000 euros). In 2017, the year registering the largest funding amount, public funding spent in food-related research and innovation was EUR 4.9 million (**Figure 2**).

⁵⁴³ Projects funded by funded by IAPMEI, AICEP and INIAV used EU Structural Funds and have therefore been excluded from our analysis of national public funding

⁵⁴⁴ Note: year the call was launched.

Figure 2: R&I food related projects between 2008 and 2020

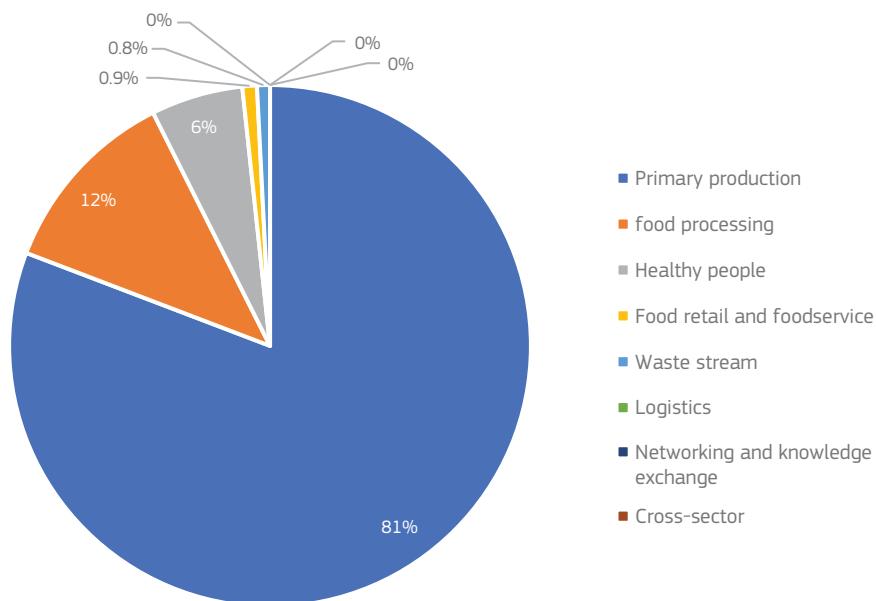


Source: FCT

Funding by sector

When analysing the sectors receiving funding for food-related R&I actions, the majority of public funding appears to be directed towards projects and/or actions related to primary production (81%). It is notable that between 2008 and 2020, there was no public investment in packaging- and logistics-related projects, as observed in Figure 3.

Figure 3: Distribution of the funding by sector

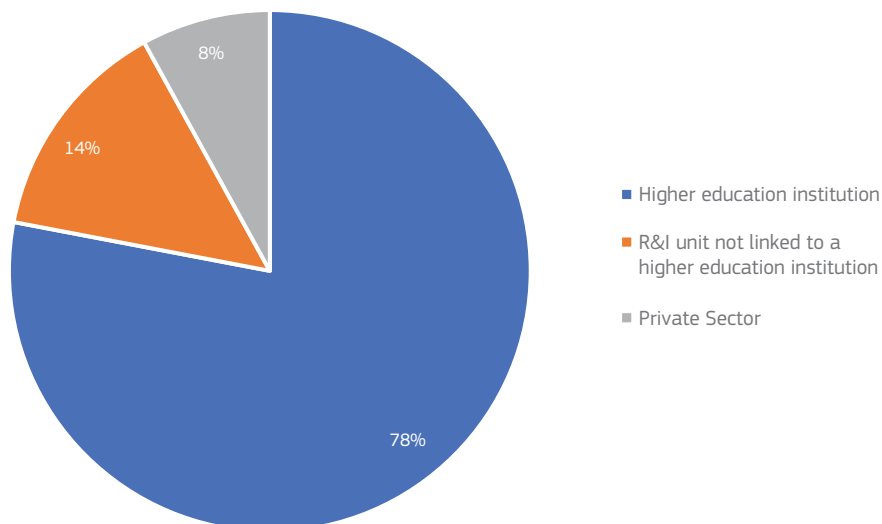


Source: FCT

5 Main recipients of public food R&I investment

A review of the data shows that Higher Education Institutions received the highest amount of Food R&I funding (EUR 16.7 million, corresponding to 78% of the total funding), followed by R&I Units not linked to higher education institutions (EUR 2.9 million, or 14% of the total). Higher Education Institutions coordinated 90 projects between 2008 and 2020, whereas independent research institutes (not linked to higher education institutions) coordinated 16. Organisations from the not-for-profit sector coordinated 13 projects, during the same period of time, and received a total of EUR 1.8 million, which represents 8% of the total funding.

Figure 4: Distribution of the funding by recipient



Source: FCT

6 Structural Funds available for Food R&I

As mentioned above, the ENEI includes agri-food as one of the main priorities. According to the first ENEI Monitoring Report⁵⁴⁵, 724 R&I projects⁵⁴⁶ associated with the agri-food priority have been funded between 2014 and 2017. The total investment of these projects was 538.8 million euros with co-funding of 306.3 million euros.

7 Links to FOOD2030 priorities and pathways⁵⁴⁷

According to an internal analysis of the funding data, publicly funded food-related R&I in Portugal has prioritised research in climate smart and environmentally sustainable food systems (51% of the total, corresponding to EUR 10.9 million). The second Food 2030 priority in Portuguese research is Nutrition for sustainable and healthy diets (34%, corresponding

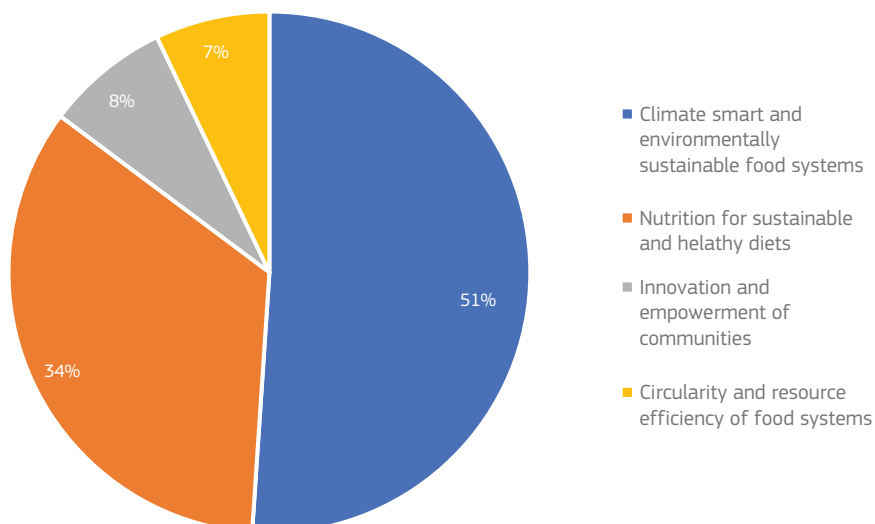
⁵⁴⁵ <https://www.ani.pt/Content/documents/Relatorio-monitoriza%C3%A7%C3%A3o-ENEI.pdf>

⁵⁴⁶ The number includes not only support to research and innovation projects but also to qualification and internationalisation.

⁵⁴⁷ In seven of the projects analysed it was not possible to find a correspondence between the themes of research and the FOOD2030 priorities and pathways. The total funding associated to these projects is 1.1 million euros.

to EUR 7.3 million). 8% of public expenditure (corresponding with EUR 1.7 million) went to innovation and empowerment of communities and 7% (corresponding to EUR 1.5 million) went to circularity and resource efficiency of food systems.

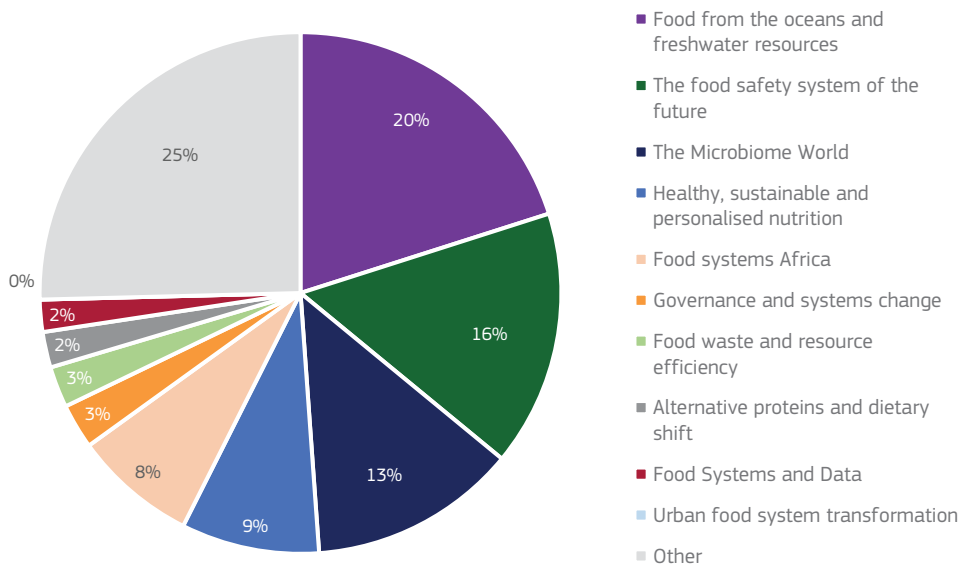
Figure 5: Distribution of the funding by FOOD2030 priority



Source: FCT

With regards to FOOD2030 pathways, publicly funded food R&I in Portugal assigns the largest share to Food from the oceans and freshwater resources (20%, corresponding to EUR 4.3 million), followed by Food safety system of the future (16%, corresponding with EUR 3.4 million). Further details can be observed in **Figure 6**.

Figure 6: Distribution of the funding by FOOD2030 pathway



Source: FCT

8 Data gaps and limitations

The results of the analysis are based on publicly available information and data from the FCT’s website. Information not available on the website includes among others: project description, keywords, start and end dates, technology readiness level (TRL), publications and patents.

Summary of data sources: Portugal

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	FCT – Foundation for Science and Technology	https://www.fct.pt/
Food innovation related policies	Agenda for Innovation in Agriculture 2020-2030	https://dre.pt/web/guest/home/-/dre/145102353/details/maximized
National R&I Strategies	R&I policy for the 2014-2020 period	https://www.fct.pt/suporte-politicas-leD/estrategia2020/
	National Science and Technology Plan for the period between 2017-2020	https://www.fct.pt/agendastematicas/
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	Total investment of 538,8 million euros and co-funding of 306,3 million euros.	https://www.ani.pt/Content/documents/Relatorio-monitoriza%C3%A7%C3%A3o-ENEI.pdf
From desk research	FCT – Foundation for Science and Technology	https://www.fct.pt/

ROMANIA

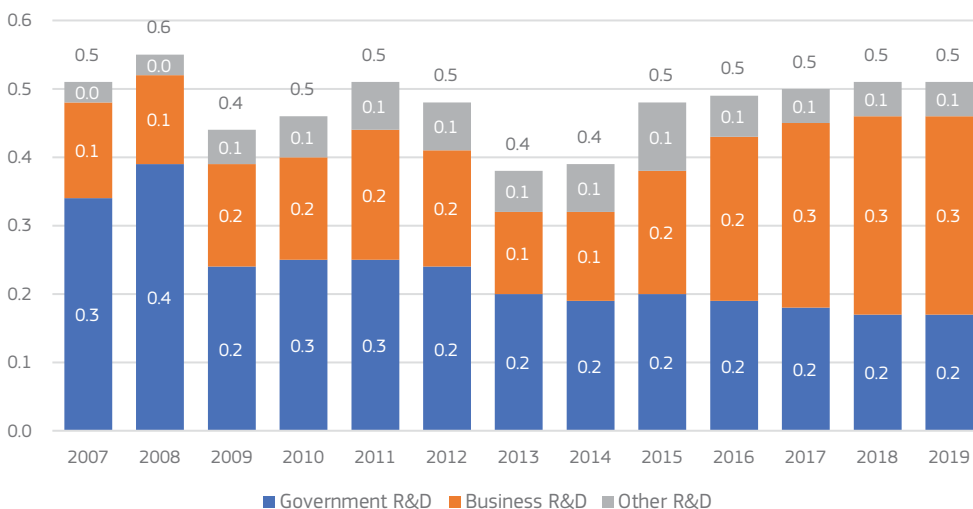
1 Overview of national R&I landscape

Funding for R&I in Romania is mainly provided by the Ministry of Agriculture and Rural Development, and a majority of the funding is directed to food production (especially fruit and vegetables).

Despite setting an R&I spending target of 1% of GDP by 2010, Romania seems to have fallen short of this objective. Figure 1 shows that although private expenditure on R&D as a share of GDP has increased year on year since 2013, public funding has declined consistently since the financial crisis in 2008 and overall investment in R&I has not returned to pre-financial crisis levels.

Romania does not have a specific food R&I policy, but the National Reform Programme specifically mentions R&I for agriculture and rural development as a means to facilitate the application of new technologies to food production and to find viable solutions for conservation and sustainable exploitation of agricultural resources.

Figure 1: R&I as a proportion of GDP in Romania 2007-2020



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main Providers of Food R&I funding at national level

Funding for research is generally provided by **UEFISCDI**, a public body that operates under the Romanian Ministry of National Education⁵⁴⁸. The agency supports the identification of R&I priority areas and coordinates the allocation of R&I funding on the basis of national R&I plans, whereas the Ministry of National Education is concerned with funding for higher education.

Overall investment levels in food systems in Romania remain low, despite efforts to modernise the sector and increase its competitiveness⁵⁴⁹. Partly, this is due to a financing gap that the European Commission and the European Investment Bank estimate in the region of EUR 482 million, affecting mainly small firms, which are the most common type of firms in a country that is still very much characterised by small holdings⁵⁵⁰. Firms in the food value chain experience high loan rejection rates due to lack of collateral and insufficient profit margin, alongside difficulties linked to low financial literacy⁵⁵¹.

Other relevant actors

The **Ministry of Research, Innovation, and Digitalisation**, established in 2017, is the government department responsible for implementing policies in the areas of scientific research, technological development, and innovation. The Ministry also oversees the development of national strategies for innovation and development and acts as the contact point for Romania's participation in EU programmes on R&I⁵⁵².

Additionally, there are a series of bodies that perform advisory roles for the Ministry of National Education and Research, such as **the Advisory Board for Research, Development and Innovation** (CCCDI) and the **National Council for Higher Education Financing** (CNFIS).

⁵⁴⁸ *Ibid.*

⁵⁴⁹ European Commission and European Investment Bank (2020), Financial needs in the agriculture and agri-food sectors in Romania, page 10, available at: https://www.fi-compass.eu/sites/default/files/publications/financial_needs_agriculture_agrifood_sectors_Romania.pdf, last accessed: 13 September 2021.

⁵⁵⁰ *Ibid.*, page 10.

⁵⁵¹ *Ibid.*, page 11.

⁵⁵² European Commission (2020), Country Profile Romania, available at: https://trimis.ec.europa.eu/country-profile/romania_mhttps://trimis.ec.europa.eu/country-profile/romania, last accessed 13 September 2021.

2 National R&I Strategy

In preparation for Romania's accession to the EU in 2007, the Romanian government published an extensive R&D strategy, which sought to align Romania's R&D policy to the European Union's priorities and programmes, including FP7. The **National Research, Development, and Innovation Strategy 2007-2013** (*Strategia Națională De Cercetare, Dezvoltare Și Inovare 2007-2013*) was informed by a national stocktaking exercise conducted in 2005-2006 that involved a wide range of stakeholders, and resulted in an assessment of strengths and weaknesses of the Romanian R&D system. The strategy outlined the difficulties faced by the research sector since 1989; in particular, it underlined how under-funding, lack of incentives for researchers, and low demand for innovation from businesses hindered the Romanian research system⁵⁵³. In particular, the strategy focused also on food and agriculture, noting the 'remarkable potential' of the sector, which at the time contributed between 13%-15% to Romania's GDP and employed 40% of the population⁵⁵⁴, suggesting low sector productivity. Areas of focus of the strategy were the food supply chain ('farm-to-fork'), with emphasis around sustainability, security, and the application of biotechnologies to the food industry⁵⁵⁵.

The main document outlining Romania's R&I strategy is the **National Strategy for Research, Technological Development and Innovation 2014-2020**⁵⁵⁶. The strategy seeks to promote competitiveness and societal well-being through a combination of fiscal measures (i.e. tax breaks), public procurement, funding programmes, and policies on intellectual property, collaboration, human capital, and governance of R&I systems. The strategy also sets out three key objectives:

- Spurring the competitiveness of the Romanian economy through innovation;
- Increasing the contribution of Romania to research;
- Enhancing the role of science in society⁵⁵⁷.

⁵⁵³ Ministry of National Education and Research (2006), Ministry of Education and Research (2006), *Strategia Națională De Cercetare, Dezvoltare Și Inovare 2007-2013*, page 11, available at: <https://uefiscdi.gov.ro/resource-82540%20>, last accessed 13 September 2021.

⁵⁵⁴ *Ibid.*, page 28.

⁵⁵⁵ *Ibid.*, page 29.

⁵⁵⁶ *Strategia națională de cercetare, dezvoltare și inovare 2014-2020*

⁵⁵⁷ Ministry of National Education and Research (2014), *Strategia națională de cercetare, dezvoltare și inovare 2014-2020*, pages 7-8, available at: https://edu.ro/sites/default/files/fi%C8%99iere/Minister/2016/strategii/strategia-cdi-2020_-_proiect-hq.pdf, last accessed 13 September 2021.

The strategy was implemented through the **National Plan for Research, Development, and Innovation 2015–2020 – PNCDI III**⁵⁵⁸ which relies on a budget of RON 500 million (approx. EUR 100 million). The Plan provides support for higher education institutions and research institutes around four main programme strands:

- Enhancement and dissemination of knowledge and research results;
- Provision of technical assistance and high-level scientific and technological services in priority areas;
- Promotion of partnerships among public and private sector stakeholders;
- Promoting internationalisation⁵⁵⁹.

A chapter on R&I is also included in the **National Reform Programme** unveiled in April 2020, which aims, among other things, to stimulate private investment in R&I, strengthen the links to EU policies and programmes. The Reform Programme specifically mentions R&I for agriculture and rural development as a means to facilitate the application of new technologies to food production and to find viable solutions for conservation and sustainable exploitation of agricultural resources⁵⁶⁰.

3 Overview of national food policy

R&I investment in the food and agricultural sector is underpinned by a number of multi-annual strategies and plans. These focus on issues such as the development of rural areas, productivity in the agricultural sector, and the safety of the agri-food chain, including adaptation to EU standards.

The National Rural Development Programme 2007–2013⁵⁶¹ provides an overview of the status of the Romanian agricultural and food sectors at the time when Romania joined the European Union. The programme centred around three key challenges, which primarily

⁵⁵⁸ Planul national de cercetare, dezvoltare și inovare 2015-2020 – PNCDI III

⁵⁵⁹ Ministry of Research and Innovation (2015), National Plan for Research, Development, and Innovation 2015-2020 – PNCDI III (*Planul national de cercetare, dezvoltare și inovare 2015-2020 – PNCDI III*), page 3, available at: <https://www.research.gov.ro/uploads/competitii/pncdi-iii/2018/pncdi-iii/subprogram2-1-performan-institu-ional/p-1-2-pachet-de-informatii-performanta-institutionala-final.pdf>, last accessed 13 September 2021.

⁵⁶⁰ Romanian Government (2020), National Reform Plan (*Programul național de reformă*), page 85, available at: http://www.mae.ro/sites/default/files/file/anul_2020/pdf_2020/2020.10.14_pnr_ro.pdf, last accessed 13 September 2021.

⁵⁶¹ Ministry of Agriculture and Rural Development (2007), National Rural Development Programme 2007-2013, available at: http://old.madr.ro/pages/dezvoltare_rurala/nrdp_en_official%20version.pdf, last accessed 13 September 2021.

aimed to address the need for transformation and modernisation in the agricultural sector⁵⁶². The programme highlighted particularly the lack of competitiveness of the agricultural and food sector, which were found to be unable to meet consumer demand and increasing competition from abroad⁵⁶³. In light of this, the Rural Development Programme sought to promote the competitiveness of Romania's agri-food sector, in particular by: (1) enhancing knowledge transfer and ensuring that workers have a skillset that enables them to take up innovation; and (2) supporting businesses in becoming more environmentally sustainable⁵⁶⁴.

The **National Rural Development Programme for 2014-2020**⁵⁶⁵ is a plan managed by the Ministry of Agriculture and Rural Development and co-funded by the European Union under the ERDF. It highlights six main priorities: (1) fostering knowledge transfer and innovation in agriculture, forestry, and rural areas; (2) enhancing farm viability and competitiveness; (3) promoting food chain organisation; (4) restoring, preserving, and enhancing ecosystems related to agriculture and forestry; (5) promoting resource efficiency and supporting the shift towards a low-carbon and climate-resilient economy; (6) promoting social inclusion and poverty reduction.

On the topic of food systems innovation, the Ministry of Agriculture and Rural Development produced a **Strategy for the development of the agri-food sector in the medium and long term 2020-2030**, which encompasses issues such as competitiveness and sustainable development of rural areas, food safety, and environmental protection⁵⁶⁶. The first objective of the plan aims to reorganise the R&I system in the agri-food sector, streamlining research, creating centres of excellence, and increasing the overall volume of fundamental and applied research. Support for research is envisaged to reach 2% of GDP in the medium-term, with half of the funding coming from the private sector, and the other half being a combination of state funding and EU funds. Furthermore, the objective stresses the need to increase the quality of research in the food sector, including the number of patents and inventions. Internationalisation of research is also central, with emphasis placed on cross-border collaboration with other European partners. The second objective related to the need to increase the role of agricultural research for the development of the

⁵⁶² *Ibid.*, page 58.

⁵⁶³ *Ibid.*, page 19.

⁵⁶⁴ *Ibid.*, pages 108-109.

⁵⁶⁵ Ministry of Agriculture and Rural Development (2014), National Rural Development Programme for the 2014-2020, available at: https://www.madr.ro/docs/dezvoltare-rurala/programare-2014-2020/PNDR_2014_EN_-_2020_01.07.2014.pdf, last accessed 13 September 2021.

⁵⁶⁶ Ministry of Agriculture and Rural Development (2015), Strategy for the development of the agri-food sector in the medium and long term 2020-2030 (*Strategia pentru dezvoltarea sectorului agroalimentar pe termen mediu și lung orizont 2020-2030*), page 53, available at: <http://www.madr.ro/docs/agricultura/strategia-agroalimentara-2020-2030.pdf>, last accessed 13 September 2021.

food sector through improved resilience of the agricultural sector, the transfer of knowledge and innovation across the industry, and a focus on suitability.

Lastly, the Ministry of Agriculture and Rural Development has also published a **Sectoral Plan for R&D in the field of agriculture and rural development for the period 2019-2022**⁵⁶⁷. The plan, which relies on a budget of LEI 133 million (approximately EUR 26.6 million), aims to finance environmentally sustainable and efficiency-enhancing R&I in the field of agriculture, with a particular view to strengthening interlinkages between research and innovation on one side, and the farming sector and the food industry on the other. Specific objectives of the plan cover, *inter alia*, the production of potatoes, sugar beet, and medicinal herbs, clean technologies in the 'farm-to-fork' food chain, beekeeping and animal welfare, and epidemiological surveillance systems.

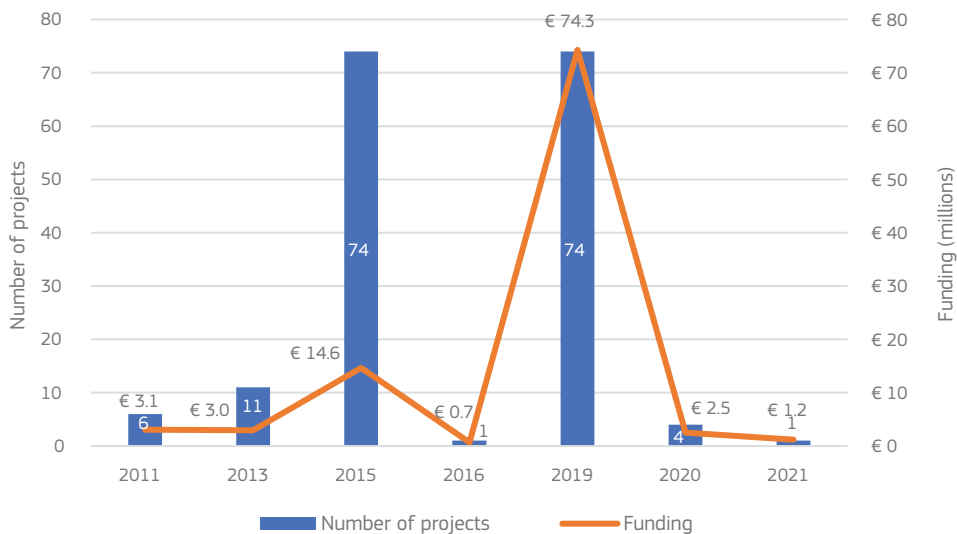
4 Public funding available for food R&I

The analysis of national public funding for R&I in the Romanian food sector is based on data retrieved as part of the SCAR project along with additional data provided for the purpose of this study by the National Research and Development Institute for Food Bioresources – IBA Bucharest, a public research entity coordinated by the Ministry of Research and Innovation. According to these sources, all the funded projects reviewed in the ensuing sections were financed via the national budget.

A total of 171 projects pertaining to R&I in the food sector funded between 2011 and 2021 was identified (Figure 2).

⁵⁶⁷ Ministry of Agriculture and Rural Development (2019), Sectoral plan for research and development in the field of agriculture and rural development of the Ministry of Agriculture and Rural Development for the years 2019-2022, Agriculture and Rural Development ADER 2022 (*Plan sectorial pentru cercetare-dezvoltare din domeniul agricol și de dezvoltare rurală al Ministerului Agriculturii și Dezvoltării Rurale, pe anii 2019-2022 "Agricultură și Dezvoltare Rurală – ADER 2022"*), available at: <http://madr.gov.ro/docs/cercetare/2019/plan-sectorial-2019-2022.pdf>, last accessed 13 September 2021.

Figure 2: R&I food related projects between 2011 and 2021

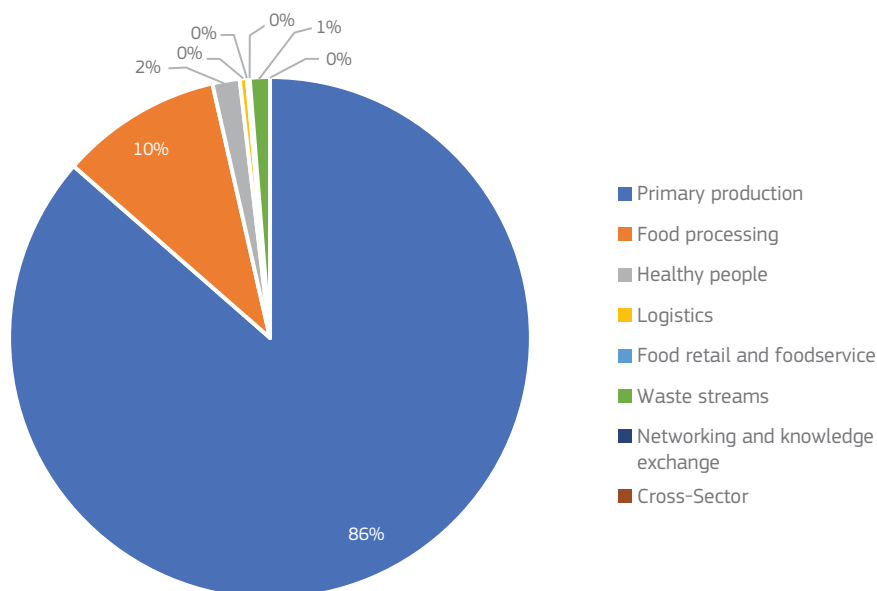


Source: Analysis of data compiled for the SCAR project and data provided by the National Research and Development Institute for Food Bioresources – IBA Bucharest.

Funding by sector

A majority of the funding was allocated for projects related to primary production (86%), followed by food processing (10%), health-related research and initiatives (2%). No projects related to packaging innovation were found.

Figure 3: Distribution of funding by sector

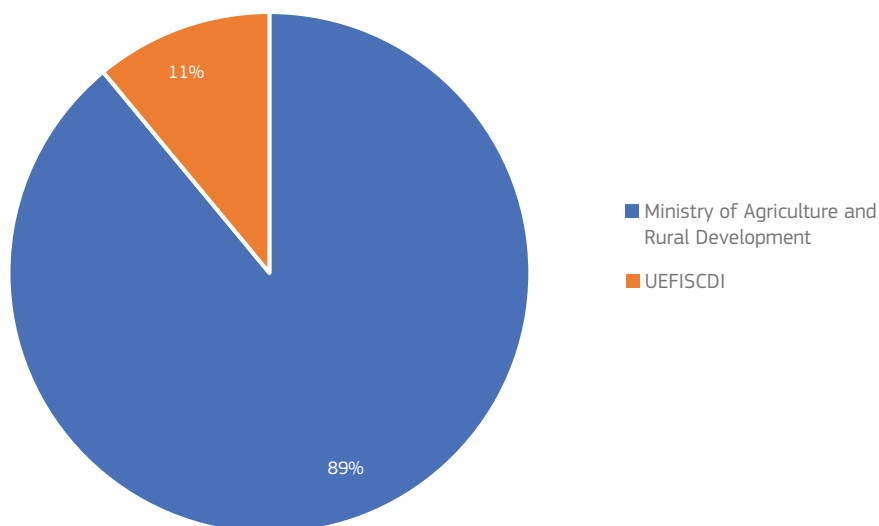


Source: Analysis of data compiled for the SCAR project and data provided by the National Research and Development Institute for Food Bioresources – IBA Bucharest.

5 Main recipients of public food R&I investment

Almost 90% of all funding for food-related R&I was provided by the Ministry of Agriculture and Rural development, with the remaining funding disbursed by UEFISCDI, as shown in Figure 4. However, funding proportions across the two institutions could be biased by lack of comprehensive data. Information on funding beneficiaries is available only for seven projects. Universities and research centres are the main beneficiaries (five projects); one project awarded funding is coordinated by an association, and one other by a private firm.

Figure 4: Funding by granting organisation



Source: Analysis of data compiled for the SCAR project and data provided by the National Research and Development Institute for Food Bioresources – IBA Bucharest.

6 Structural and investment funds available for Food R&I

Romania benefits from funding under the European Maritime and Fisheries Fund, the Cohesion Fund, the European Social Fund, the European Agricultural Fund for Rural Development, the European Social Fund.

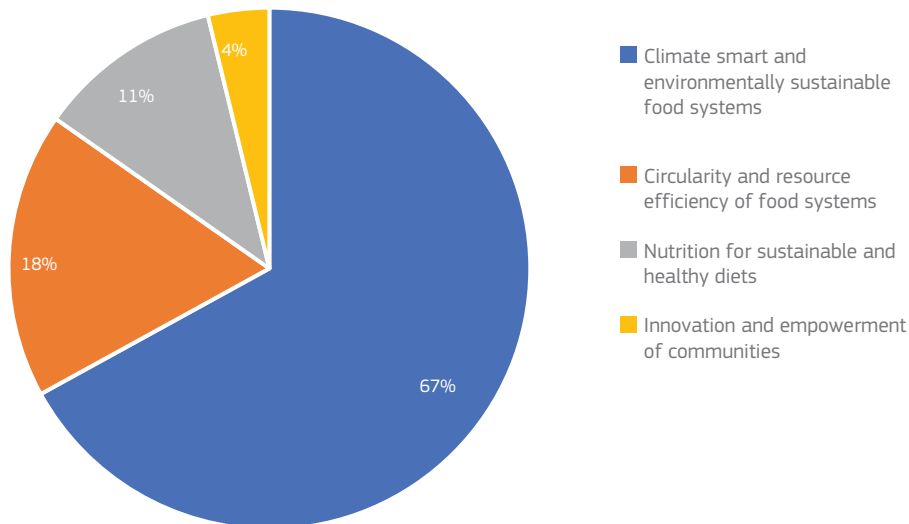
7 Links to FOOD2030 priorities and pathways

In total, 172 projects across the datasets were found to be in scope could be classified against one or more pathways⁵⁶⁸. As illustrated in Figure 5, the largest share of projects belonged to the priority of ‘climate smart and sustainable food systems’, ranging from innovation in seed production, for example by producing seeds and plants that were resistant to adverse climate conditions, or genetic modification of crops varieties. Eighteen percent of projects referred to circularity, resource efficiency, and re-use of by-products.

⁵⁶⁸ Forty-seven projects funded research on meat production, which could not be matched to any Food 2030 priority, whereas 17 projects across the datasets received were found to be out of scope.

Projects in the area of sustainable and healthy diets ranged from the development of food with enhanced health benefits to technologies to ensure product freshness.

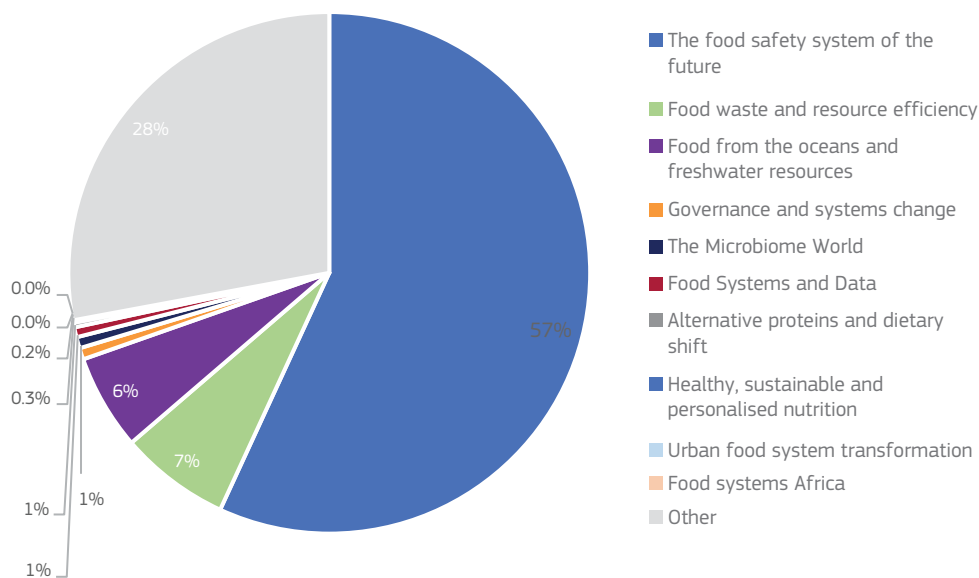
Figure 5: Distribution of funding by Food 2030 priority



Source: Analysis of data compiled for the SCAR project and data provided by the National Research and Development Institute for Food Bioresources – IBA Bucharest.

As can be seen from Figure 6, most of the projects reviewed (57%) belonged to the pathway of food safety systems of the future, which could be partly explained by Romania’s commitment in the early 2010s to align with the EU agri-food standards, as could be the case for those projects that fell under the pathway of governance and systems change.

Figure 6: Distribution of funding by FOOD2030 pathway



Source: Analysis of data compiled for the SCAR project and data provided by the National Research and Development Institute for Food Bioresources – IBA Bucharest.

8 Data gaps and limitations

The analysis of national public funding for R&I in the Romanian food sector is based on data retrieved as part of the SCAR project along with additional data provided for the purpose of this study by the National Research and Development Institute for Food Bioresources – IBA Bucharest, a public research entity coordinated by the Ministry of Research and Innovation. Aside from the information provided by this entity, no further data was available on national funding for the period 2007-2020.

Summary of data sources: Romania

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Research, Innovation, and Digitalisation	https://www.research.gov.ro/
	Ministry of National Education	https://www.edu.ro/
	Executive Unit for the Financing of Higher Education, Research, Development and Innovation (UEFISCDI)	https://uefiscdi.gov.ro/
	Advisory Board for Research, Development and Innovation (CCCDI)	https://www.research.gov.ro/ro/articol/2713/despre-ancs-organizare-organe-consultative-atribu-iile-colegiului-consultativ-pentru-cercetare-dezvoltare-i-inovare
	National Council for Higher Education Financing (CNFIS)	http://www.cnfis.ro/
Food innovation related policies	Ministry of Education and Research (2006), National Research, Development, and Innovation Strategy 2007-2013	https://uefiscdi.gov.ro/resource-82540%20
	Ministry of Agriculture and Rural Development (2014), National Rural Development Programme for the 2014-2020	https://www.madr.ro/docs/dezvoltare-rurala/programare-2014-2020/PNDR_2014_EN_-_2020_01.07.2014.pdf
	Ministry of Agriculture and Rural Development (2007), National Rural Development Programme 2007-2013	http://old.madr.ro/pages/dezvoltare_rurala/nrdp_en_official%20version.pdf

	Ministry of Agriculture and Rural Development (2015), Strategy for the development of the agri-food sector in the medium and long term 2020-2030 (<i>Strategia pentru dezvoltarea sectorului agroalimentar pe termen mediu și lung orizont 2020-2030</i>)	http://www.madr.ro/docs/agricultura/strategia-agroalimentara-2020-2030.pdf
	Ministry of Agriculture and Rural Development (2019), Sectoral plan for research and development in the field of agriculture and rural development of the Ministry of Agriculture and Rural Development for the years 2019-2022, Agriculture and Rural Development ADER 2022 (<i>Plan sectorial pentru cercetare-dezvoltare din domeniul agricol și de dezvoltare rurală al Ministerului Agriculturii și Dezvoltării Rurale, pe anii 2019-2022 “Agricultură și Dezvoltare Rurală – ADER 2022”</i>)	http://madr.gov.ro/docs/cercetare/2019/plan-sectorial-2019-2022.pdf
National R&I Strategies	Ministry of Education (2014), National Strategy for Research, Development, and Innovation 2014-2020 (<i>Strategia națională de cercetare, dezvoltare și inovare 2014-2020</i>)	https://edu.ro/sites/default/files/ff%C8%99iere/Minister/2016/strategii/strategia-cdi-2020_-proiect-hg.pdf
	Ministry of Research, Innovation, and Digitalisation (2018), National Plan for Research, Development and Innovation 2015-2020 (PNCDI III) (<i>Planul național de cercetare, dezvoltare și inovare 2015-2020 – PNCDI III</i>)	http://www.research.gov.ro/uploads/competitii/pncdi-iii/2018/pncdi-iii/subprogram2-1-performan-institu-ional/p-1-2-pachet-de-informatii-performanta-institutionala-final.pdf
	Romanian Government (2020), National Reform Programme (Programul național de reformă)	http://www.mae.ro/sites/default/files/file/anul_2020/pdf_2020/2020.10.14_pnr_ro.pdf

Available data (reports, datasets)		
Source	Name and description	Link
From SCAR quantitative mapping (where available)	?	?
From desk research	European Commission (2020), European Innovation Scoreboard 2020 - Romania	https://ec.europa.eu/docsroom/documents/41888
	European Commission (2020), Country Profile Romania	https://trimis.ec.europa.eu/country-profile/romania
	OECD and European Commission (2019), Supporting Entrepreneurship and Innovation in Higher Education in Romania	https://www.oecd.org/cfe/smes/HEInnovate-Romania.pdf
	European Commission and European Investment Bank (2020), Financial needs in the agriculture and agri-food sectors in Romania	https://www.fi-compass.eu/sites/default/files/publications/financial_needs_agriculture_agrifood_sectors_Romania.pdf

SLOVAKIA

1 Overview of national R&I landscape

In the past decades, the **Slovakian R&I system has experienced a significant growth**, driven by participation in the EU programmes and increased investments, also characterised by the emergence of various centres of excellence and research and technology centres. As a result, at the moment, the Slovakian **national R&I landscape is often assessed as having pockets of highly innovative activities** in different areas such as bioeconomy and ICT. However, compared to the other EU-27 countries, Slovakia still invests modestly into R&I. In particular, in 2019, **Slovakia's R&I expenditure** represented only **0.8% of GDP**, also representing a slight **decline compared to 2018** and well **below the EU-27 level (2.0%)** (see Figure 1). With that in mind, international and in particular EU funding, represents an important aspect of Slovakia's R&I landscape. The European Commission reports that about 39% of R&D investment relies on foreign funding sources, 89% of which are EU funds, with both figures being among the highest in the EU⁵⁶⁹. With regards to R&I actors, there are more than **500 R&I units in Slovakia**, out of which **almost three quarters (73%)** come from the **private sector**⁵⁷⁰. Among those, there are 20 public universities, 10 private universities and three state universities and colleges⁵⁷¹.

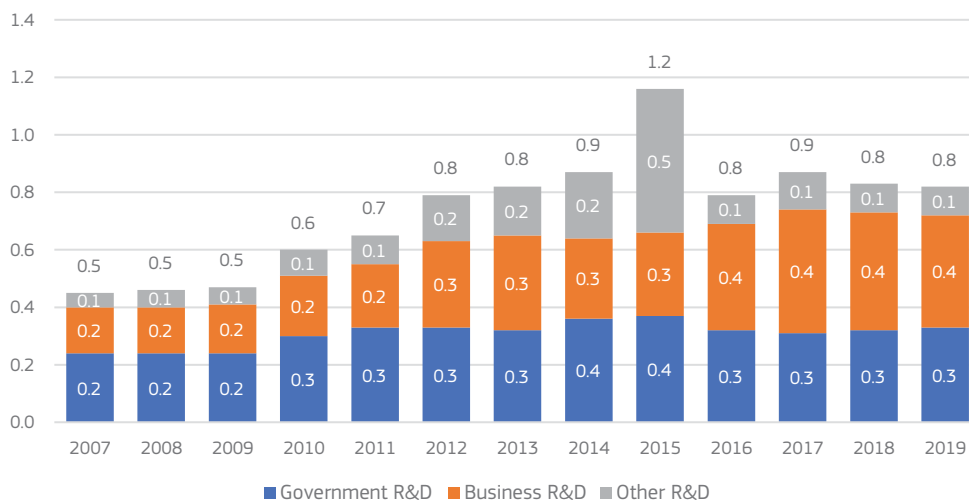
Agriculture and Food security is identified as one of the R&I priorities in Slovakia's Research and Innovation Smart Specialisation Strategy (RIS3) 2014–2020, the main strategic document governing RTDI in Slovakia.

⁵⁶⁹ <https://op.europa.eu/en/publication-detail/-/publication/1bde568f-5946-11ea-8b81-01aa75ed71a1/language-en>

⁵⁷⁰ <https://sario.sk/sites/default/files/sario-research-and-development-2020-10-05.pdf>

⁵⁷¹ <https://www.timeshighereducation.com/student/where-to-study/study-in-slovakia#:~:text=At%20present%20there%20are%2020,universities%20and%20colleges%20in%20Slovakia.>

Figure 1: R&I as a proportion of GDP in Slovakia 2007-2020



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

Main providers of Food R&I funding at national level

R&I policy is a central government competence, with the national government responsible for science and technology policy, industrial policy and higher education policy. In addition to national level, there are eight regional governments that hold competences in secondary education and vocational training, and in regional innovation⁵⁷². **Ministry of Education, Science, Research and Sport of the Slovak Republic** (MESRS) is the **central body** of state administration for science and technology and ensures the **creation and implementation** of state **science and technology policy**⁵⁷³. The centrally placed coordination body is the **Government Council for Science, Technology and Innovation**. The Council is the key advisory body for coordination of Slovakian R&I related policies. Its role is to coordinate the cooperation of public and private sector organisations to ensure the objectives of the science, technology and innovation policies are met and to comprehensively assess the materials of central state administration bodies in the fields of science, technology and innovation⁵⁷⁴. In this context it also represents an important actor

⁵⁷² <https://www.mirri.gov.sk/wp-content/uploads/2021/03/RTDI-in-Slovakia-AS-IS-report.pdf>

⁵⁷³ <https://www.minedu.sk/science-and-research/>

⁵⁷⁴ https://www.researchgate.net/publication/324132080_RIO_Country_Report_2017_Slovak_Republic_Research_and_Innovation_Observatory_country_report_series

for **R&I in Food Systems**, both from a legal and institutional point of view, together with the national **Ministry of Agriculture and Rural Development** (MoARD).

MoARD and its agencies, together with public research and education institutes, private sector companies, farmers, forest owners-based organisations and third sector nongovernmental organisations also make up the core of the **Slovakian Agriculture and Innovation Knowledge System (AKIS)**. In particular, some of the **key AKIS actors** that can be highlighted are: MoARD; Agricultural and Food Chamber; Chamber of Forestry; Agroinstitut at Nitra; National Agricultural and Food Centre; National Forest Centre; Slovak Agricultural University at Nitra; University of Veterinarian Sciences at Kosice; Technical University at Zvolen; Slovak Technical University in Bratislava; Institute for Forestry Extension and Education; Agricultural, Forestry and Veterinary Vocational Schools; Union of Cooperatives and Business Association; Youth Farmers Association; Agency for Rural Development, among others⁵⁷⁵.

It should be noted that MoARD founded six subsidised research organisations to perform basic and applied research, development and related innovations for the agricultural practice, with a view of compatibility towards the Europe 2020 Strategy⁵⁷⁶. As of 2020, some of these research organisations were merged, and with the most important being the above mentioned National Agricultural and Food Centre and National Forest Centre.

2 National R&I Strategy

In 2020, the Government of the Slovak Republic approved the **long-term vision and Development Strategy of Slovakia until 2030 (Slovakia 2030)**. Slovakia 2030 represents the overarching long-term strategy of sustainable development of the state, aiming to improve the predictability of public policies, the efficiency of the use of public resources and the stability of the business environment. In addition to being the basic implementation document of the 2030 Agenda for the Slovak Republic, also fulfils the role of the National Strategy for Regional Development. The priorities and objectives of the Slovakia 2030 are to be further elaborated in the National investment plan, sectoral strategies of individual central government bodies, and at the same time will be reflected in the preparation of the new EU programming period 2021–2027, in particular the Partnership Agreement and the Operational Programmes⁵⁷⁷. One of the priorities is to

⁵⁷⁵ <https://i2connect-h2020.eu/resources/akis-country-reports/>

⁵⁷⁶ <https://www.opvai.sk/media/57255/through-knowledge-towards-prosperity-research-and-innovation-strategy-for-smart-specialisation-of-the-slovak-republic.pdf>

⁵⁷⁷ <https://www.mirri.gov.sk/wp-content/uploads/2021/01/Slovensko-2030.pdf>

improve the health and active life expectancy of the population, within which a particular emphasis is drawn towards the support for research and promotion within the domain of health (improving foods and products).

Succeeding the Innovation Strategy of the Slovak Republic for the years 2007 – 2013⁵⁷⁸, since 2014, **Slovakia's Research and Innovation Smart Specialisation Strategy (RIS3) 2014-2020**⁵⁷⁹ is the main strategic document governing RTDI in Slovakia. The national R&D strategy aims to support innovation through cooperation between industry and R&D capacities, setting goals and policy measures linked to research, innovation and education. RIS3 has four main objectives:

- Deepening integration and embeddedness of major key industries to increase local value added through the cooperation of the local supply chains and turning local supply chains into embedded clusters;
- Increased contribution of research to the economic growth via global excellence and local relevance;
- Creating a dynamic, open, and inclusive innovative society as one of the preconditions for the increase in the standard of living;
- Improving the quality of human resources for an innovative Slovakia.

Within the Strategy, **Environment, Agriculture and Food security** is identified as one of the R&I priorities. The focus of this priority area is on advanced technologies and practices in agriculture and food production to ensure the sufficiency of good quality food production.

The strategy is accompanied by the Implementation Plan of the Research and Innovation Strategy for Smart Specialisation, which was adopted in 2017. The implementation plan prioritises the smart specialisation areas and defines five smart specialisation domains based on economic, prospective and scientific areas of specialisation. **One of the domains is Healthy Food and Environment, within which crop and animal production, hunting and related service activities is highlighted as a key sector**⁵⁸⁰.

⁵⁷⁸ <https://www.vedatechnika.sk/SK/VedaATechnikaVSR/SDokumenty/Forms/tandardn%20zobrazenie.aspx?RootFolder=%2fSK%2fVedaATechnikaVSR%2fSDokumenty%2fInova%c4%8dn%c3%a1%20strat%c3%a9gia%20SR%20na%20roky%202007%20%2d%202013&FolderCTID=&View=%7b6-8D9DBC2%2dCA0B%2d4203%2dB4B1%2d88D5B038ABEE%7d>

⁵⁷⁹ <https://www.opvai.sk/media/57255/through-knowledge-towards-prosperity-research-and-innovation-strategy-for-smart-specialisation-of-the-slovak-republic.pdf>

⁵⁸⁰ https://s3platform-legacy.jrc.ec.europa.eu/documents/20182/274840/SK-RIS3_IMPLEMENTACNY-PLAN_SK_final_EK.pdf/8c3e2be9-3c32-44d1-83e8-8ea508b6775a3

It should be noted that the update of the RIS3 strategy that will outline the priorities for the period 2021–2027 is still in preparation⁵⁸¹.

Another important policy document is the **2030 Digital Transformation Strategy for Slovakia**⁵⁸². Adopted in 2019, the 2030 Strategy for Digital Transformation of Slovakia is a cross-sectional government strategy that defines the policy and particular priorities of Slovakia in the context of the currently on-going digital transformation of economy and society under the influence of innovative technologies and global megatrends of the digital era. Thus, the Strategy puts primary emphasis on integrating current innovative technologies such as Artificial Intelligence, Internet of Things, 5G Technology, Big Data and Analytical Data Processing, Blockchain and High-Performance Computing, to drive economic growth and strengthen the competitiveness. Thus, the main objective of the document is to support the adaptation of economy, industry and agriculture to the needs of the digital era. With regards to the food systems, the Strategy specifically focuses on the application of the latest knowledge about sustainable use of soil by means of robotisation and analysis of data from sensors, as well as utilisation of cutting-edge technologies to improve the industrial processes. Additionally, creating partnerships between the public, private and scientific sectors to bring new innovations to agriculture and apply them effectively and efficiently is also established as one of the long-term goals.

3 Overview of national food policy

As evident from the national development priorities, food systems play an important role in the Slovakian economy. The total value of agriculture production was EUR 2.2 billion in 2020. The sector accounted for 3% of the Gross Value Added, which was higher than the EU28 average of 2%. In terms of employment, the agriculture sector accounted for 3% of the total workforce in 2020, which is lower than the EU average of 4%⁵⁸³. More than half of the land (around 58%) is used for agriculture⁵⁸⁴. Similarly, the food industry represents an important pillar and driver of the economic growth in Slovakia. In particular, revenues of the Slovakian food processing industry totalled EUR 4.9 billion in 2019, with over 2,100 companies operating in this particular industry⁵⁸⁵.

⁵⁸¹ <https://www.mirri.gov.sk/sekcie/investicie/strategia-vyskumu-a-inovacii-pre-inteligentnu-specializaciu-sr/aktualizacia-ris3/>

⁵⁸² <https://www.mirri.gov.sk/wp-content/uploads/2021/03/RTDI-in-Slovakia-AS-IS-report.pdf>

⁵⁸³ https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agri-statistical-factsheet-sk_en.pdf

⁵⁸⁴ https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/key_policies/documents/rdp-factsheet-slovakia_en.pdf

⁵⁸⁵ <https://www.mpsr.sk/en/index.php?navID=16&id=76>

Several key documents that governed the development of food systems in the programming period 2014-2020 can be highlighted. Adopted in 2013, the **Concept for the Development of Agriculture of the SR 2013-2020**⁵⁸⁶ followed upon the previous strategy, the Concept for the development of the agricultural sector 2007-2013⁵⁸⁷ and outlines key priorities with the aim of supporting resource efficiency in the interest of smart, sustainable and inclusive growth of agriculture and rural areas. The Concept focuses on meeting the following strategic goals: increasing production performance in key agricultural commodities to the level of 80% of the current consumption of the population in Slovakia; ensuring sustainable forest management; and rural development and the improvement of the living conditions and employment of the rural population, in particular by supporting sectors which are potential sources of employment. To accompany the Concept, in 2014, an **Action plan for the development of agriculture in the Slovak Republic for the years 2014-2020**⁵⁸⁸ was adopted. This Action plan specifies an effective set of tools and measures to fulfil objectives arising from the Concept of Agricultural Development for the years 2014 – 2020. Another important policy document for the period 2014-2020 is the **Concept of food industry development 2014 – 2020**⁵⁸⁹. The document is based on a priority of its program statement for the years 2012 – 2016 with the purpose of ensuring the food self-sufficiency at the level of 80% by 2020, strengthening the position of the Slovakian food industry on the domestic market and increasing its export performance and competitiveness. **The Slovak Republic Rural Development Programme (RDP)**, formally adopted by the European Commission in 2015 and last modified in 2021, outlines Slovakia's priorities for the utilization of the EU funding (EUR 3,0 billion) that is available for the nine-year period 2014-2022 (EUR 2 300 million from the EU budget and EUR 700 million of national funding). The extended programming period includes two years of the transitional period 2021- 2022. As such, it is the main strategic document governing the development of the sector. The programme focuses on six strategic areas with an overall objective to increase the competitiveness of agriculture and forestry by supporting the investments bringing the higher added-value to the primary production and increasing the efficiency of the organisation of the supply chain, including the knowledge transfer and innovation in agriculture, forestry and rural areas⁵⁹⁰.

In addition to these four key documents, in 2014, Slovakia adopted the updated version of the **National Strategy for the Protection of Biodiversity to 2020**, which established

⁵⁸⁶ <https://www.mpsr.sk/koncepcia-rozvoja-podohospodarstva-sr-na-roky-2013-2020/59---7593/>

⁵⁸⁷ <https://www.mpsr.sk/resources/documents/135.pdf>

⁵⁸⁸ <https://rokovania.gov.sk/RVL/Material/10519/1>

⁵⁸⁹ <https://www.mpsr.sk/koncepcia-rozvoja-potravinarskeho-priemyslu-2014-2020/59---8878/>

⁵⁹⁰ https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/key_policies/documents/rdp-factsheet-slovakia_en.pdf

several principles to provide guidance for biodiversity protection⁵⁹¹. Another relevant policy document is the **National Forest Programme** which represents a national sectoral programme of the Slovak Republic. Its main objective is to support and enhance sustainable and multi-purpose forest management⁵⁹².

Most recently, Slovakia adopted the **Strategy of the Environmental Policy of the Slovak Republic until 2030 “Greener Slovakia”**, which defines a vision until 2030, considering future developments related to the circular economy and environmental protection. This Strategy identifies the fundamental systemic problems, sets the objectives until 2030 and proposes a framework for measures to improve the current situation. One of the priorities of the Strategy is to work towards supporting more environmentally friendly practices in agriculture⁵⁹³. Other relevant documents in the framework of the circular economy include the **Waste Management Plan of the Slovak Republic** and the **Waste Prevention Plan of the Slovak Republic**⁵⁹⁴. It should also be noted that since 2012 Slovakia has a **National Action Plan to achieve the sustainable use of pesticides**⁵⁹⁵. Since 2019, and prepared pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action, Slovakia also developed an **Integrated National Energy and Climate Plan for 2021 to 2030**. The strategic objective is to achieve a competitive low-carbon energy industry sector, ensuring the secure and efficient supply of all forms of energy at affordable prices and taking customer protection and sustainable development into account. To achieve so, the document outlines a number of objectives and measures to reduce emissions and improve circularity in the economy, including those related to food systems. It should be noted that Slovakia is also currently in the process of developing a bioeconomy strategy.

4 Public funding available for food R&I

The public funding for food R&I in Slovakia is allocated through two main public bodies: **Slovak Research and Development Agency (SRDA)** and **Scientific Grants Agency (VEGA)**.

⁵⁹¹ <http://extwprlegs1.fao.org/docs/pdf/slo163413.pdf>

⁵⁹² <http://extwprlegs1.fao.org/docs/pdf/slo163416.pdf>

⁵⁹³ https://www.minzp.sk/files/iep/greener_slovakia-strategy_of_the_environmental_policy_of_the_slovak_republic_until_2030.pdf

⁵⁹⁴ https://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a-zoznamy/poh-sr-2016-2020_vestnik_en-2.pdf

⁵⁹⁵ <http://extwprlegs1.fao.org/docs/pdf/slo191347.pdf>

SRDA is the only national agency established in order to support research and development in Slovakia by granting financial means from the State Budget⁵⁹⁶. The following calls have been considered in the quantitative analysis:

- General Calls: Support for research and development projects in particular fields of science and technology (data available for the following years: 2010 – 2012; 2014 – 2019);
- Bilateral Calls: Support of researchers' mobility on the grounds of international contracts on scientific and technological cooperation (data available for the following years: 2008 – 2020).

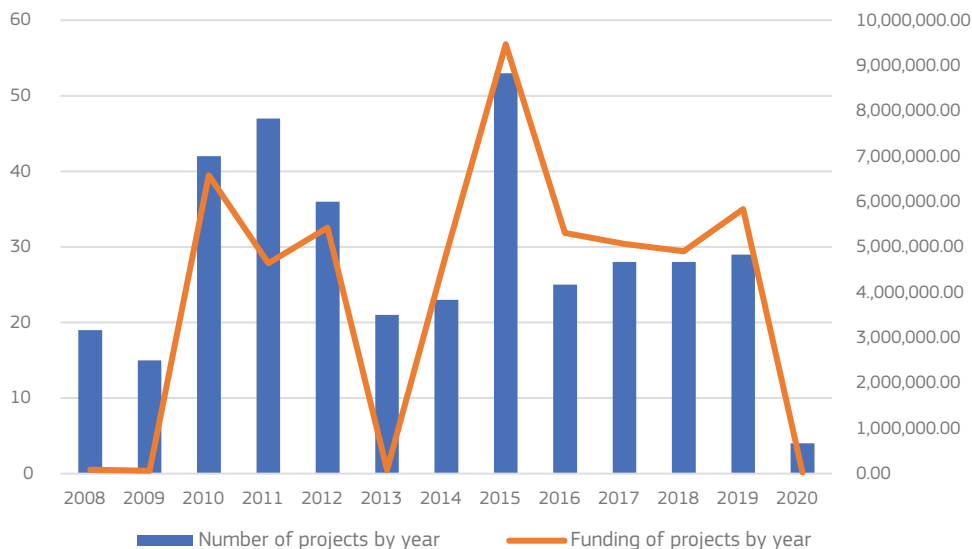
VEGA is an internal grant system for the Ministry of Education, Science, Research and Sport and Slovakia Academy of Sciences, which ensures a mutually coordinated procedure for selection and evaluation of basic research projects proposed by the scientific institutes of the Slovak Academy of Sciences. It proposes to the Minister of Education, Science, Research and Sport of the Slovak Republic and the President of the Slovakia Academy of Sciences the amount of the subsidy to be provided for selected new and ongoing scientific projects (data available for the following years: 2008 – 2020)⁵⁹⁷.

According to data from the public databases of SRDA and the Ministry of Education, Science, Research and Sport, a total of 373 R&I food-related projects were developed by Slovakian organisations between 2008 and 2020, receiving a total of EUR 52.4 million in funding. A review of the number of projects approved during this period shows that 2011 and 2015 were the years with the highest number of projects approved (47 and 53 respectively). The year in which the highest funding was used for food-related projects was 2015 (EUR 9.5 million) (see Figure 2).

⁵⁹⁶ <https://www.apvv.sk/?lang=en>

⁵⁹⁷ <https://trimis.ec.europa.eu/programme/scientific-grant-agency>

Figure 2: Food systems R&I projects between 2008 and 2020.

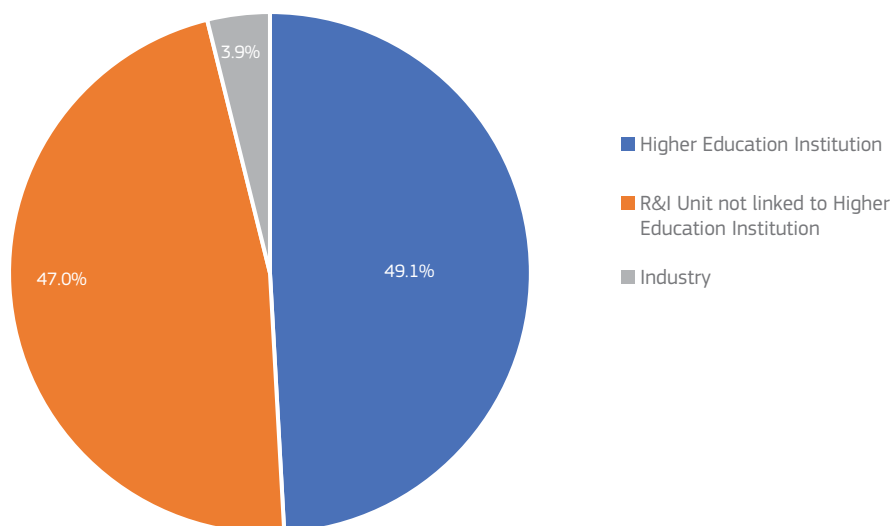


Source: Analysis of data from public databases of SRDA and the Ministry of Education, Science, Research and Sport of Slovak Republic (2021)

5 Main recipients of public food R&I investment

A majority of the funding was awarded to projects developed by the Higher Education Institutions (HEIs) (49%, equal to EUR 25.7 million), with the remaining funding shared between the R&I Units not linked to HEIs (47%, or EUR 24.6 million) and industry (4%, or EUR 2 million), as reported in Figure 3.

Figure 3: Distribution of the funding by recipient



Source: Analysis of data from public databases of SRDA and the Ministry of Education, Science, Research and Sport of Slovak Republic (2021)

6 Structural Funds available for Food R&I

The Slovak Republic, through 9 national programmes, benefits from ESIF funding of EUR 15.3 billion⁵⁹⁸. The majority of overall R&I supported is funded via the European Regional Development Fund (ERDF) (mainly through the Operational Programme Research and Innovation, with a total budget of more than EUR 2.1 billion), though smaller amounts of money – EUR 56.7 million out of EUR 2,410m – comes from the European Agricultural Fund for Rural Development (EAFRD)⁵⁹⁹.

7 Links to FOOD2030 priorities and pathways

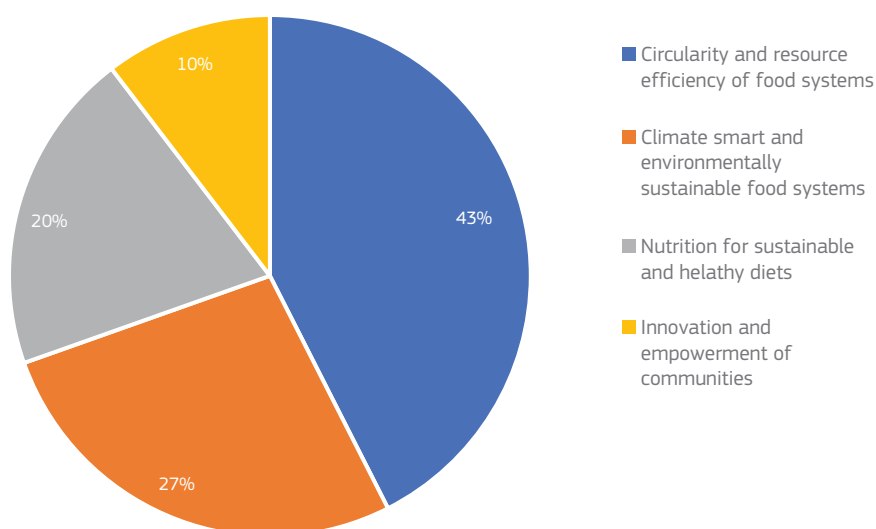
According to an analysis of the funding data, publicly funded food-related R&I in Slovakia has prioritised research in circularity and resource efficiency of food systems (43% of the total, corresponding to EUR 22.5 million). This was followed by climate smart and environmentally sustainable food systems (27%, corresponding to EUR 14.1 million),

⁵⁹⁸ <https://cohesiondata.ec.europa.eu/countries/SK>

⁵⁹⁹ <https://www.mirri.gov.sk/wp-content/uploads/2021/03/RTDI-in-Slovakia-AS-IS-report.pdf>

nutrition for sustainable and healthy diets (20%, or EUR 10.5 million) and Innovation and empowerment of communities (10%, corresponding to EUR 5.2 million). According to the data analysis, the main single priority is Circularity and resource efficiency of food systems (44%, corresponding to EUR 6.1 million), followed by Nutrition for sustainable and healthy diets (23%, corresponding to EUR 3.2 million), Climate smart and environmentally sustainable food systems (19%, or EUR 2.6 million) and Innovation and empowerment of communities (14%, or EUR 1.9 million).

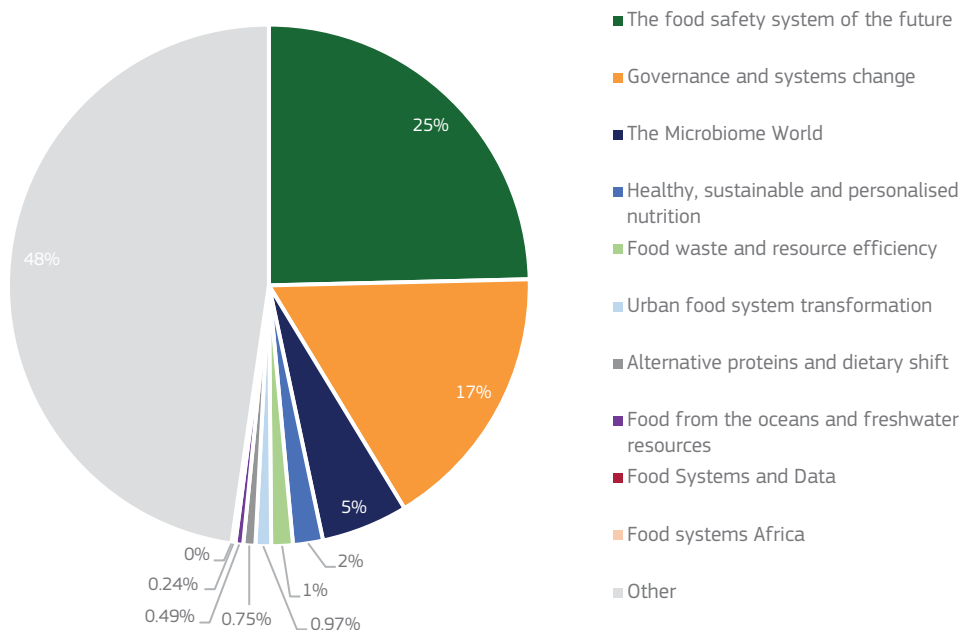
Figure 4: Distribution of the funding by FOOD2030 priorities



Source: Analysis of data from public databases of SRDA and the Ministry of Education, Science, Research and Sport of Slovak Republic (2021)

As Figure 5 illustrates, almost half of all funding (48%, corresponding with EUR 25.0 million) went on projects that couldn't be characterised under any of the FOOD2030 pathways (characterised here as 'other'). In terms of FOOD2030 pathways, the highest funding went to Food safety system of the future (25%, corresponding with EUR 12.9 million), followed by Governance and system change (17%, corresponding with EUR 8.7 million).

Figure 5: Distribution of the funding by FOOD2030 pathway



Source: Analysis of data from public databases of SRDA and the Ministry of Education, Science, Research and Sport of Slovak Republic (2021)

8 Data gaps and limitations

Data entering the quantitative analysis was identified from public databases of SRDA and the Ministry of Education, Science, Research and Sport of Slovak Republic. Information not available in the databases includes, among others: project description, keywords, technology readiness level (TRL), publications and patents.

Summary of data sources: Slovakia

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture and Rural Development; Slovak Research and Development agency; Scientific Grants Agency; Slovak Business Agency	https://www.mpsr.sk/en/ http://srd.sk/ https://www.minedu.sk/vedecka-grantova-agentura-msvas-sr-a-sav-vega/ http://www.sbagency.sk
Food innovation related policies	Concept for the Development of Agriculture of the SR 2013-2020 Concept of food industry development 2014 – 2020 The Slovak Republic Rural Development Programme	https://www.mpsr.sk/koncepcia-rozvoja-podohospodarstva-sr-na-roky-2013-2020/59---7593/ https://www.mpsr.sk/koncepcia-rozvoja-potravinarskeho-priemyslu-2014-2020/59---8878/ http://www.apa.sk/index.php?start&navID=496
National R&I Strategies	Long-term vision and Development Strategy of Slovakia until 2030 (Slovakia 2030) Slovakia 's Research and Innovation Smart Specialisation Strategy (RIS3) 2014-2020	https://www.mirri.gov.sk/wp-content/uploads/2021/01/Slovensko-2030.pdf https://www.opvai.sk/media/57255/through-knowledge-towards-prosperity-research-and-innovation-strategy-for-smart-specialisation-of-the-slovak-republic.pdf

Summary of amount spent from structural funds in agriculture and food projects	<p>Slovak Republic, through 9 national programmes, benefits from ESIF funding of EUR 15.3 billion⁶⁰⁰.</p> <p>The majority of overall R&I supported is funded via the European Regional Development Fund (ERDF) (mainly through the Operational Programme Research and Innovation, with a total budget of more than EUR 2.1 billion), though smaller amounts of money – EUR 56.7 million out of EUR 2,410m – comes from the European Agricultural Fund for Rural Development (EAFRD)</p>	<p>https://cohesiondata.ec.europa.eu/countries/SK</p> <p>https://www.mirri.gov.sk/wp-content/uploads/2021/03/RTDI-in-Slovakia-AS-IS-report.pdf</p>
From desk research	<p>SRDA Database</p> <p>Vega funded projects</p>	<p>https://www.apvv.sk/databaza-financovanych-projektov.html</p> <p>https://www.minedu.sk/vysledky-hodnotenia-novych-projektov-a-financovanie-projektov-vega/</p>

⁶⁰⁰ <https://cohesiondata.ec.europa.eu/countries/SK>

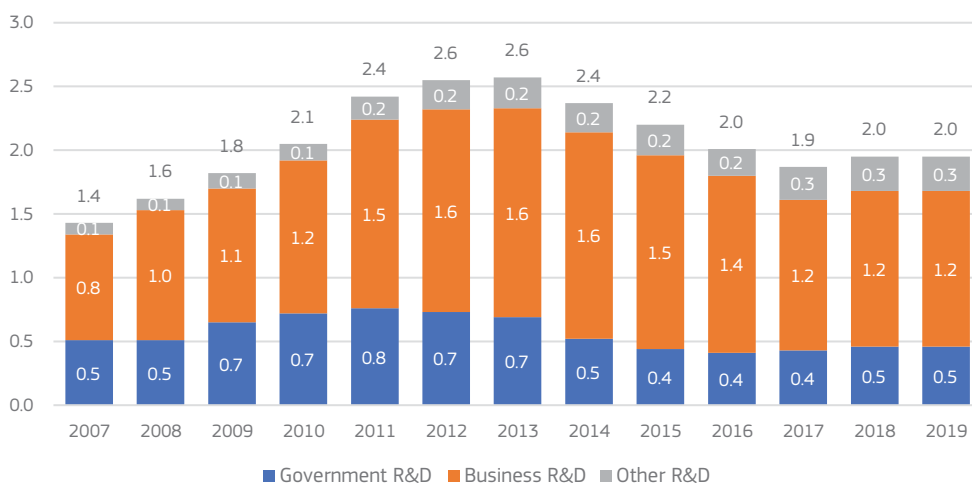
SLOVENIA

1 Overview of national R&I landscape

The national R&D landscape in Slovenia has suffered several changes since 2007. As seen in Figure 1, R&D expenditure in Slovenia as a percentage of its GDP increased from 2007 to 2013, when it reached a peak of 2.6%. After that year, it suffered a considerable drop, reaching a new relative minimum of 1.9% in 2017. It has since recovered a little, but not to the extent of reaching the levels of 2012 and 2013. As for the source of the investments, Business expenditure in R&D contributed to an average of 71% of total expenditure, being the main driver of investment in Slovenia.

Slovenia does not have a specific food R&I policy, but food and R&I are embedded in the R&I strategy and food policies.

Figure 1: R&I expenditure in Slovenia as a % of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

Main providers of Food R&I funding at national level

Within the Slovene public administration, the field of R&I falls within the competencies of the **Ministry of Education, Science and Sport (MESS)**. In addition to MESS as the main

responsible ministry for implementing the National Research and Innovation Strategy, other ministries are involved with respect to their fields of responsibility. As a consequence, the **Ministry of Agriculture, Forestry and Food (MAFF)** is involved in the co-financing of applied research projects pertaining to food systems. In collaboration with MESS, MAFF is also actively involved in preparing calls for tenders and in the process of selecting projects.

Research and innovation related specifically to food systems in Slovenia are provided by MAFF in cooperation with:

- **Scientific research institutions:** like the Agricultural Institute of Slovenia, Biotechnical Faculty in Ljubljana, Faculty of Agriculture and Life Sciences Maribor, Veterinary Faculty in Ljubljana, Vocational College - Center for Biotechnology and Tourism Novo Mesto, University of Primorska and the National Institute of Biology;
- Inter-branch associations:
 - **Primary production:** Chamber of Agriculture and Forestry⁶⁰¹ and Cooperative Association of Slovenia⁶⁰²;
 - **Food processing:** Chamber of Agricultural and Food Enterprises⁶⁰³;
 - **Food retail and wholesale:** Slovenian Chamber of Commerce⁶⁰⁴;
 - **Horeca system:** Chamber of Tourism and Hospitality of Slovenia⁶⁰⁵ and Association of Tourist Farms of Slovenia⁶⁰⁶;
 - **Consumers and households:** Consumers' Association of Slovenia⁶⁰⁷.
- **Other ministries in their fields of competence:** like Ministry of Science, Ministry of Health (CINDI programme on diet food), Ministry of Economic Development and Technology and Ministry of the Environment and Spatial Planning;

⁶⁰¹ <https://www.kgzs.si/>

⁶⁰² <https://www.zzs.si/dejavnosti>

⁶⁰³ https://www.gzs.si/zbornica_kmetijskih_in_zivilskih_podjetij

⁶⁰⁴ <https://www.tzsl.si/si>

⁶⁰⁵ <https://tqzs.si/domov/>

⁶⁰⁶ <https://www.turisticnekmetje.si/gastronomija>

⁶⁰⁷ <https://www.zps.si/>

- **Slovenian Research Agency (ARRS)**⁶⁰⁸: an independent public funding organisation that performs tasks related to the National Research and Development Programme and creation of European Research Area;
- **Slovene Enterprise Fund (SEF)**⁶⁰⁹: a public fund for financial support to Slovenian micro, small and medium-sized enterprises (SMEs) with favourable guarantee, credit and equity lines for the growth and development of the SMEs.

MAFF is also currently preparing a comprehensive review of the Slovenian AKIS (Agriculture Knowledge and Innovation Systems) for sustainable food systems. In this regard, MAFF has already collected data in a Draft Strategic Plan, which is the horizontal objective of AKIS and is in the process of revision.

2 National R&I Strategy

The main national R&I strategy is the **Resolution on Research and Innovation Strategy of Slovenia 2011-2020 (RISS)**⁶¹⁰, which aimed to achieve societal objectives such as improved living standards for all and an improved quality of life. These objectives were achieved through the establishment of a modern research and innovation system, which contributed to increased knowledge and understanding of society, responded to its challenges, increased the value added per employee, and provided quality workplaces and living environment. The RISS strategy focused on fostering scientific excellence, promoting cooperation between universities, research institutions and industry, international mobility and technology transfer, smart specialisation and raising public awareness on R&D.

RISS is based on the Development Strategy of Slovenia and is in accordance with the Europe 2020 documents and leading initiatives of the EU with the aim of achieving synergies in society. It relates to the **National Programme for the Development of Higher Education 2011–2020**⁶¹¹, and together they constitute the “knowledge triangle”, which is at the heart of the strategic reflection on further development of the Slovenian society.

The **overall long-term objective** set was to establish a modern research and innovation system that will allow for a higher quality of life for all through critical reflection of

⁶⁰⁸ <https://www.arrs.si/en/>

⁶⁰⁹ <https://aecm.eu/sef-slovene-enterprise-fund/>

⁶¹⁰ <https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/ZNANOST/Strategije/Resolution-on-Research-and-Innovation-Strategy-of-Slovenia-2011-2020-ENG.pdf>

⁶¹¹ www.gov.si/assets/ministrstva/MIZS/Dokumenti/Zakonodaja/EN/Resolution_on_the_National_Higher_Education_Programme_2011_2020.pdf

society, efficiency in addressing social challenges, increased value added per employee, and assurance of more and higher quality workplaces. The strategy also set objectives such as achieving better governance; increasing autonomy and responsibility of Public Research Organisations (PROs); and improving the system of public funding for research and innovation, among other objectives.

Other important R&I strategies in Slovenia include: the **Slovenian strategy for strengthening the European Research Area 2016-2020 (ERA Roadmap)**⁶¹² which guided the Slovenian research position in the European Research Area, furthering developments and ensuring greater efficiency and success; and **Research Infrastructure Roadmap 2011-2020, Revision 2016**⁶¹³, which presented and set the priorities of the Republic of Slovenia in the field of research infrastructures.

3 Overview of national food policy

Slovenian agricultural policy promotes sustainable development, cost-effectiveness and competitiveness of agriculture in Slovenia, fostering socially responsible and environmentally friendly practices. The focus is on providing food security by ensuring the stable production of safe and easily accessible high-quality food, while maintaining a clean environment and fertile soil and promoting coherent development and settlement of rural areas. Additionally, support is given for promoting technological innovation and applying new insights to modernise agricultural practice. Another area of focus is the sustainable development of forests, which are essential to the Slovenian natural and cultural heritage and landscape⁶¹⁴.

The key objectives and orientations of Slovenian agricultural policy are set out in the **Resolution on the Strategic Guidelines for the Development of Slovenian Agriculture and Food Industry until 2020, “Ensuring Food for Tomorrow”**, which was released in 2011. The focus was on producing safe and quality food with the aim of ensuring food security and increasing the competitiveness of agriculture and the food industry. In this context, the principle of sustainable use of production potential is to be respected and rural development ensured in a coherent and socially sustainable way⁶¹⁵.

⁶¹² http://mizs.arhiv-spletisc.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Zakonodaja/Strategije/Sl_ERA_Roadmap.pdf

⁶¹³ http://mizs.arhiv-spletisc.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Strategije/NRRI_2016_ENG.pdf

⁶¹⁴ <https://www.gov.si/en/policies/agriculture-forestry-and-food/>

⁶¹⁵ <https://www.gov.si/en/policies/agriculture-forestry-and-food/agriculture-and-rural-development/>

A new fundamental strategic framework that builds upon the previous one has recently been created for agriculture and rural areas beyond 2021, entitled **Resolution on the National Programme on Strategic Orientations for the Development of Slovenian Agriculture and Food Industry “Our Food, Rural and Natural Resources 2021”**⁶¹⁶. The essence of the new approach is a targeted strategic planning of public support to food production and processing and to rural development, taking into account the natural features of the Slovenian countryside and its actual needs. Particular emphasis is placed on the protection of the environment and nature and on the conservation of agricultural areas, which should become an asset rather than an obstacle to management.

Other relevant policies and resolutions related to food systems include the **Resolution on the National Nutrition and Physical Activity Programme 2015-2025**⁶¹⁷, which was preceded by the **Food and Nutrition Action Plan for Slovenia 2005-2010**⁶¹⁸, and the **Resolution on Slovenia’s Long-Term Climate Strategy until 2050**⁶¹⁹.

4 Public funding available for food R&I

The information provided in the sections below contains data featured in SICRIS - the Slovenian Current Research Information System⁶²⁰. Only the basic information of the research projects is publicly available, with the funding and recipients’ information being provided by MAFF and the ARRS.

Between 2007 and 2020, a total of 79 Slovenian R&I food-related were funded, which received a total of EUR 11.6 million in funds. The number of projects approved by year has been fluctuating each year, with the year 2009 having no projects approved and the year 2011 having the biggest number of projects (18, which corresponds to EUR 2.1 million). As for the year with most funding, the 14 projects that started in 2016 received a total of EUR 2.7 million (Figure 2).

⁶¹⁶ <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC192737/>

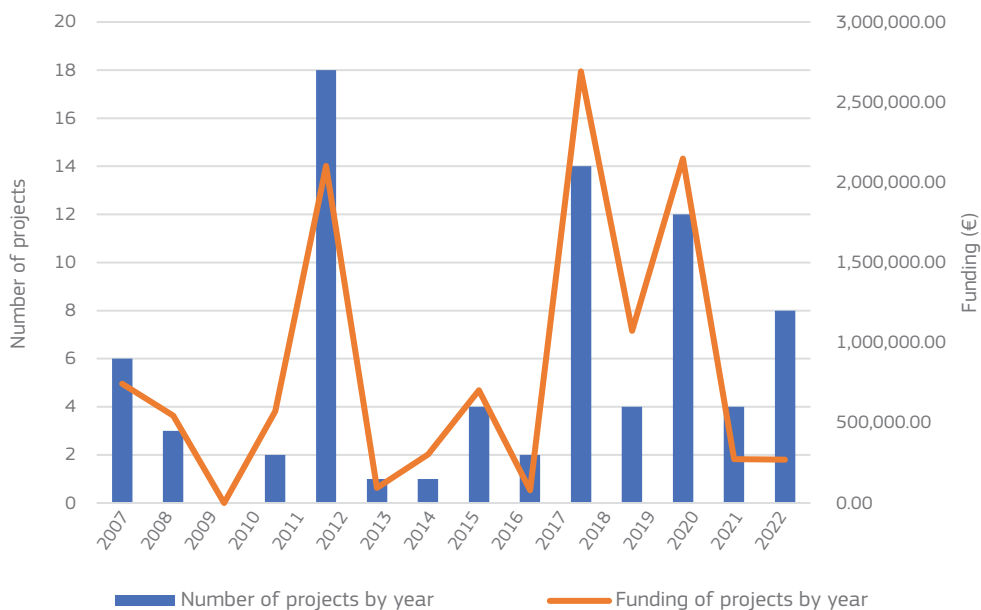
⁶¹⁷ <https://leap.unep.org/countries/si/national-legislation/resolution-national-nutrition-and-physical-activity-programme>

⁶¹⁸ <https://extranet.who.int/nutrition/gina/en/node/8380>

⁶¹⁹ https://unfccc.int/sites/default/files/resource/LTS1_SLOVENIA_EN.pdf

⁶²⁰ <https://www.sicris.si/public/jqm/cris.aspx?lang=eng&opdescr=home&opt=1>

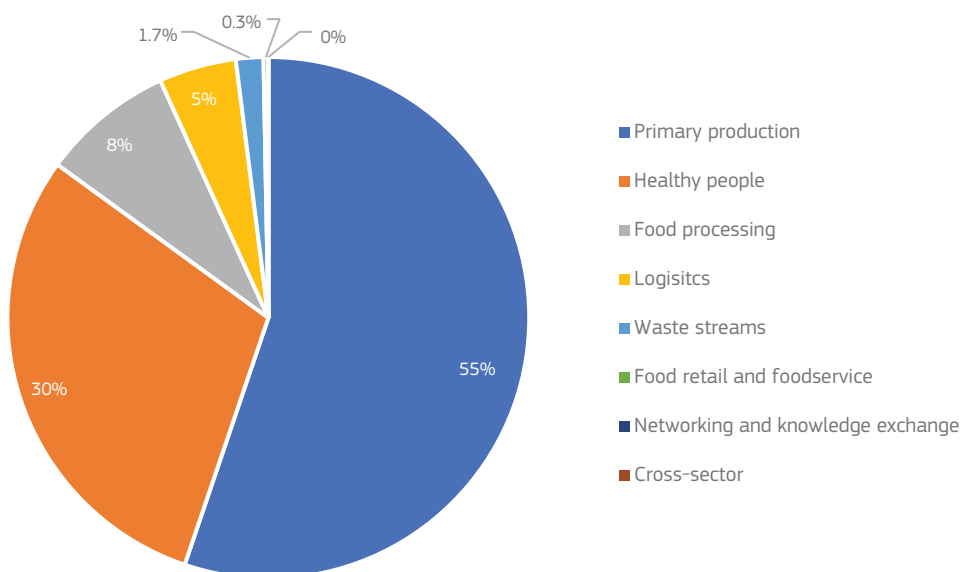
Figure 2: R&I food related projects between 2007 and 2020



Source: SPI analysis of MAFF and ARRS

When sorting the food-related R&I projects into major sectors, as observed in Figure 3, most funding is directed towards projects related to primary production (55%, EUR 6.4 million), with the healthy people sector coming in second (30%, EUR 3.5 million). Next in line comes the food processing sector (8%, EUR 953 thousand) and the logistics sector (5%, EUR 554 thousand). It is notable that wastes stream (2%), and food retail/service (0.3%) had the lowest number of projects developed. No projects fit into the networking and knowledge transfer sectors.

Figure 3: National public funding by sector

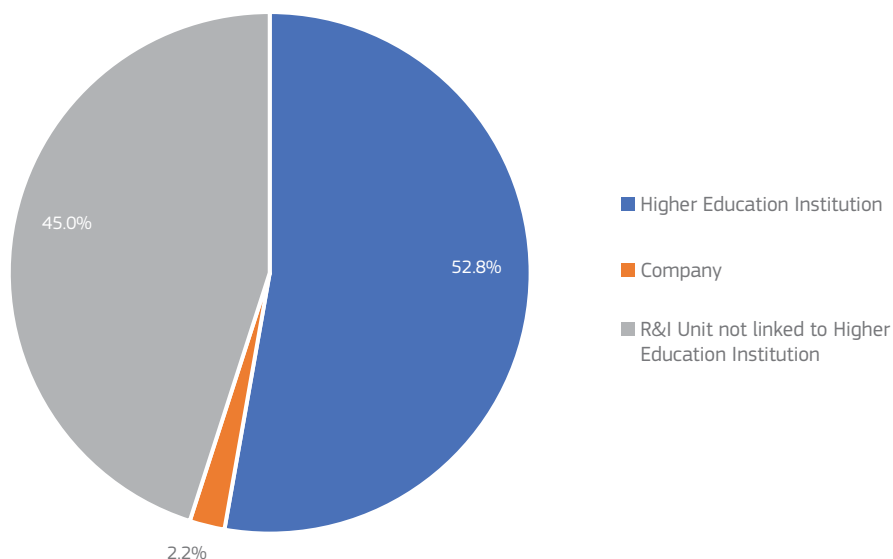


Source: SPI analysis of MAFF and ARRS

5 Main recipients of public food R&I investment

As seen in Figure 4, more than half of Slovenian public funding for food-related projects was received by Higher Education Institutions, with 53% of funds (EUR 6.1 million). This value was mostly driven by the University of Ljubljana and, more specifically, by the Biotechnical Faculty. R&I Units not linked to Higher Education Institutions come in a close second, with 45% (EUR 5.2 million), where organisations like the Agricultural Institute of Slovenia, Institute for Nutrition, National Institute for Public Health and Institute Jožef Stefan are featured. Finally, companies received only 2% of funding.

Figure 4: Distribution of the funding by recipients



Source: SPI analysis of MAFF and ARRS

6 Structural Funds available for Food R&I

In Slovenia, policy governance is characterised by national-level management of all 5 ESI Funds as well national-level bodies in charge of directly-managed instruments such as Horizon 2020. In recent years, Slovenia has been increasingly active in Horizon 2020, particularly as lead partner ⁶²¹.

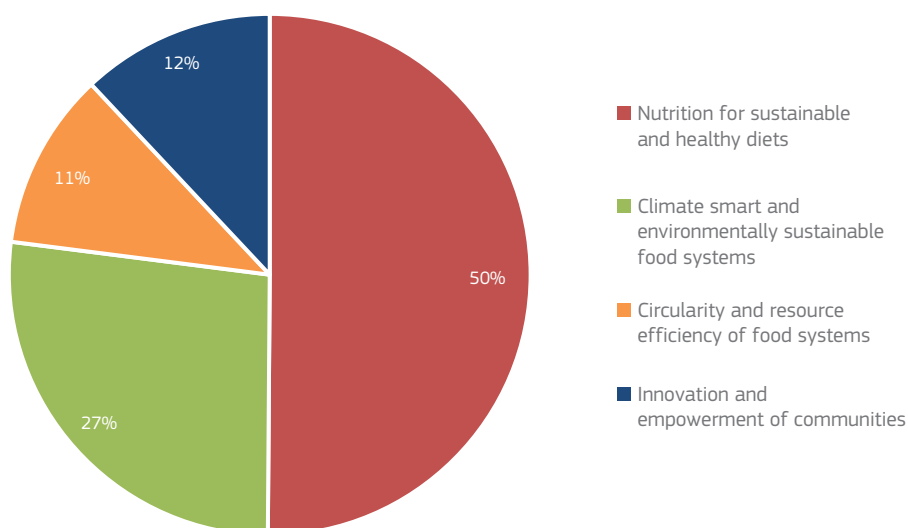
Slovenia, through 3 national programmes, benefits from ESIF funding of EUR 3.9 billion. Sorting by theme, EUR 652.6 million were allocated to Research & Innovation. However, it is not known what share of this amount corresponds to food-related projects.

⁶²¹ https://scar-europe.org/images/SCAR-Documents/Reports_outcomes_studies/AKIS2_Synergies_study_final_210219.pdf

7 Links to FOOD2030 priorities and pathways

Taking in consideration the four FOOD2030 priorities, half of funded food-related R&I projects in Slovenia have heavily prioritised research in nutrition for sustainable and healthy diets (50%, EUR 5.8 million). The second FOOD2030 priority in Slovenia is climate smart and environmentally sustainable food systems (27%, EUR 3.1 million). Lastly, innovation and empowerment of communities (12%, EUR 1.4 million) and resource efficiency of food systems (11%, EUR 1.3 million) come in a close third and fourth places.

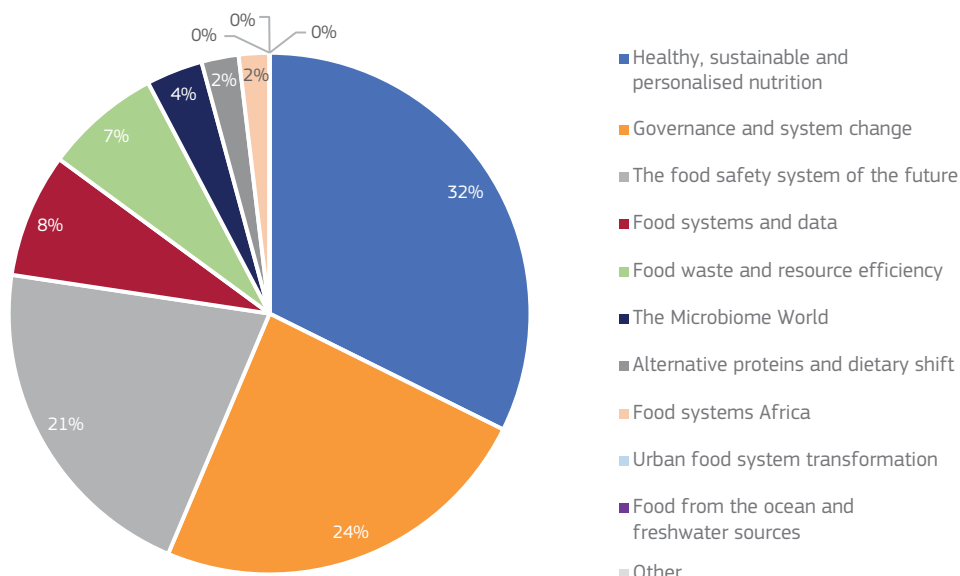
Figure 5: Public spend on food-related R&I projects by Food2030 priority



Source: MAFF and ARRS

With regards to FOOD2030 pathways, publicly funded food-related R&I projects in Slovenia were mostly allocated to the healthy, sustainable and personalised nutrition pathway (32%, EUR 3.7 million). Other two pathways had more than 20% of funding: the governance and system change pathway (24%, EUR 2.8 million) and the food safety system of the future pathway (21%, EUR 2.4 million). Other five pathways, seen in Figure 6, had less than 10% of funds. Two pathways (urban food systems transformation and food systems Africa) have no projects allocated.

Figure 6: Public spend on food-related R&I projects by Food2030 pathway



Source: MAFF and ARRS

8 Data gaps and limitations

The information required for the development of the Slovenian analysis is not publicly available on the websites of the national funding entities. It was provided by MAFF with the help of the ARRS. Therefore, the results of the analysis are based on data provided by these funding entities. Information not provided by the mentioned entities includes among others: project description, keywords, technology readiness level (TRL), publications and patents.

Summary of data sources: Slovenia

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	Ministry of Agriculture, Forestry and Food (MAFF)	?
Food innovation related policies	Resolution on the Strategic Guidelines for the Development of Slovenian Agriculture and Food Industry until 2020, "Ensuring Food for Tomorrow"	https://www.gov.si/en/policies/agriculture-forestry-and-food/agriculture-and-rural-development/
	Resolution on the National Programme on Strategic Orientations for the Development of Slovenian Agriculture and Food Industry "Our Food, Rural and Natural Resources 2021"	https://www.fao.org/faolex/results/details/en/c/LEX-FAOC192737/
National R&I Strategies	Resolution on Research and Innovation Strategy of Slovenia 2011-2020 (RISS)	https://www.gov.si/assets/ministrstva/MIZS/Dokumenti/ZNANOST/Strategije/Resolution-on-Research-and-Innovation-Strategy-of-Slovenia-2011-2020-ENG.pdf
From desk research	SICRIS - Slovenian Current Research Information System	https://www.sicris.si/public/jqm/cris.aspx?lang=eng&opdescr=home&opt=1

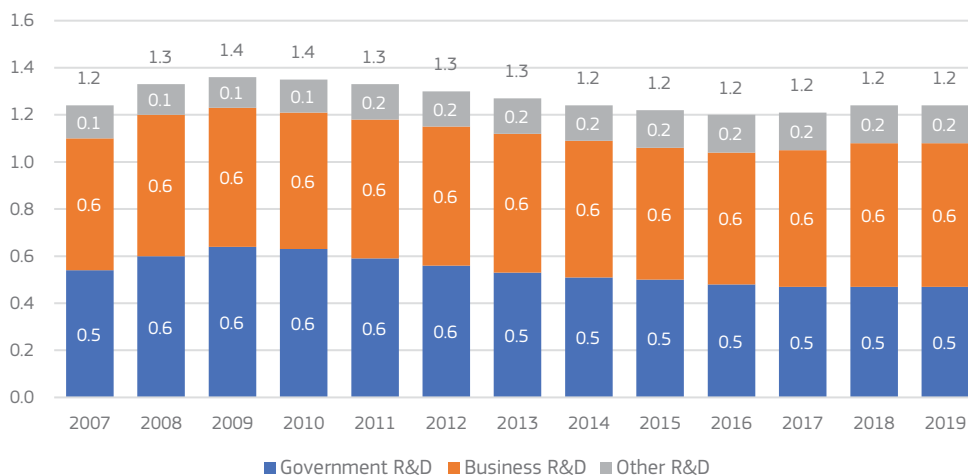
SPAIN

1 Overview of national R&I landscape

This section provides an overview of the Research and Innovation landscape in Spain, outlining key developments in R&I expenditure as well as introducing the main actors responsible for shaping R&I policy and providing R&I funding. Figure 1 tracks the levels of R&I expenditure in Spain as a percentage of GDP between 2007 and 2019. While levels of investment in research and development had been increasing faster than the EU average in the years between 2000 and 2008, the financial crisis, economic recession and fiscal constraints led to a drop in R&I expenditure both from the private as well as the public sector⁶²². In 2019, Gross Domestic Expenditure on R&I in Spain amounted to EUR 15.6 million⁶²³, or 1.2% of GDP.

Spain does not have a single food R&I policy, but food and agriculture innovation is present in most strategies in this field.

Figure 1: National R&I expenditure, as percentage of GDP



Source: Eurostat (2021), GERD by sector of performance (rd_e_gerdtot)

⁶²² <https://rio.jrc.ec.europa.eu/sites/default/files/report/spain.pdf>

⁶²³ OECD.Stat, Gross domestic expenditure on R&D by sector of performance and type of R&D, available at: https://stats.oecd.org/Index.aspx?DataSetCode=GERD_TORD#

Mirroring the development of overall R&I expenditure, R&I in the agri-food sector⁶²⁴ decreased as a result of the financial crisis, showing a cumulative fall of 10% from 2008 to 2016. In 2016, R&I in the agri-food sector accounted for 4% of total national R&I expenditure.⁶²⁵ However, recent years saw levels of R&I recover, with corporate investments in R&I in the agri-food sector in Spain amounting to EUR 354 million in 2018 (latest year for which data is available), up 12% from the year before. Looking at the period of 2013 to 2018, corporate investments in R&I grew by 48.1%, double the rate of the EU-27 average (24%). Nevertheless, Spanish R&I investment efforts (R&I investments as a percentage of GVA) was below the EU-27 average (with 0.6% in Spain as compared to 0.8% across the EU-27).⁶²⁶

Main Providers of Food R&I funding at national level

At the national level, the **Spanish Ministry for Science and Innovation** (Ministerio de Ciencia e Innovación, MCIN) is responsible for the execution of the Government's policy regarding scientific and technical research, technological development and innovation in all sectors. The MCIN distributes its funding to foster R&I through several dependent public bodies. These are:

- The **Centre for industrial technological development (Centro para el Desarrollo Tecnológico Industrial, CDTI)** promotes innovation and technological development in private companies through the provision and promotion of various financial instruments and aligned with the National Science and Technology Strategy.
- The **State Research Agency (Agencia Estatal de Investigación, AEI)** provides funding for R&I projects that align with the National Science and Technology Strategy to academic institutions, research centres etc. The AEI also takes on the role as a facilitator of knowledge transfer and supports projects to bring together research centres, academic institutions and the private sector.
- The **Spanish Foundation for Science and Technology (Fundación Española para la Ciencia y Tecnología, FECYT)** works to strengthen the link between science and society through actions that promote open and inclusive science,

⁶²⁴ The 'agri-food' sector here includes agriculture, livestock, the fisheries sector as well as the agri-food industry.

⁶²⁵ Cajamar Caja Rural, 2019. *Observatorio sobre el sector agroalimentario español en el contexto europeo. Informe 2018*. Available at: <https://www.cajamar.es/storage/documents/observatorio-sector-agro-96da6.pdf>

⁶²⁶ Cajamar Caja Rural, 2021. *Observatorio sobre el sector agroalimentario español en el contexto europeo af 2020*. Available at: <https://www.publicacionescajamar.es/publicacionescajamar/public/pdf/series-tematicas/informes-coyuntura-monografias/informe-observatorio-sector-agroalimentario-informe-2020.pdf>

scientific culture and education, responding to the needs and challenges of the Spanish Science, Technology and Innovation System. The FECYT reports annually on the state of Spanish R&I systems, presenting relevant indicators on levels of investment of financial and human resources.⁶²⁷

Other relevant actors

Public Research Bodies (*Organismos Públicos de Investigación, OPI*) carry out scientific and technical research and are also charged with the transfer of knowledge to other sector and training R&I personnel. They are autonomous and assigned to the General Research Secretariat of the MCIN⁶²⁸. There are eight OPIs.

- One of these, the National Institute for Agricultural and Food Research and Technology (Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, INIA), is specifically focused on food systems. INIA is responsible both for the management and coordination of food and agriculture research at the national level as well as for the execution of research projects. In April 2021, the INIA, alongside the Spanish Institute for Oceanography and the Geological Survey of Spain (mentioned below) have been incorporated into the Spanish National Research Council.
- Several other OPIs, namely the Geological and Mining Institute of Spain (Instituto Geológico y Minero de España, IGME), the Spanish Institute for Oceanography (Instituto Español de Oceanografía, IEO), the Research Centre for Energy, Environment and Technology (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, CIEMAT) and the Carlos III Health Institute (Instituto de Salud Carlos III, ISCIII) can also be considered to provide some thematic overlap with food systems research.
- The Spanish National Research Council (Consejo Superior de Investigaciones Científicas, CSIC) is Spain's largest public research institution, comprising a network of 120 research institutions. These conduct basic and applied research across a wide range of thematic fields, covering the areas of Life, Society and Materials. A number of these specifically focus on food science and technology (8) and on agricultural sciences (26).⁶²⁹

⁶²⁷ Fundación Española para la Ciencia y Tecnología, F.S.P. (FECYT), *Indicadores del Sistema Español de Ciencia, Tecnología e Innovación*, available at: <https://icono.fecyt.es/informes-y-publicaciones/indicadores-del-sistema-espanol-de-ciencia-tecnologia-e-innovacion>

⁶²⁸ With one exception being the National Institute for Aerospace Technology (INTA) being assigned to the Ministry of Defence.

⁶²⁹ Most institutions focus on more than one field of research.

While most competencies regarding agriculture and fisheries fall within the remit of the autonomous regions (Comunidades autónomas), the **Ministry for Agriculture, Fisheries and Food** (Ministerio de Agricultura, Pesca y Alimentación, MAPA) also plays a role to support R&I in food systems, such as by promoting and strengthening the Agricultural Knowledge and Innovation Systems (AKIS) or by creating an interactive search tool (Idi-A portal⁶³⁰) to share the most relevant information on EU and national R&I funding calls, aimed at farmers, stockbreeders, foresters, industries and other actors in the agri-food and forestry chain. Furthermore, since 2012 (with the launch of EIP-AGRI) MAPA is responsible for the implementation of inter-regional R&I activities within the framework of EIP-AGRI through the National Rural Development Plan. Specifically, this includes the task of supporting the creation of operational working groups as well as supporting the implementation of innovative projects thereunder. In 2018, the Ministry created a specific Subdirectorate General for Innovation and Digitalisation to manage this. MAPA itself also provides co-funding to EIP-AGRI projects.

MAPA also collaborates with the Ministry of Science, informing national R&I policy by bringing in the needs and challenges faced in the agricultural sector gathered through different activities (e.g. events, studies, the future CAP strategic plans). In addition, MAPA acts as focal point for the regional authorities for agriculture and fisheries (or the respective equivalent), fostering a cooperative ecosystem at the administrative level as well as the operational level.

In addition, each autonomous region has regional institutions to provide funding for innovation projects in the private sector (regional versions of the CDTI at national level), regional research centres, and regional ministries with funding capacities of their own. As at the national level, the regional equivalent of the CDTI does not have any agri-food specific funding streams but rather supports projects across the board, in alignment with the priorities identified by the regional government. Regional agricultural ministries provide funding for multi-actor innovation projects in the agri-food sector (and any other sector that may fall within their remit). This funding however comes from the European Agricultural Fund for Rural Development (see below).

Technological Platforms (*Plataformas Tecnológicas y de Innovación*) also play an important role in shaping the R&I landscape in Spain. These are sector-specific stakeholder networks, mirroring the European Technology Platforms (ETPs) at the national level. The Technological Platforms facilitate collaboration and knowledge sharing between its members (which includes companies, research centres, universities and technology centres) and supports them in developing projects and getting funding for them. In Spain, there are

⁶³⁰ See www.idi-a.es

several technological platforms related to food systems R&I, most importantly the 'Food for Life Spain' Technological Platform, bringing together stakeholders in the agri-food sector, the 'Spanish Technological Platform for Fisheries and Aquaculture' and the BIOVEGEN Technological Platform, focusing on plant biotechnology. Technological Platforms also exist at the regional level, such as the Galician Aquaculture Technology Platform.

2 National R&I Strategy

The **National Science and Technology Strategy 2007-2015** (*Estrategia Nacional de Ciencia y Tecnología, ENCYT*⁶³¹) covered the main principles and general objectives governing both the national and regional science and technology policies, outlining how R&I would promote economic growth, social wellbeing and sustainable development. The **National Scientific Research, Development and Technological Innovation Plan 2008-2011** (*Plan Nacional de Investigación Científica, Desarrollo e Investigación Tecnológica*⁶³²) is the programming instrument to implement the Strategy. It is structured around four areas: Knowledge and Skills Development Promoting Cooperation in R&D; Sectoral Development and Technological Innovation; and Strategic Actions. While general in nature, the Plan highlights 10 key sectors in which to boost development and technological innovation, including Food, Agriculture and Fisheries and the Environment and Eco-innovation.

A new **Spanish Strategy for Science and Technology and Innovation 2013-2020**⁶³³ was launched in 2012. It pursues four general objectives, one of which is the promotion of R&I activities aimed at addressing global societal challenges, in particular those affecting Spanish society. This objective is further divided up into 8 great societal challenges, of which one is 'Food Safety and Quality, Productive and Sustainable Agriculture, Sustainability of Natural resources, Marine, Maritime and Inland Waterway Research'. It outlines the need for a technological transition to promote a sustainable economy and promote R&I to enable sustainable primary production of food that is healthier, safer and of better quality, and also mentions areas of personalised nutrition (*nutrition and nutritional genomics*) and waste management. The strategy highlights the over-arching and cross-cutting nature of this (and other) challenges and the importance of policy synergies.

The **National Plan for Research and Development** defines the funding instruments and other implementation measures to put the Strategy for Science and Technology and

⁶³¹ Available at: <https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Encyt.pdf>

⁶³² Available at: https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Politiclas_I+D+i_PlanNacional/PLAN_NACIONAL_2008-2011_ingles.pdf

⁶³³ Available at: https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Spanish_Strategy_Science_Technology.pdf

Innovation into action. It sets out State Programmes corresponding to the Strategy's objectives. The 2013-2020 Strategy was covered by two National Plans:

- The National Plan for Research and Development 2013-2016⁶³⁴ set out four programmes, corresponding to each of the objectives of the National R&I strategy 2013-2020. The national programme for research aimed at the challenges of society 2013 has seven subprogrammes, of which one is 'food safety and quality; productive and sustainable farming activity; sustainability of natural resources, marine and maritime research', which are translated into the following R&I-related priorities:
 - Comprehensive, efficient and sustainable preservation and management of the agro-ecological systems and of the agro-forestry, water and fishing resources
 - Sustainable improvements of the agricultural, livestock and forestry production systems
 - Improvement and development of new systems, processes and technologies for agri-industrial production and control, bioproducts and biorefineries
 - Increase the quality and safety of the foods and new food products
 - Articulation and optimisation of the agri-food chain
 - Safety, traceability, alert and risk management
 - Improving competitiveness and sustainability in the fishery and aquaculture sector
 - Marine research
- The National Plan for Research and Development 2017-2020⁶³⁵ builds on the 2013-2016 plan, it's objectives seeking to continue and strengthen the 2013-2016 plan's work, including a focus on addressing social challenges of which "Bioeconomy: Sustainability of Primary Production and Forestry Systems, Food Safety and Quality, Marine and Maritime Research and Bioproducts" is specifically named.

⁶³⁴ Available at: https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Spanish_RDTI_Plan_2013-2016.pdf

⁶³⁵ Available at: <https://www.ciencia.gob.es/stfls/MICINN/Prensa/FICHEROS/2018/PlanEstatallDI.pdf>

In 2020, the current **Spanish Science, Technology and Innovation 2021-2027 Strategy** (*ECTI 2021-2027*⁶³⁶) was published. The Strategy expressively links and aligns to the United Nations Agenda 2030, the Paris Agreement and European strategic priorities, namely the European Green Deal and picks up the six clusters in Pillar II of Horizon 2020 (including *Food, Bioeconomy, Natural Resources and Environment: from biodiversity to food use of land and sea*), identifying these as areas in which it will be key to address challenges in strategic national sectors.

3 Overview of national food policy

The following section introduces the key national policies in Spain that relate to different aspects of the food system, mapped against the Food 2030 priorities.

Nutrition for sustainable and healthy diets

The Spanish Agency for Food Safety and Nutrition (*Agencia Española de Seguridad Alimentaria y Nutrición, AESAN*) plays an important role. AESAN is an autonomous body attached to the Ministry of Consumer Affairs and connected to the Ministry of Health and the Ministry of Agriculture, Fisheries and Food. Its objectives are to promote food safety and to promote information and education in the field of nutrition, in particular regarding the prevention of obesity.

The **National Strategy for Nutrition, Physical Activity and Prevention of Obesity** (*Estrategia para la Nutrición, Actividad Física y Prevención de la Obesidad, Estrategia NAOS*⁶³⁷), launched in 2005, picks up these issues and sets out to improve health and prevent obesity through promotional and educational actions to help people make good choices regarding their nutrition as well as engage in more physical activity. Building on this, the **collaboration plan for the improvement of the composition of food and drink and other measures 2020** (*Plan de colaboración para la mejora de la composición de los alimentos y bebidas y otras medidas 2020*⁶³⁸) by the Ministry of Health (through AESAN) calls for various sectors to work together to ensure that citizens achieve a more balanced and nutritional consumption of food and drink, calling for a reduction in added sugars, salt and saturated fats. To this end, amongst others, the plan includes a specific objective to support and encourage research and development of products that form such a diet.

⁶³⁶ Available at: https://www.ciencia.gob.es/stfls/MICINN/Ciencia/Ficheros/ECTI_2021-2027_EN.pdf

⁶³⁷ Available at: https://www.aesan.gob.es/AECOSAN/web/nutricion/seccion/estrategia_naos.htm

⁶³⁸ Available at: https://www.aesan.gob.es/AECOSAN/docs/documentos/nutricion/DOSSIER_PLAN_2020.pdf

Climate smart and environmentally sustainable food systems

Spain also recognized the importance of transitioning towards sustainable food systems throughout the food chain. Given the importance of agriculture to the Spanish economy, promoting climate smart and resilient food production is a key priority. The **Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas** (*Estrategia de Digitalización del Sector Agroalimentario y Forestal y del Medio Rural*⁶³⁹) sets out to foster an economically, socially and environmentally sustainable agri-food sector by promoting its digital transformation. Several specific measures listed in the strategy centre around fostering research and innovation and promoting knowledge exchange.

The **Spanish Bioeconomy Strategy** (*Estrategia española de Bioeconomía*⁶⁴⁰) is 'assigning a fundamental role to the food and agriculture and forestry sector' in achieving its aim to build a strong bioeconomy. The role of agriculture and food production in its economy and therefore the potential for research in this area to act as a driving force are highlighted. Several of its targets reflect this, such as the fostering of interaction between public, private and international science and technology systems to stimulate the creation of multidisciplinary teams able to develop technologies that diversify and enhance the efficiency of the use of resources of biological origin, as well as the target to promote rural economic development and the diversification of productive activities to enhance the economic, social and environmental sustainability of traditional activities and the generation of new activities based on the transformation of biological resources generated in that context.

Circularity and Resource efficiency of food systems

The **Circular Economy Spanish Strategy** (*ESPAÑA CIRCULAR 2030*⁶⁴¹) looks to contribute to the country's efforts to become a sustainable, decarbonized economy that uses resources efficiently. It takes an intersectoral approach and highlights the food sector as one of particular importance. R&I is recognized as a key component towards achieving this transition, and the strategy calls for the promotion of both public and corporate research and innovation initiatives, especially under public-private partnerships.

⁶³⁹ Available at: https://www.mapa.gob.es/images/en/digitisationstrategy_tcm38-513192.pdf

⁶⁴⁰ Available at: <https://bioeconomia.chil.me/download-doc/102159>

⁶⁴¹ Available at: https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/espanacircular_2030_executivesummary_en_tcm30-510578.pdf

The **Spanish Urban Agenda**⁶⁴² was launched in 2019, aligned to the United Nations Urban Agenda and the Urban Agenda for the European Union. Under its objective of ‘Sustainable resource management and circular economy’, the optimisation and reduction of water consumption, reduction of waste and promotion of recycling are specific sub-objectives.

Innovation and empowering communities

Rural development in Spain lies within the competencies of the autonomous regions. In accordance with the requirements of the European Agricultural Fund for Rural Development (EAFRD), each autonomous region develops rural development programmes, focused on the agri-food sector. As noted in an OECD report, the investment priorities of the rural development programmes in Spain have been “gradually shifting away from infrastructure towards climate change and innovation”.⁶⁴³ Stakeholders consulted highlighted the important role ascribed to the development and modernisation of the agri-food sector to rural development in particular. The sector is the key lever to enhance the economic potential of rural regions and therefore address the socio-economic challenge of de-population and of an increasingly aging population in those communities. In addition to the regional rural development programmes, the **Spanish National Rural Development Programme** (*Programa Nacional de Desarrollo Rural*, PNDR⁶⁴⁴) covers the respective inter-regional aspects thereof. The current PNDR covers the period 2014-2020 and aims to promote increased collaboration within the agri-food sector, foster investment in transforming, marketing and/or developing agricultural products and also supports actions to mitigate and adapt to climate change.

Additionally, several of the previously mentioned policies also comprise aspects that relate to the Food 2030 priority of innovation and empowering communities.

- The *Spanish Urban Agenda* sets out to transform urban systems to be more environmentally, economically, and socially sustainable. This includes urban food systems, with the Agenda calling for the promotion of local food production to shorten supply chains as well as bring people closer to the food they consume.
- The *Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas* not only pursues the objective of future-proofing food systems, but also highlights

⁶⁴² Available at: <https://apps.fomento.gob.es/CVP/handlers/pdfhandler.ashx?idpub=BAW061>

⁶⁴³ OECD (n.d.), *Regional Outlook 2019: Spain*, available at: https://www.oecd.org/cfe/_Spain.pdf

⁶⁴⁴ Available at: <https://www.fega.es/es/programa-nacional-desarrollo-rural>

the importance of economic and social sustainability and promoting regional development of rural areas.

- The *Spanish national strategic plan for aquaculture 2014-2020* (Plan Estratégico Plurianual de la Acuicultura Española 2014-2020, PEAÉ⁶⁴⁵), while also including some mention of objectives related to the environmental sustainability of the sector, mainly focuses on enhancing the competitiveness of Spanish aquaculture, including through R&I, with a particular focus on SMEs.
- The *Spanish national strategy to face the demographic challenge* (Estrategia Nacional frente al Reto Demográfico⁶⁴⁶) focuses on challenges posed by depopulation, ageing and the effects of the floating population and includes support for innovation and digitalisation of the agri-food sectors as one pathway to address these.

4 Public funding available for food R&I

The following section presents data on public funding available for food-systems related R&I in Spain over the period of 2007 to 2020. No comprehensive dataset comprising food-systems related R&I projects covering this period was available to the study team, however. Instead, this section draws on several sources, namely statistical information on R&I in the agricultural sector provided by MAPA, funding information provided by CDTI (publicly available for the years 2012 – 2021) and data provided by INIA in 2018, including projects funded by INIA, CDTI⁶⁴⁷, AEI and the regional government of Andalusia between 2012 and 2018.

While overall public R&I funding data is not available in a disaggregated manner for the agri-food sector, it is for agriculture. Between 2008 and 2018, agriculture on average accounted for 7% of overall public R&I funding distributed.⁶⁴⁸

Both the AEI and the CDTI support a significant number of projects in the agri-food sector. However, neither has sector-specific funding instruments and there is no ring-fenced public funding for food systems R&I. The CDTI is considered by stakeholders to be the most

⁶⁴⁵ Available at: https://www.mapa.gob.es/es/pesca/temas/acuicultura/plan_estragico_6_julio_tcm30-77594.pdf

⁶⁴⁶ General guidelines of the Strategy available at https://www.miteco.gob.es/es/reto-demografico/temas/directricesgeneralesenfrd_tcm30-517765.pdf

⁶⁴⁷ To avoid any duplication, CDTI projects were removed from the dataset provided by INIA as part of the scar mapping, and the mapping done by the evaluation team of the publicly available CDTI data was used for the purpose of this report.

⁶⁴⁸ Fundación Española para la Ciencia y Tecnología, F.S.P. (FECYT), *Indicadores del Sistema Español de Ciencia, Tecnología e Innovación: Edición 2020*, Available at: https://icono.fecyt.es/sites/default/files/filepublicaciones/indicadores_2020_web.pdf

important national funding stream available for R&I (both generally, as well as specifically for the agri-food sector).

The CDTI used to not distribute funding through specific calls but instead follows a bottom-up approach, with private companies coming up and seeking funding for their projects. Since 2019 however, the CDTI introduced the CDTI Missions, which are, now requires funding applications to address these in their proposed projects. Since 2019, the CDTI also combined their bottom-up funding approach with a more targeted one by launching mission-oriented funding calls. The CDTI missions funding instrument supports public-private research projects carried out by business groups with the participation of research centres. The missions are defined to address the main strategic challenges facing Spain, and in 2021 included inter alia making agriculture sustainable, intelligent, efficient in the consumption of water resources and agricultural inputs and adapted to climate change and the promotion of the circular economy.⁶⁴⁹ The majority of CDTI funding (ca. 80-90%) is distributed through a bottom-up approach.⁶⁵⁰

In the period 2012-2020 (for which data was made available), a total of 2,900 projects in the agri-food sector were supported by CDTI, with a total funding amount of EUR 1,188,082,613. Of this, EUR 489,865,093.2 was national funding, while EUR 698,217,519.8 derived from EU Co-funding (ERDF, EMFF, and EEA grants). CDTI funding only contributes a maximum of 85% to total project values, with the remainder mostly financed by the private companies themselves.

Similarly, the AEI does not have any funds ring-fenced for food-systems research either, but as it is an instrument through which the MCIN aims to implement the National Plan for Research and Development (outlined above), projects funded are aligned to the social challenges outlined in the Plan, of which several are food-systems specific. Project data available shows that between 2012 and 2017, a total of EUR 238,677,674 of AEI funding has been given to food-systems-related projects.⁶⁵¹

The National Institute for Agricultural and Food Research and Technology (Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, INIA) was an autonomous Public Research Organisation exclusively focusing on the agri-food and forestry sector. INIA was divided into several regional institutions. INIA held centralized funding competencies to support R&I specifically in the agri-food and forestry sectors. However, in 2017, these

⁶⁴⁹ Articaí (2021), *Call for applications 2021 of the CDTI Missions Programme is already available*, available at: <https://www.articai.es/call-for-applications-2021-of-the-cdti-missions-programme-is-already-available/?lang=en>

⁶⁵⁰ Qualitative interview

⁶⁵¹ SCAR quantitative mapping

competencies were transferred to the AEI. Project data available shows that between 2012 and 2017, INIA granted a total of 55,634,509 EUR to food-systems-related projects.⁶⁵²

Public funding for R&I is also available at the regional level through the regional research centres as well as through regional governments. Project data available shows that from 2012 to 2017, the Regional Government of Andalusia for example provided 6,924,579 EUR of public funding for food-systems-related R&I projects.⁶⁵³ These are mostly funded through the European Regional Development Funds, as well as partially through the regional state budgets.

5 Main recipients of public food R&I investment

With CDTI the most important funding source for food-systems R&I, the private sector is the main recipient of public food R&I funding. Nearly 80% of the food-systems-related public funding from 2012 to 2017 in Spain went to the private sector.⁶⁵⁴

Whereas in the past, companies would apply for funding from CDTI alone, recent years have seen a trend towards a more collaborative approach. This includes collaboration both within sectors themselves, but also collaboration across the food value chain as well as with research centres, technology centres, universities etc.

Stakeholders consulted identified several drivers causing this. On the one hand, the Spanish economy is made up of mostly small and medium-sized enterprises and does not boast any national champions in the agri-food sector. This means companies are required to collaborate to pool resources and to outsource technological know-how. Secondly, intersectoral collaboration has recently seen a rise to align with R&I investment trends around digitalisation, functional foods and the circular economy (amongst others), all areas which affect several sectors. Specifically, an increased collaboration between companies in the agri-food sector and biotechnology, ICT and robotics companies were highlighted. Finally, this increase in collaboration is further encouraged by the funding landscape in Spain, with the CDTI making a cooperative approach mandatory in several of its new funding calls and promoting technology transfer, private-public cooperation and multisector and multi-actor approaches through its latest financing instruments.⁶⁵⁵

⁶⁵² SCAR quantitative mapping

⁶⁵³ SCAR quantitative mapping

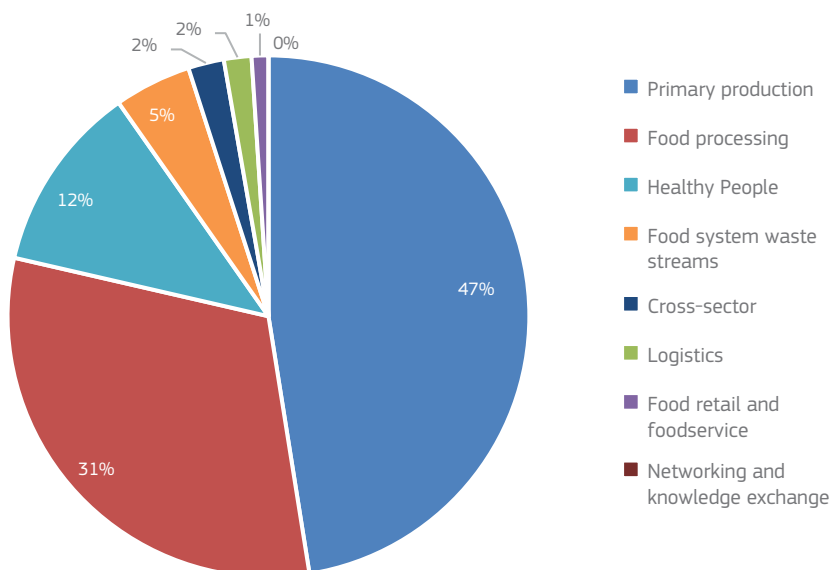
⁶⁵⁴ SCAR 2018 mapping

⁶⁵⁵ Qualitative interviews

Funding by sector

Looking at the distribution of public food-systems-related project funding awarded between 2012 and 2020 in Spain along the food systems value chain, the majority of this funding went to projects in the primary production sector, reflecting the importance of this sector in Spain's agri-food landscape. This includes projects related to make agriculture more sustainable and climate resilient, but also includes a significant number (over 400) of projects related to the livestock sector: Almost a third (31%) of projects funded were in the food processing sector, most of which were projects funded by CDTI and therefore carried out by the private sector. 12% of projects were related to research and innovation to make food healthier. 2% of projects were related to research and innovation to make food healthier.

Figure 2: Food-systems-related project funding in Spain 2012-2020, by sector



Source: Analysis of CDTI funding data (2012-2020), and INIA, AEI and Government of Andalusia funding data (2012-2016) collected for the SCAR quantitative mapping in 2018

6 Structural Funds available for Food R&I

European Structural and Investment Funds (ESIF) play an important role in food systems R&I in Spain, particularly in the primary sector. EU funding for regional development under the second pillar of the Common Agricultural Policy (CAP) is provided through the European Agricultural Fund for Rural Development (EAFRD) and distributed within the framework of EIP-AGRI which, as previously mentioned, is implemented through the National Rural Development Program and the regional Rural Development Programs. Funding from the CAP provides approximately 80% of the costs of measures falling under the EIP-AGRI, co-financed by national and regional public funding.⁶⁵⁶ During the period 2014-2020, 8.4 million EUR of national public funding was awarded to co-finance the creation of 177 inter-regional operational groups, and 45.34 million EUR to 68 innovation projects by inter-regional operational groups. A third funding call from 2020 is still in the resolution phase, and data not yet available. In total 58.5 million euros of national public funding will have been allocated to the creation of inter-regional operational groups and their projects.⁶⁵⁷ This has further been supplemented by ca. 66 million EUR in funding from the autonomous communities.⁶⁵⁸ Additionally, a small number of autonomous communities have provided R&I funding through their own rural development programs outside of EIP-AGRI.

Spain was the main recipient of the European Maritime and Fisheries Fund (EMFF) 2014-2020 with 1,161,620,889 EUR allocated to the country, accounting for 20% of the total funding available.⁶⁵⁹ This funding is matched by 396,659,864 EUR in national funding.⁶⁶⁰ EMFF funding was providing co-financing to CDTI-supported innovation projects in the aquaculture and fisheries sectors (as well as investment projects in aquaculture and in activities for the transformation of fishery and aquaculture products). This includes innovation projects in the fishing and aquaculture sector generally, but also specifically innovation project related to the conservation of marine biological resources. According to the Operational Programme (OP), 24% of the overall EMFF funding (EUR 274.4 million) were dedicated towards investing in developing new products, processes, conservation techniques, management systems and commercial strategies for fisheries and aquaculture products and 18% (EUR 205.9 million) went to achieving the objectives of the Spanish

⁶⁵⁶ Qual interview

⁶⁵⁷ Ministry of Agriculture, Fisheries and Food of Spain, *The AEI or EIP of productive and sustainable agriculture in Spain*. Available at <https://www.mapa.gob.es/es/desarrollo-rural/temas/innovacion-medio-rural/EIP-agricultura-productiva-sostenible/default.aspx>

⁶⁵⁸ Qualitative interview

⁶⁵⁹ Seafood Source (2014), *Spain leading recipient of EMFF funds*, available at: <https://www.seafoodsource.com/news/supply-trade/spain-leading-recipient-of-emff-funds>

⁶⁶⁰ European Commission (2016), *European Maritime and Fisheries Fund (EMFF) – Spain*, available at: https://ec.europa.eu/oceans-and-fisheries/system/files/2016-09/op-spain-fact-sheet_en.pdf

national strategic plan for aquaculture (*Plan Estratégico Plurianual de la Acuicultura Española, PEAE*⁶⁶¹) that aimed at boosting the competitiveness and sustainability of the Spanish aquaculture sector.⁶⁶²

7 Links to FOOD2030 priorities and pathways

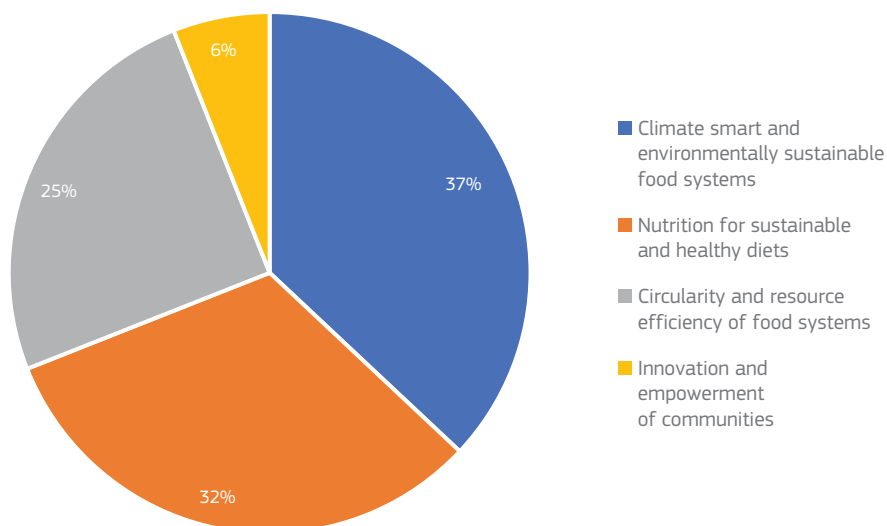
As described above the various food-systems related R&I policies and strategies in Spain, and in particular the societal challenges identified in the national R&I strategy show a clear link to the Food 2030 priorities. The following section further analyses the available funding data against the Food 2030 priorities and pathways.

Looking at the detailed project data available, spanning the years 2012-2020, Figure 3 below shows that the priority of fostering climate smart and environmentally sustainably food systems has featured most. This priority accounts for 37% of overall funding over this period (EUR 261,126,492.9). This likely relates to the fact that the most food-systems-related R&I projects target the primary sector, where sustainability of agricultural practices are a key topic. Nutrition-related R&I projects, seeking to ensure a sustainable and healthy diet, are the next most funded group in the selection of projects analysed, accounting for 32% of overall funding provided (EUR 229,506,040). R&I projects related to circularity account for 25% of overall funding (EUR 176,487,924.1). Projects related to empowering communities (6% overall, EUR 41,483,474.4) received comparatively little attention. This split is (with the exception of 2012, where a number of comparatively large projects funded by AEI distort the ratio) observed over the years 2012-2020.

⁶⁶¹ Ministry of Agriculture, Fisheries and Food of Spain, *Plan Estratégico Plurianual de la Acuicultura Española*. Available at: <https://www.mapa.gob.es/es/pesca/temas/acuicultura/plan-estrategico/default.aspx>

⁶⁶² European Commission, *EMFF operational programmes 2014 – 2020*, available at: https://ec.europa.eu/oceans-and-fisheries/funding/emff-operational-programmes-2014-2020_en

Figure 3: Food-systems-related project funding, 2012-2020, by Food2030 priority

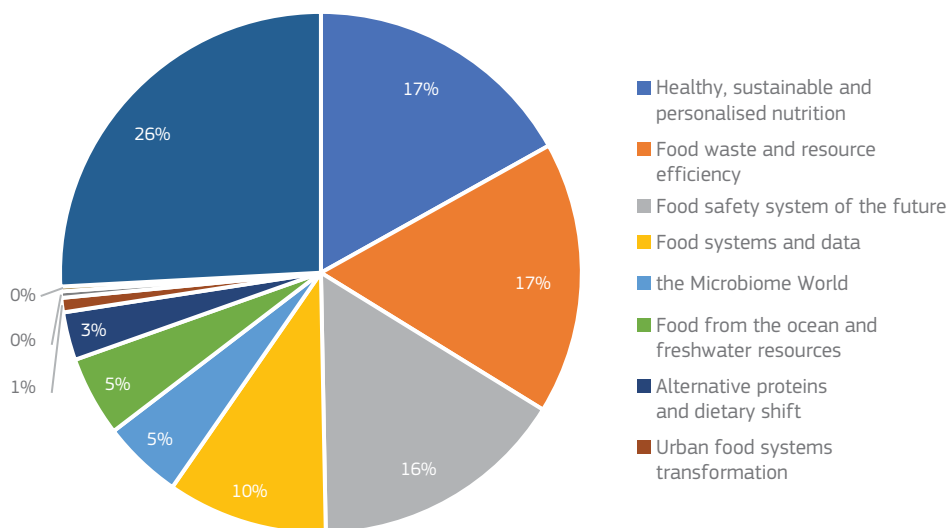


Source: Analysis of CDTI funding data (2012-2020), and INIA, AEI and Government of Andalusia funding data (2012-2016) collected for the SCAR quantitative mapping in 2018

This division has seemingly remained fairly constant in more recent years as well, as is reflected in the 2019 CDTI Science and Innovation funding call, which includes the formation of a large, sustainable and health-oriented agri-food industry as one of five major challenges to address, and the 2021 CDTI Science and Innovation funding call, which identifies “To promote Spanish agriculture in the 21st century: sustainable, intelligent, efficient in the consumption of water resources and agricultural inputs, and adapted to climate change” as one of its nine missions.

These two funding calls in particular also show the recognition and understanding of the interconnected nature of food systems, being thus open to a wide variety of projects. Analysis of the food-systems-related R&I projects funded in Spain between 2012 and 2020 demonstrates that 74% of projects correspond to a Food 2030 pathway, with a comparatively even split amongst a number of pathways. 26% of project funding was given to projects that do not directly map onto a Food 2030 pathway. While these projects relate to a variety of topics, common themes are the development of new products or processes to improve competitiveness and sustainable and resilient agricultural practices.

Figure 4: Food-systems-related project funding, 2012-2020, by Food2030 pathway



Source: Analysis of CDTI funding data (2012-2020), and INIA, AEI and Government of Andalusia funding data (2012-2016) collected for the SCAR quantitative mapping in 2018

17% of project funding (to a total of 117,792,810.1 EUR) went to projects related to Food waste and resource efficiency. Of these, the majority are projects related to improved packaging solutions, both in terms of reducing plastic and developing novel, biodegradable packaging, but also in terms of improving the quality of packaging to reduce spoilage and food loss.

121,512,243.7 EUR (17%) of public funding between 2012 and 2020 was allocated to R&I projects related to healthy, sustainable and personalised nutrition. Funding for projects in this field has increased over the years. This reflects a growing trend mentioned by stakeholders as well, with increased investment in R&I in functional foods and personalised nutrition noted. Project funding for R&I related to alternative proteins (such as meat substitutes) and the microbiome world also showed a slight upwards trend over time, corroborated with stakeholder feedback.

8 Data gaps and limitations

As briefly mentioned above, several data gaps and limitations restricted a comprehensive analysis of national R&I funding over the period of 2007 and 2020. Listed below are the data sources the above analysis draws on, as well as the associated gaps and limitations.

- **Publicly available statistics and reports published by the Spanish national government or other governmental entities.** However, data from these sources is only presented at the aggregate level, and when sectoral breakdowns are provided, given the intersectoral nature of food systems these do not clearly allow conclusions to be drawn as to how much R&I funding was awarded to food-systems related projects.
- **Funding data of the CDTI.** This data shows levels of CDTI funding over the period of 2012 to 2020, split into thematic categories as used internally within the CDTI. However, these categories, while partially mapping onto some of the Food 2030 priorities and pathways, were rather broad and no granular project data was shared that would have allowed to conduct a more in-depth analysis of the total volumes funded. Project-level data is publicly available from 2012 onwards, but does not include project descriptions or keywords. This made mapping difficult, and a number of projects had to be excluded from the mapping (i.e. considered not relevant) due to insufficient information. Furthermore, no data prior to 2012 is available.
- **Project-level data of food-systems related R&I funded in Spain between 2012 and 2016, compiled for the SCAR 2018 mapping exercise.** This dataset was compiled by the Spanish SCAR representative, sitting within INIA. It comprises funding data from INIA, CDTI, AEI and the regional government of Andalusia. Attempts to obtain further data from 2017 onwards from the AEI or pre-2012 from INIA were unsuccessful, however.
- **Qualitative interviews carried out with representatives from CDTI, MAPA and the Technology Platform “Food for Life Spain”.** These interviews served to provide an in-depth overview of the national landscape regarding food-systems related R&I and to seek support in filling any gaps in the available data.

Summary of data sources: Spain

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	The Spanish Ministry for Science and Innovation is responsible for the execution of the Government's policy regarding scientific and technical research, technological development and innovation in all sectors.	https://www.ciencia.gob.es/site-web/?jsessionid=57B11301A4C7AE7E1EA5EE710A5D9A59
	The State Research Agency (AEI) and the Centre for Industrial Technological Development (CDTI) fund R&I projects in all sectors. The Ministry for Agriculture, Fisheries and Nutrition (MAPA) also plays a funding role, with budget mainly coming from European funds.	http://www.aei.gob.es/ https://www.cdti.es/ https://www.mapa.gob.es/es/ministerio/default.aspx
	The Spanish National Research Council comprises 120 research institutions which conduct basic and applied research, including in areas relevant to food systems.	https://www.csic.es/es
	Several public research bodies, most notably the National Institute for Agricultural and Food Research and Technology (INIA), also focus on food systems R&I.	http://www.inia.es/IniaPortal/verPresentacion.action
Food innovation related policies	National Strategy for Nutrition, Physical Activity and Prevention of Obesity	https://www.aesan.gob.es/AECOSAN/web/nutricion/seccion/estrategia_naos.html
	Collaboration plan for the improvement of the composition of food and drink composition and other measures 2020	https://www.aesan.gob.es/AECOSAN/docs/documentos/nutricion/DOSSIER_PLAN_2020.pdf
	Digitisation Strategy for the Agri-Food and Forestry Sector and Rural Areas	https://www.mapa.gob.es/images/en/digitisationstrategy_tcm38-513192.pdf

	Spanish Bioeconomy Strategy	https://bioeconomia.chil.me/download-doc/102159
	Circular Economy Spanish Strategy	https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/espanacircular_2030_executivesummary_en_tcm30-510578.pdf
	Spanish Urban Agenda	https://apps.fomento.gob.es/CVP/handlers/pdfhandler.ashx?idpub=BAW061
	Spanish National Rural Development Programme	https://www.fega.es/es/programa-nacional-desarrollo-rural
	Spanish national strategic plan for aquaculture 2014-2020	https://www.mapa.gob.es/es/pesca/temas/acuicultura/plan_estrategico_6_julio_tcm30-77594.pdf
National R&I Strategies	National Science and Technology Strategy 2007-2015	https://www.ciencia.gob.es/stfls/MICINN/investigacion/FICHEROS/Encyt.pdf
	Spanish Strategy for Science and Technology and Innovation 2013-2020	https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Spanish_Strategy_Science_Technology.pdf
	Spanish Science, Technology and Innovation 2021-2027 Strategy	https://www.ciencia.gob.es/stfls/MICINN/Ciencia/Ficheros/EECTI_2021-2027_EN.pdf
	National Scientific Research, Development and Technological Innovation Plan 2008-2011	https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Políticas_I+D+i_PlanNacional/PLAN_NACIONAL_2008-2011_ingles.pdf

	National Plan for Research and Development (multiple)	https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Spanish_RDTI_Plan_2013-2016.pdf https://www.ciencia.gob.es/stfls/MICINN/Prensa/FICHEROS/2018/PlanEstatalIDI.pdf
EU Structural funds on agri-food projects		
	Description	Link
Summary of amount spent from structural funds in agriculture and food projects	EUR 274.4 million of EMFF funding were dedicated towards investing in developing new products, processes, conservation techniques, management systems and commercial strategies for fisheries and aquaculture products and EUR 205.9 million went to achieving the objectives of the Spanish national strategic plan for aquaculture that aimed at boosting the competitiveness and sustainability of the Spanish aquaculture sector.	https://ec.europa.eu/oceans-and-fisheries/funding/emff-operational-programmes-2014-2020_en
	During the period 2014-2020, EUR 58.5 million euros of national public funding and ca. EUR 66 million from the autonomous communities has been made available for co-funding of EIP-AGRI supported projects, with EU funding through CAP amounting to approximately EUR 500 million.	Information from qualitative interviews
Food innovation funding		
	Name and description	Link

Specific food innovation related R&I competitions/funding	CDTI Missions Programme (Misiones Ciencia e Innovacion) 2021, with a budget of 141 million EUR. 9 missions have been identified, of which one is “To promote Spanish agriculture in the 21st century: sustainable, intelligent, efficient in the consumption of water resources and agricultural inputs, and adapted to climate change”.	https://www.articai.es/call-for-applications-2021-of-the-cdti-missions-programme-is-already-available/?lang=en
	CDTI Missions Programme (Misiones Ciencia e Innovacion) 2019, with a budget of 70 million EUR. Projects are to address (at least) one of five major challenges, of which one is to build “A large, sustainable and health-oriented agrifood industry”.	https://www.prointprojecten.com/news/2019/09/05/call-cdti-missions-large-research-projects

Available data (reports, datasets)

Source	Name and description	Link
From SCAR quantitative mapping (where available)	Assessment of R&I on Food Systems – SCAR working group	Not publicly available
From desk research	Library of reports from CSIC Research institutes	equals&filter_value_1=Memoria+anual&filter_field_2=itemtype&filter_type_2>equals&filter_value_2=trabajo+de+divulgaci%C3%B3n">https://digital.csic.es/simple-search?location=10261%2F2&query=memoria+anual&rpp=10&sort_by=bi_sort_1_sort&order=asc&filter_field_1=subject&filter_type_1>equals&filter_value_1=Memoria+anual&filter_field_2=itemtype&filter_type_2>equals&filter_value_2=trabajo+de+divulgaci%C3%B3n
From interviewees	CDTI funding data	Not publicly available

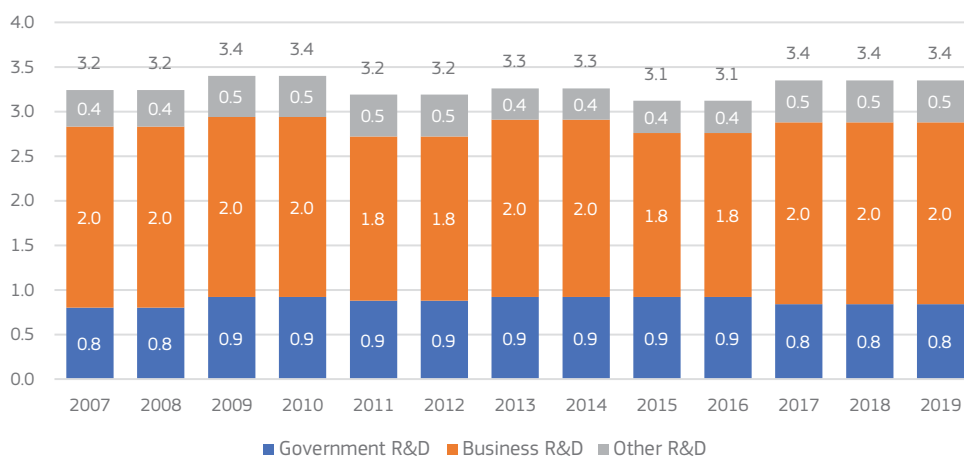
SWEDEN

1 Overview of national R&I landscape

Sweden aims to become one of the most important countries in the world in the areas of knowledge and innovation. Overall, the country invests more than 3.0% of its GDP in R&D (Figure 1), with businesses contributing the most to R&D expenditure, and the central government the least. In 2020, funds for research and development (R&D) in the central government budget were estimated at SEK 38.5 billion (approx. EUR 3.75 billion)⁶⁶³.

Sweden's Innovation Strategy includes food and agriculture among the main societal challenges to address, and the government initiated a National Research Programme on Food following the implementation of the National Food Policy.

Figure 1: R&I expenditure in Sweden, as a percentage of GDP



Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

⁶⁶³ <https://www.scb.se/en/finding-statistics/statistics-by-subject-area/education-and-research/research/government-budget-allocations-for-rd/pong/statistical-news/government-budget-allocations-for-rd-gbard-2020/>

Main Providers of Food R&I funding at national level

There are four main funding institutions for R&D in food systems in Sweden:

- The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas);
- The Swedish Governmental Agency for Innovation (Vinnova);
- The Swedish Research Council (VR);
- The Swedish Research Council for Health, Working Life and Welfare (Forte).

Additionally, non-public funders in the committee of the National Food Programme include the **Foundation for Environmental Strategic Research** (Mistra), **the Swedish Foundation for Strategic Research** (Strategiska), and **the Swedish Farmers' Foundation for Agricultural Research** (Stiftelsen Lantbruksforskning).

Other relevant actors

The main providers of Food R&I at the national level are Higher Education Institutions. Other actors worth mentioning in order to provide a more complete picture of the food systems landscape in Sweden include: the research institute of Sweden (RISE), which collaborates with industry, academia, and the public sector; the Om Agrifood Economics Centre which is a collaboration between the Swedish University of Agricultural Sciences (SLU) and the School of Economics at Lund University on the topics of agriculture, fisheries, food and rural areas; the Sweden Food Arena which gathers food supply chain stakeholders for cooperation; and an EU funded AKIS network^{664 665}.

2 National R&I Strategy

Note: In 2020 Sweden presented a new **Research and Innovation Bill**. This is outside of the scope of this study, as it establishes funding for the 2021-2024 period. Under this bill, VINNOVA (the government agency for innovation), several research facilities and institutes, and research programmes, will receive increased funding. The investment will enable new

⁶⁶⁴ Agricultural Knowledge and Information Systems

⁶⁶⁵ <http://foodsciencesweden.se/>

ten-year national research programmes, including in the areas of oceans and water, and reinforce the existing national **food research programme**⁶⁶⁶.

In 2020, Sweden adopted an **Innovation Strategy**⁶⁶⁷ in light of the societal challenges around health, bioeconomy, energy, transport, climate and security. The Strategy identifies the main challenges for the European bioeconomy as food security, sustainable agriculture, and marine and maritime research. According to the Ministry of Enterprise, the Strategy will help Sweden to face global societal challenges, increase its competitiveness, create more jobs in a global knowledge economy, and deliver public services with increased quality and efficiency. The government's commitment to a strong innovation climate translates into three areas:

Well-functioning framework conditions (e.g. markets, competition, research, infrastructure, contracts and procurement laws, intellectual property protection, and societal entrepreneurship and creativity);

- Innovation in public services;
- Direct measures targeting innovation processes (e.g. financing, advocacy, infrastructures, and formation of networks and clusters).
- The **Innovation Strategy** has three main goals:
- Fostering conditions for entrepreneurs and innovative people;
- Achieving international research quality standards and contributing to innovation;
- Promoting framework and infrastructure conditions that promote a strong innovation climate (e.g. markets, societal norms and regulations).

Sweden's **Innovation Strategy** calls for the establishment of "links between different industries and fields of knowledge" including food and traditional agriculture⁴⁷¹.

The **2016 Research Policy Bill 'Collaborating for knowledge – for society's challenges and strengthened competitiveness'** presented a 10-year perspective

⁶⁶⁶ <https://www.regeringen.se/pressmeddelanden/2020/12/kraftig-forstarkning-av-svensk-forskning/>

⁶⁶⁷ <https://www.government.se/contentassets/cbc9485d5a344672963225858118273b/the-swedish-innovation-strategy>

focusing on the 2017-2020 period. The bill presents research on climate, health and life sciences, and digitalisation, as priorities⁶⁶⁸.

Further measures have been implemented by the government in order to foster R&I in Swedish food systems. These include: the creation of a graduate school at the Swedish University of Agricultural Sciences and the provision of increased funds to Vinnova and the Swedish Agency for Economic and Regional Growth in order to foster incubation in the food chain and to establish a collaborative arena for food research (the Sweden Food Arena). The Sweden Food Arena was formed by stakeholders in the food sector, and is a network for research and innovation. The Arena's research agenda pledges an investment of SEK 150-200 million / EUR 14.5-19.5 million per year, and up to SEK 400 million/ EUR 38.9 million if public funders invest corresponding amounts. The stakeholder's mission includes fostering competitive food innovation, promoting better eating habits, establishing a resource-efficient food sector, and achieving climate neutral food production⁶⁶⁹.

3 Overview of national food policy

In 2017, Sweden adopted a **National Food Strategy** covering the entire food chain. The goal of the strategy is to foster competitive food production; increase growth, employment and sustainable development by promoting resource efficient production; foster research into new production methods, plant and crop varieties; as well as sustainable and healthy foods. The National Food Strategy defines three strategic areas:

- Terms and conditions;
- Consumer and market;
- Knowledge and Innovation.

The Strategy considers innovation and technology to have a role in safeguarding access to crops, adapting agriculture to the changing climate, as well as resource efficiency, and plant protection methods. The Strategy also mentions seafood, game and reindeer meat as potential areas of expansion, and calls for the development of innovative products and new sustainable models of production. In order to develop a system of knowledge and innovation, the National Food Strategy requests the engagement of the entire food supply

⁶⁶⁸ <https://www.government.se/press-releases/2016/11/collaborating-for-knowledge--for-societys-challenges-and-strengthened-competitiveness/>

⁶⁶⁹ https://swedenfoodarena.se/wp-content/uploads/Final_Sweden-Food-Arena_ENG_innovations-och-forskningsagenda_digital.pdf

system through the development of partnerships between academia, industry, business and other relevant stakeholders. According to the government's assessment, coordination between the knowledge and innovation system and the food supply chain must be enhanced, and stakeholders ought to articulate their needs within the knowledge and innovation system. Additionally, the strategy calls for needs-driven and applied research, as well as developments relating to skills and training. The National Food Strategy has been complemented by three **Action Plans so far**⁶⁷⁰.

Another relevant reference in the national food landscape of Sweden is the **Strategy for Sustainable Consumption (2016)**⁶⁷¹, whose goal is creating economically, socially, and environmentally sustainable consumption. In total, the strategy highlights seven focus areas:

- Increasing knowledge;
- Encouraging sustainable consumption;
- Streamlining resource use;
- Improving information on companies' sustainability efforts;
- Phasing out harmful chemicals;
- Increasing security for consumers;
- Food, transport and housing.

This Strategy focuses on what the state, municipalities, the business sector and civil society can do together in order to motivate consumers to be sustainable. In regards to the first focus area, knowledge, the Swedish government wants to establish a new forum under the responsibility of the Swedish Consumer Agency in order to bring together stakeholders who can contribute to eco-smart consumption and lifestyles (e.g. schools, researchers, business sector, county administrative boards, municipalities, and civil society). The forum aims to spread examples of good practices, and create solutions for more sustainable consumption.

⁶⁷⁰ <https://www.regeringen.se/regeringens-politik/en-livsmedelsstrategi-for-jobb-och-hallbar-tillvaxt-i-hela-landet/handlingsplan-for-livsmedelsstrategin/>

⁶⁷¹ <https://www.government.se/4a9932/globalassets/government/dokument/finansdepartementet/pdf/publikationer-infomtrl-rapporter/en-strategy-for-sustainable-consumption-tillganglighetsanpassadx.pdf>

National Research Programme on Food

In 2017, Formas initiated the government funded **National Research Programme on Food** (which also includes a research agenda) following the implementation of the National Food Strategy and action plan⁶⁷². The ten-year **Strategic Research Agenda “Towards a sustainable and competitive food system”** is based on five perspectives (system perspective; knowledge and skills development; governance and leadership; digitalisation and technology development; and gender equality and diversity), and four themes (sustainable production systems; tasty food for a healthy population and planet; the meal and the consumer; and innovative and safe food). Overall, the National Research Programme on Food focuses on interdisciplinary and collaborative research that contributes to a system perspective. In order to develop the research agenda, Formas consulted research funders from the national committee for food research and engaged in dialogues with academia and research institutes, the business sector, government authorities and other stakeholders.

The Strategic Research Agenda contributes to the prioritisation of the activities of the National Research Programme for Food and to the coordination of other research and innovation efforts within the food area.

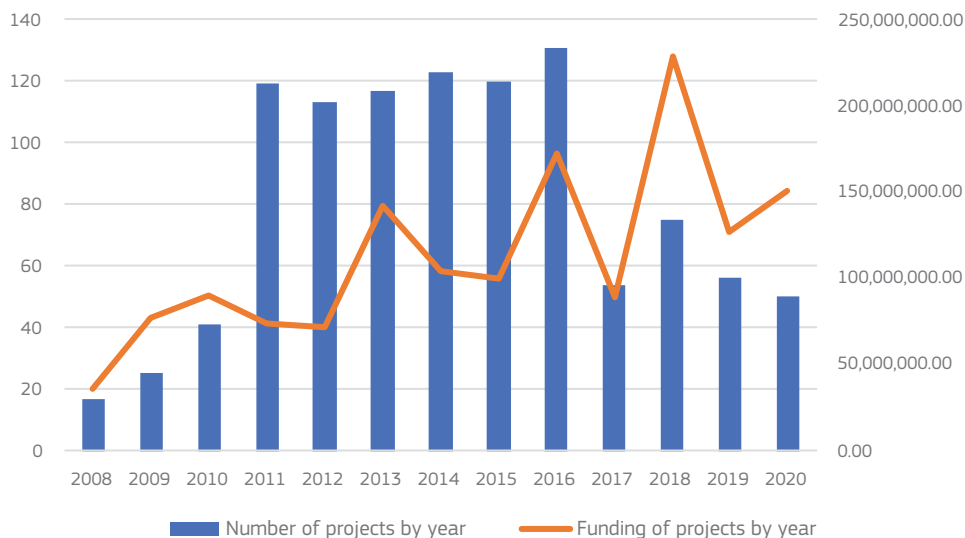
The National Research Programme on Food is implemented in parallel with other national research programmes under the 2016 Research and Innovation Bill, in order to encourage synergies. The other government sponsored research programmes focus on antibiotic resistance, workplace research, climate, migration and integration, sustainable spatial planning and applied welfare research.

4 Public funding available for food R&I

Internal review identified a total of 1,323 R&I food-related projects developed by Swedish organizations between 2008 and 2020, receiving a total of SEK 2.6 billion / EUR 264 million in funding (Figure 2). A review of the number of projects approved during this period shows that 2008 and 2009 were the years with less projects approved (18 and 25, respectively) and 2018 was the year with most projects approved (139). The year in which the least funding was used for food-related projects was 2008 (SEK 36.5 million / EUR 3.5 million). In 2020, the year registering the largest funding amount, public funding spent in food-related research and innovation is estimated at SEK 512 million / EUR 49.8 million).

⁶⁷² <https://formas.se/en/start-page/about-formas/what-we-do/national-research-programmes.html>

Figure 2: R&I food related projects between 2008 and 2020

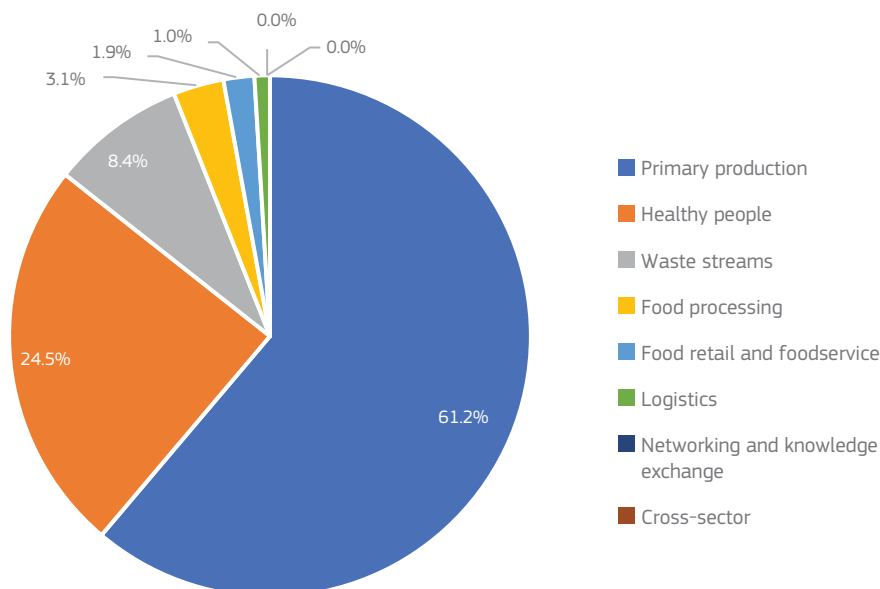


Source: SCAR mapping (2018), Swecris database and correspondence with funding agencies

Funding by sector

When analysing the sectors receiving funding for food-related R&I actions, the majority of public funding appears to be directed towards projects and/or actions related to primary production (61%), followed by healthy people (25%) (Figure 3).

Figure 3: Distribution of the funding by sector

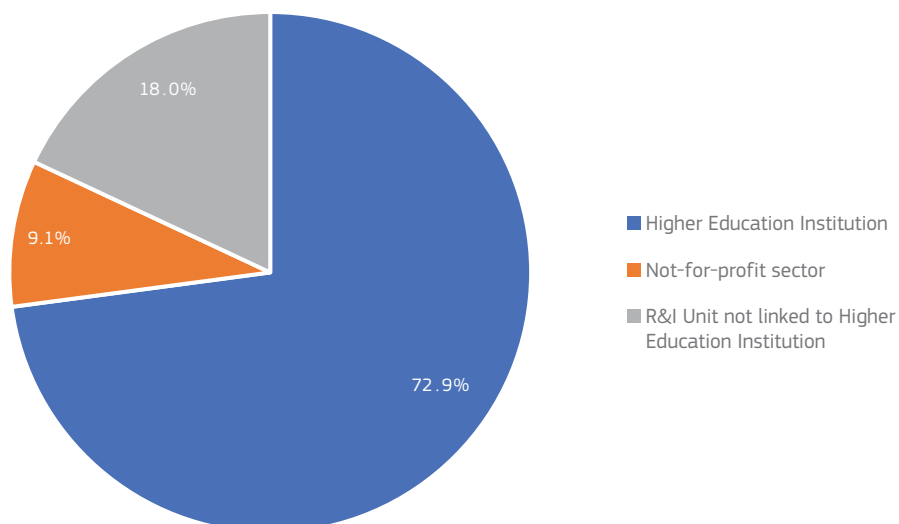


Source: SCAR mapping (2018), Swecris database and correspondence with funding agencies

5 Main recipients of public food R&I investment

A review of the data shows that Higher Education Institutions received the highest amount of food R&I funding (SEK 195 billion / EUR 191 million, corresponding to 81% of the total funding), followed by R&I Units not linked to Higher Education Institutions (SEK 344 million / EUR 33.7 million, or 14% of the total). According to the available data, Higher Education Institutions coordinated at least 557 projects between 2008 and 2020, whereas R&I Units not linked to higher education institutions coordinated at least 206. Organisations from the not-for-profit sector are estimated to have coordinated 25 projects, during the same period of time, and having received a total of SEK 104 million / EUR 10 million, which represents 4% of the total funding (Figure 4). However, it is important to note that only 788 project results out of 1,323 disclosed the coordinator or type of recipient per project.

Figure 4: Distribution of the funding by recipients



Source: SCAR mapping (2018), Swecris database and correspondence with funding agencies

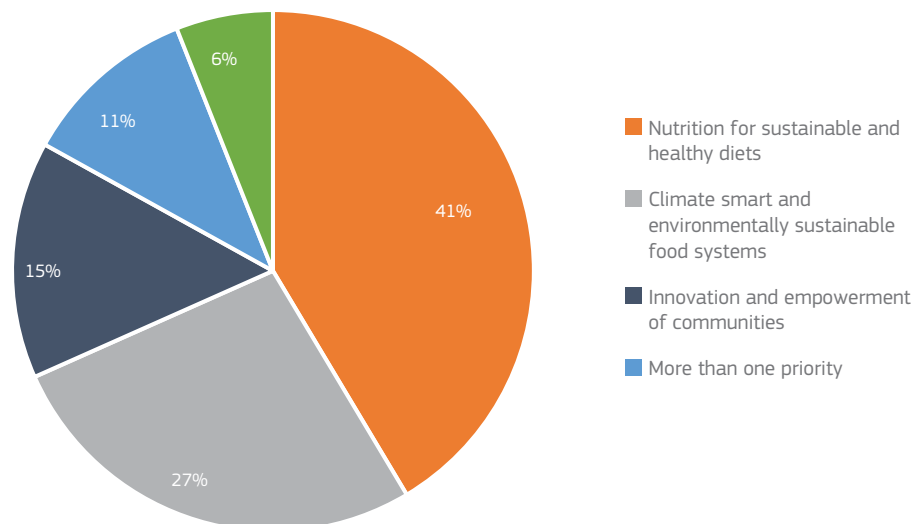
6 Structural Funds available for Food R&I

According to internal communication with the Swedish Agency for Economic and Regional Growth, Sweden has nine different regional ERDF-programs. The agency identified 64 relevant food projects, with a total funding of EUR 28.3 million.

7 Links to FOOD2030 priorities and pathways

According to an analysis of the funding data, publicly funded food-related R&I in Sweden has prioritised research in nutrition for sustainable and healthy diets (44% of the total, corresponding to EUR 116 million). This was followed by climate smart and environmentally sustainable food systems (with 31% and EUR 81.8 million), innovation and empowerment of communities (17%) and circularity and resource efficiency of food systems (7%) (Figure 5).

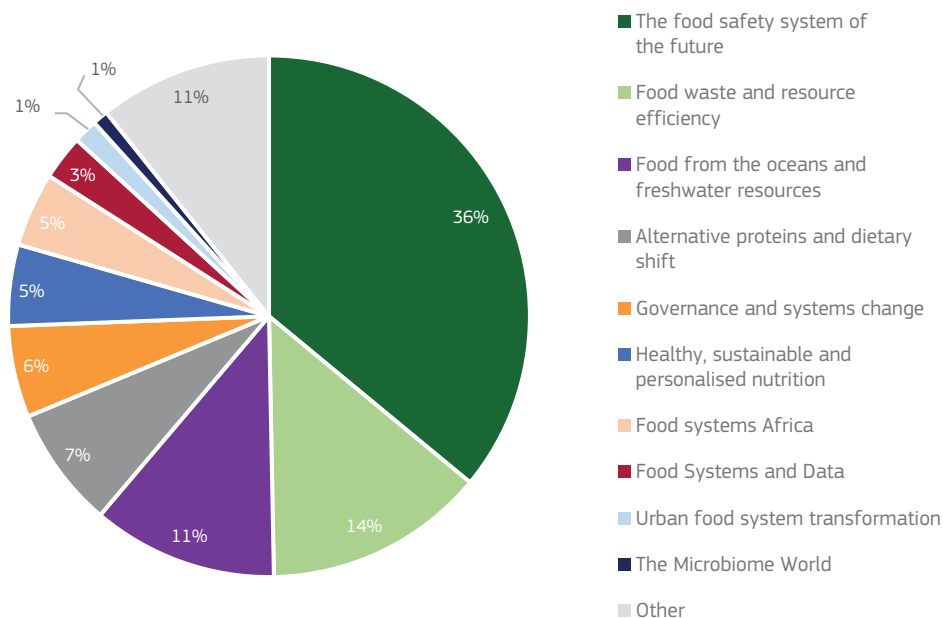
Figure 5: Distribution of the funding by FOOD2030 priorities



Source: SCAR mapping (2018), Swecris database and correspondence with funding agencies

With regards to FOOD2030 pathways, according to the available data publicly funded food R&I in Sweden assigns a large share to food safety systems of the future (36%, corresponding to SEK 1 billion / EUR 98.5 million), and food waste and resource efficiency (14% and SEK 355 million / EUR 34.8 million), followed by food from the oceans and freshwater resources (11%, corresponding to SEK 348 million / EUR 34.2 million). Further details can be observed in Figure 6.

Figure 6: Distribution of the funding by FOOD2030 pathways



Source: SCAR mapping (2018), Swecris database and correspondence with funding agencies

8 Data gaps and limitations

This overview of public R&I investment in food systems in Sweden builds largely upon the 2018 SCAR mapping of Sweden R&I funding into food systems. None of the projects in SCAR's mapping present coordinators or type of recipients for R&I projects.

Additionally, projects in this overview are based on the Swedish Research Council database <https://www.vr.se/english/swecris.html#/> and direct correspondence with funding agencies. However, this database only presents a limited number of Swedish funders of R&I, and not all funding agencies contributed data to the overview.

Due to the large number of projects in Sweden, it is difficult to manually complete the missing information of projects, which includes in some cases, project descriptions, keywords, start and end dates. Overall, no information was found on technology readiness level (TRL), nor publications and patents.

Summary of data sources: Sweden

Country context		
	Name and description	Link
Institutions responsible for funding R&I on food systems	The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas)	https://www.formas.se/
	The Swedish Governmental Agency for Innovation Systems (Vinnova)	https://www.vinnova.se/en/
	The Swedish Research Council (VR)	https://www.vr.se/english
	The Swedish Research Council for Health, Working Life and Welfare (Forte)	https://forte.se/en/
Food innovation related policies	A National Food Strategy – more jobs and sustainable growth throughout the country (2017)	http://extwprlegs1.fao.org/docs/pdf/swe195360.pdf
	More to do more - Action plan for food loss and food waste reduction by 2030	https://www.livsmedelsverket.se/globalassets/publikationsdatabas/rapporter/2016/2018-more-to-do-more-action-plan-for-food-loss-and-food-waste-reduction-by-2030-summary.pdf
	Strategy for Sustainable Consumption (2016)	https://www.government.se/4a9932/globalassets/government/dokument/finansdepartementet/pdf/publikationer-infomtrl-rapporter/en-strategy-for-sustainable-consumption--tillganglighetsanpassadx.pdf
	Swedish Research and Innovation Strategy for a Bio-based Economy (2012)	https://www.formas.se/download/18.462d60ec167c69393b91e60f/1549956092919/Strategy_Biobased_Ekonomy_hela.pdf

National R&I Strategies	Swedish Innovation Strategy (2020)	https://www.government.se/contentassets/cbc9485d5a344672963225858118273b/the-swedish-innovation-strategy	
	Collaborating for Knowledge - for society's challenges and strengthened competitiveness (2017-2020)	https://www.regeringen.se/4adad0/contentassets/72faaf7629a845af9b30fde1ef6b5067/kunskap-i-samverkan--for-samhallets-utmaningar-och-starkt-konkurrenskraft-prop.-20161750.pdf	
EU Structural funds on agri-food projects			
	Description	Link	
Summary of amount spent from structural funds in agriculture and food projects	total EUR 28,3 million from 9 ERDF programmes with 64 relevant food projects identified by the Swedish Agency for Economic and Regional Growth	https://tillvaxtverket.se/english.html	
Food innovation funding			
	Name and description	Link	
Specific food innovation related R&I competitions/ funding	Sustainable Food Systems	https://www.vinnova.se/en/m/sustainable-food-systems/	
	Swedish National Research Programme for Food	https://www.formas.se/en/start-page/about-formas/what-we-do/national-research-programmes.html	
Available data (reports, datasets)			
	Source	Name and description	Link
From desk research	Swecris database – Swedish Research Projects		https://www.vr.se/english/swecris.html#/

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The main purpose of this research is to deliver a comparative study of food systems research and innovation (R&I) investment levels in the EU, considering public and private R&I spend at both national and EU level. Three main strands of research have been used to inform this study: a review of projects funded through the EU Framework Programmes (Seventh Framework Programme (FP7) and Horizon 2020); a mapping of national public funding available for food-systems R&I; and an estimation of private sector investment in food systems R&I by firms headquartered in the EU. Data have been categorised according to the priorities, pathways and sectors identified by the European Commission's Food 2030 R&I policy framework to understand overall levels of expenditure on different priorities in food-related sectors and to identify any potential funding gaps.

Research and Innovation policy

