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INSTITUTE FOR CLIMATE ECONOMICS
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Assessing the sustainability of the French food system: methodological issues and results

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Content

Summary

The transition of the French food system towards a sustainable development model is essential from the perspective of climate change mitigation, adaptation to climate change consequences, protection of biodiversity, soil and water, as well as protection of the health of farmers and consumers in general. The implementation of this transition however is complex, especially given the economic context of the stakeholders involved in the food chain.

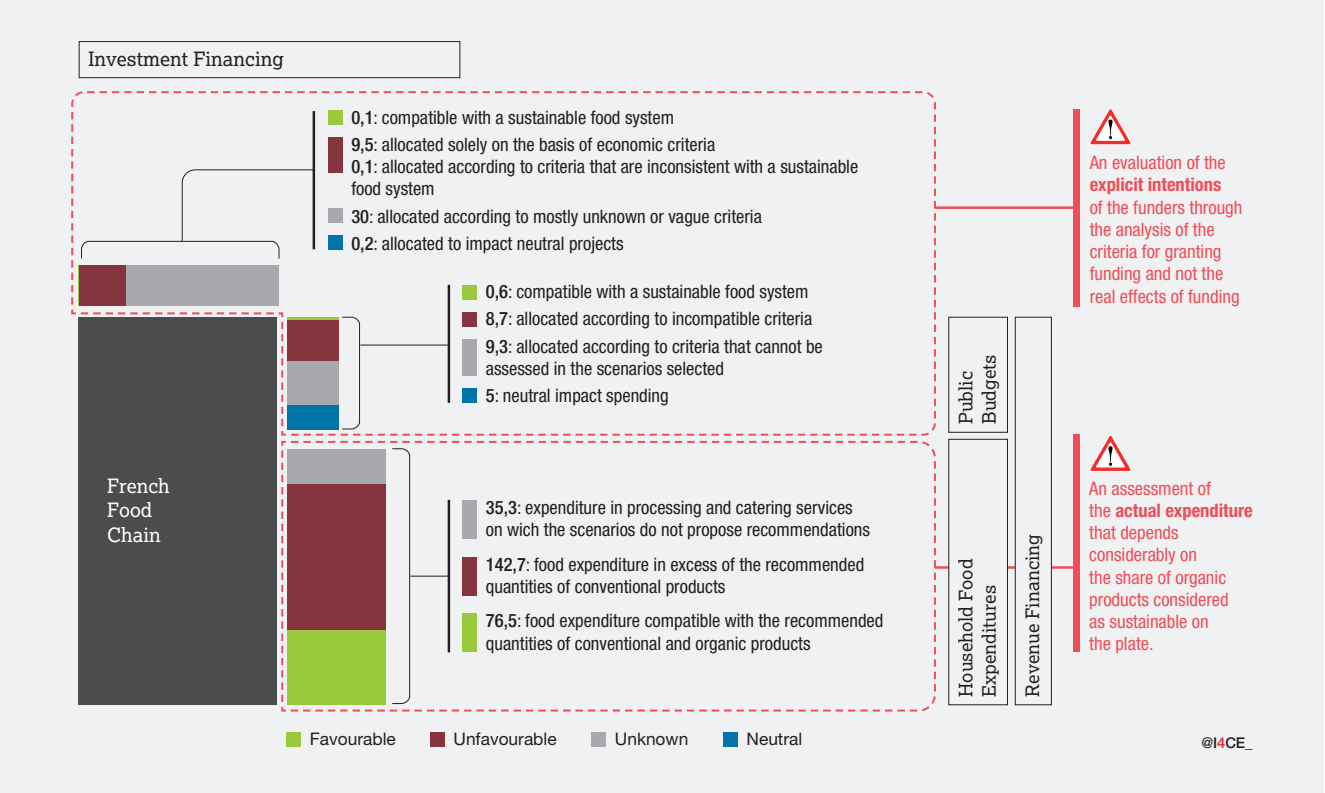
The financial lever is one of the various levers available to steer this transition. In 'Décryptage des financements du système alimentaire français et de leur contribution aux enjeux de durabilité' (2021), I4CE has drawn up an initial estimate of the number of financial flows that cross the food system and their contribution to sustainability. The resulting conclusion is that activating the financial lever has two components: financing investments that transform the means of production in the long term and securing the income of sustainable production methods so that they are economically viable.

This working paper discusses the methodology we have used to assess the contribution of financing flows to the emergence of a sustainable food system.

The following methodological challenges have been identified:

- The definition of a clear and consensual parameter for the food system, the links that form it and the financial flows involved.
- The consensual definition of a sustainable food system, which simultaneously satisfies environmental, social, and economic objectives.
- The evaluation of the funding in relation to the objective of a sustainable food system, whist considering that:
  - information on the projects and products funded is incomplete, and knowledge of the funding levels necessary to achieve a sustainable food system is negligible;
  - in contrast to the energy sector, where the objective is to replace fossil fuels entirely with renewable sources, a sustainable food system is characterised by complex balances that make it difficult to distinguish between financing that is favourable or unfavourable to the transition.

SUSTAINABILITY OF FOOD CHAIN FINANCE IN 2018 (IN BILLION EUROS)



In response to these challenges, we propose a methodology and present the results here.

The assessment of the sustainability of household spending has been separated from all other types of financing: government grants, loans, equity, bonds, and donations.

For each of these types of funding, we assess the compatibility of the criteria used by the different institutions to allocate their funding to companies in the food chain. The results obtained should be interpreted as an assessment of the *explicit intentions* of the funding grant providers rather than an evaluation of their *actual contribution* to the transition.

- A large part of public funding is still directed according to criteria that are inconsistent with the transition to a sustainable food system.
- The financing of non-subsidy investments in the food chain is largely opaque and not sufficiently linked to sustainability criteria.

As this assessment of financing criteria does not apply to household food expenditures, we explore a methodology that focuses on what is 'actually' financed by households. Due to the dependence of the results of this study on a non-consensus indicator, we do not consider them sufficiently robust to determine a share of current total expenditure that would be 'sustainable'.

Nevertheless, the work carried out allows us to draw the following lesson:

- Household food expenditures are still far from the recommendations of the three scenarios.

In addition to providing relatively general results, the objective of this working paper is to open the debate about the evaluation of the sustainability of the French food system and in particular, the methodology to be used.

Introduction

The French food system must make the transition to sustainable development.

This is a fact that is becoming clear as the following challenges accumulate:

- to considerably reduce greenhouse gas emissions;
- to stem the degradation and preserve biodiversity, water resources and soils;
- to adapt to the consequences of climate change;
- to guarantee healthy and nutritious food;
- to provide jobs and ensure a fair distribution of value;
- to ensure the country's food security in the face of shocks of various kinds, etc.

It is therefore important that environmental, health and socio-economic objectives must be met simultaneously.

Changing the food system requires a change in its financing.

Transitioning the food system to a sustainable development model involves modifying the production processes as well as the tools of the companies that make up this system. Therefore, it is a matter of financing investments to acquire new production tools on one hand and maintaining the income of companies whose production processes are sustainable on the other hand. It is also necessary to mobilise financial resources in order to facilitate these transitions, for example by encouraging professional retraining, compensating all or part of any stranded assets[1] or aiding entrepreneurs or households in difficulty.

Monitoring the contribution of financing in the emergence of a sustainable food system seems vital.

It is very important to identify the areas of financing that should be redirected, reduced or increased and to monitor annually whether these changes have taken place. One way to do this is to evaluate, as comprehensively as possible, the coherence of the financing of the food system with a set of recommendations. This is the route we have chosen to explore and which we report on here.

Opening the debate on how to evaluate the financing sustainability of the France food system.

The results that seem robust to us – concerning the evaluation of subsidies and investment financing – are also reported in I4CE 2021. At this stage however, it does not seem relevant to combine all types of financing or to estimate an overall share that would be favourable or unfavourable.

1 Stranded assets are assets that are no longer in use although their purchase has not fully depreciated. For example, a polluting vehicle purchased a few months before it was prohibited from circulation.

1. Methodological challenges

In this section, we attempt to identify the major obstacles to assessing the sustainability of food system financing and propose a methodology for overcoming them. The descriptions of the methodological obstacles are written on a blue background, the methodology we propose is written on a grey background, and the limitations of this methodology and possible ways to overcome them are written on a pink background.

1.1. Defining the outline of the French food system and its financing

1.1.1. Defining the selected sectors

Prior to any assessment of the quantity of financing, the scope of what is covered must be clearly defined.

National accounts distinguish between the various operators in the economy by institutional sector: households, financial companies, non-financial companies, public administrations, non-profit institutions serving households and the rest of the world. Enterprises (non-financial companies) distinguish the various operators by branch of activity: agriculture, forestry and fishing, mining and quarrying, manufacturing.

As a result, there is currently no institutional definition of the food system. The FAO (2018) currently defines the food system as '*the set of actors and their activities related to the production, collection, processing, distribution, consumption and disposal of products from agriculture, forestry, aquaculture and fisheries, and the sections of the economy, society or environment in which they are embedded.*' This definition leaves a great deal of room for interpretation.

Within the food system, we have chosen to distinguish the following elements (Figure 1):

- The food chain[2], whose stakeholders are directly involved in the production or consumption of food products or services. This chain is composed of 6 links:
  - **Input production**: veterinary care, pesticide production, fertilizer production and seed and plant production
  - **Primary production**: farms, fishing and aquaculture enterprises
  - **Food processing and trading**: all enterprises whose main activity is the processing of products for human consumption or the wholesale of agricultural or food products. A large proportion of agricultural cooperatives are included in this category.
  - **Distribution**: companies whose main activity is the retail sale of food products (supermarkets, specialised shops, commercial craft stores, etc.) or catering services.
  - **Households**: French and non-French individuals who consume food products and services sold in France.
  - **Food-related public services**: all services provided by the State, local authorities, or public agencies for which the links in the food chain are the main beneficiaries without receiving any funding: health control services, operating costs of public institutions such as FranceAgriMer or INRAE etc.
- Peripheral links, whose stakeholders are part of distinct value chains but are involved in the production or consumption of food products or services:
  - **The external financial grant providers** (public and private, French and non-French) that provide external financing to the links in the food chain: State, European Union, Regions, public financial institutions (Bpifrance, the EIB, the Bank of the Territories), commercial banks, financial markets, philanthropic stakeholders.
  - **French companies** supplying goods and services to the food chain (energy, transport, machinery, packaging, research and development, waste and water management, etc.) or using the food chain as their source to produce non-food goods and services (biofuels, biochemicals, biomaterials, etc.)
  - **Foreign companies** that import or export agricultural or food products or services to France.

2 We use the term 'food chain' here because it is widely used and allows us to distinguish the central links from the rest of the food system. This term however is problematic because it suggests a linear organisation of value chains, whereas the rest of the food system is far more complex.

1.1.2. Defining the selected funding streams

These interdependent stakeholders are linked by a multitude of different types of financing flows. They may be purchases of raw materials, finished goods, services, fixed assets, financial products, loans of various maturities, insurance indemnities, grants or even unrequited donations.

Exemptions from taxes or social security contributions can also be considered as financial flows, although these do not result in a transfer of money but correspond to an avoided cost.

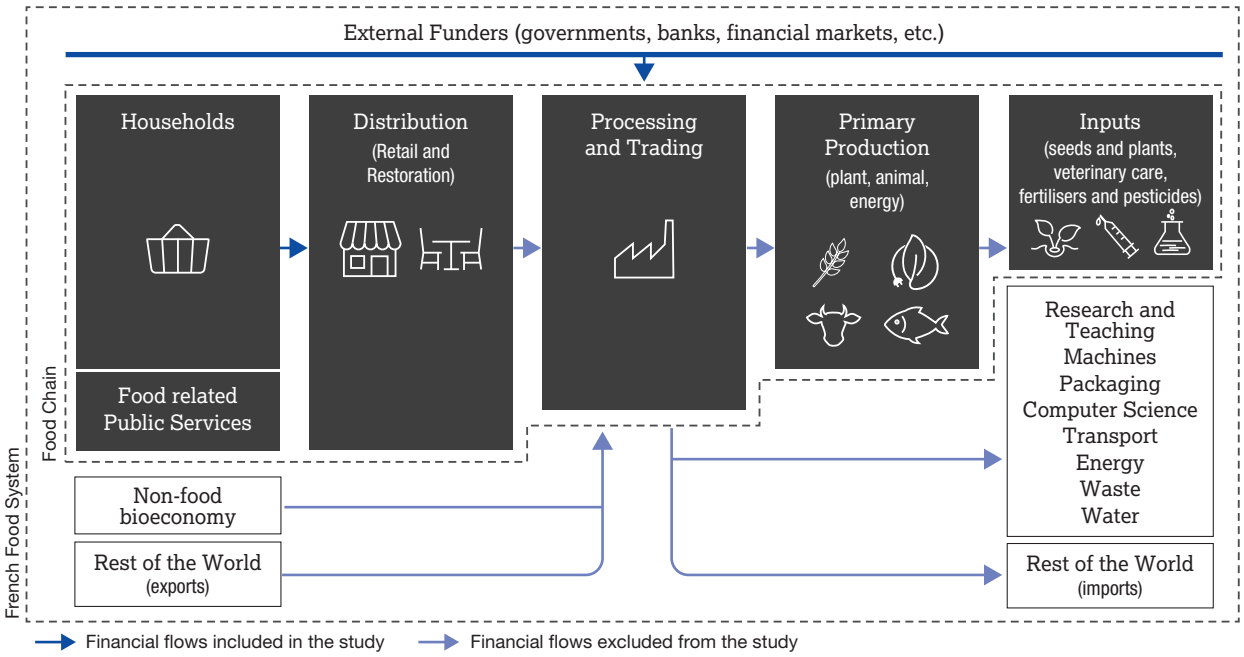
Societal costs, which are generated by the operators of an activity but not borne by them[3], could also be included in the scope of financial flows of the food system.

Due to lack of time and resources, we were not able to study all the various financing that flows through the food system described above. While this is our ultimate goal, **we have currently limited ourselves to two types of financing flows**:

- **The flows of external financing** to the various links in the food chain in metropolitan France. Various kinds of flows are included here: public subsidies, tax and contribution exemptions, concessional loans[4], commercial loans, bonds[5], equity financing and donations. Insurance claims and short-term loans (less than one year) are temporarily excluded from this study.
- **Households flow** to the upstream links of the food chain – and essentially to the distribution link – which constitute household food expenditure in metropolitan France.

Figure 1 illustrates the representation of the food system we have chosen, as well as the financial flows that are covered within its parameter.

FIGURE 1: PARAMETER OF THE FOOD SYSTEM AND FINANCING COVERED



3 Societal costs may correspond to actual expenditures by economic stakeholder. For example, public expenditures to clean up water, health expenditures related to unbalanced diets, etc.

4 Loans with more favourable terms than traditional commercial loans, usually provided by public financial institutions or participatory finance services.

5 Bonds are debt instruments that can be traded on financial markets.

In its current form, the scope we have chosen is not exhaustive. It would need to be expanded further to include, as an example, financial flows between the links in the supply chain as well as with other peripheral links – especially with the rest of the world.

The breakdown of the food system would also need to be refined. It would need to ensure that a commodity chain analysis can be carried out within this system, as well as an analysis of the flow of financing within the various links.

1.2. Defining a sustainable food system

1.2.1. Two types of methodologies

A sustainable food system is defined in the same document cited in the previous section, FAO (2018) as, 'a food system that ensures food security and nutritional balance for all, so that the economic, social and environmental conditions for ensuring food security and nutritional balance for future generations are not compromised'. This can be divided into three points:

- it generates profits along the value chain (economic sustainability),
- it generates a wide range of benefits for society (social sustainability),
- it has a positive impact on the environment (environmental sustainability).

To address the multi-dimensionality of sustainability, the following two methodologies can be employed:

- an issue-by-issue assessment (preservation of biodiversity, climate change mitigation, preservation of water resources, nutrients, etc.) or,
- an assessment in relation to a vision of the food system that is balanced with respect to the different issues.

We have chosen the systemic view of sustainability for two main reasons.

- The first reason is practical: to assess the impact of each orientation of the system at each stage of the value chain, on each of the dimensions of sustainability, would have required an extensive literature review with no guarantee of arriving at a relatively comprehensive overall perspective.
- The second reason is conceptual: when it comes to agriculture and food, we believe that it is not advisable to separate the two issues.

If the goal for example is to produce enough food while minimising greenhouse gas emissions (GHG), then livestock farming would have to be abandoned in favour of plant protein, which would limit methane and nitrous oxide emissions and allow for carbon sequestration by reforestation. Such a scenario would however pose issues of social acceptability as well as possible issues of nutritional adequacy or even the completion of the nitrogen cycle. However, reducing GHG emissions, social acceptability, nutritional adequacy and closing the nitrogen cycle are not mutually exclusive. They must be considered simultaneously to achieve a balance.

1.2.2. Defining a balanced and comprehensive sustainable system

Our chosen methodology is not without its difficulties. Defining a food system that is globally and truly sustainable is a very complex task.

Essentially, it consists of defining the conditions under which a wide variety of interdependent stakeholders can simultaneously meet a diversity of objectives that are difficult to reconcile. Typically, these exercises involve the development of food system scenarios, narratives, and models. Modelling is often used to ensure the physical and/or economic feasibility of the system.

In addition to the difficulty of modelling complex systems, these scenarios also face the challenge of setting up determining parameters that are subject to great uncertainty, such as agricultural yields (see Box 1) or future prices. Furthermore, when the objectives to be achieved multiply and are not consistent with each other, it is necessary to make trade-offs that are rarely consensual.

BOX 1: THE WIDE RANGE OF FARM YIELD ASSUMPTIONS

In all modelling designed to test the biophysical feasibility of different agronomic and food scenarios, agricultural yield assumptions are a crucial parameter. This parameter however, is dependent on a multitude of other parameters, it is highly uncertain and is characterised by a lack of consensus (Le Mouël and Forslund 2017).

Here is an example: A scientific expertise from INRAE tests the capacity of world agriculture to feed the population by 2050, whilst taking into account the effects of climate change (Tibi *et al.* 2020). Two yield levels – low and high – are modelled under different assumptions of climate change effects, atmospheric CO2 concentration, and technical progress. This study found that crop yields, excluding grassland, increased 15% to 20% between 2010 and 2050 throughout Europe and particularly in France (18%).

In contrast, the Afterres (Couturier *et al.* 2016) and TYFA (Poux and Aubert 2018) scenarios assume decreasing crop yields to the order of -10% to -50% in France and Europe compared to current averages. These assumptions of declining yields are due to the adoption in these scenarios of more sustainable modes of production, which are currently characterized by lower yields than conventional modes. The conservative assumptions are also based on the observation that yields of certain production will stagnate, notably due to the effects of climate change which are already felt. (Schauberger *et al.* 2018).

This wide range of performance assumptions makes it very difficult to compare the different scenarios and to assess their feasibility.

In our study, we have selected three scenarios that strike a balance between the different dimensions of sustainability. These are:

- the National Low Carbon Strategy (Ministry of Ecological and Solidarity Transition 2020);
- the Ten Years for Agroecology or TYFA scenario (Poux and Aubert 2018);
- the Afterres2050 scenario (Couturier *et al.* 2016).

Contrary to other scenarios examined, these provide quantitative recommendations for the orientation of the French or European food system – or at least the agricultural sector. They do this by considering different issues simultaneous, not only the issue of the reduction of greenhouse gas emissions or the issue of food security, for example.

The second version of the National Low Carbon Strategy (SNBC in French) was adopted in 2020 and describes decarbonisation trajectories for all sectors of the French economy by 2050 with a target of carbon neutrality by that date. Mitigation of climate change is the principal objective of this strategy, but it also aims to limit the adverse effects on other sustainability issues and even to generate synergies between them. The agricultural component of the SNBC is also based on a modelling of physical flows (land use, material and nutrient flows, etc.) using the ClimAgri tool, developed by Solagro on behalf of Ademe.

The TYFA and Afterres2050 scenarios are two physical scenarios of food production and consumption. The Afterres2050 scenario is at the French level and TYFA at the European level, but the latter is currently being adapted for France. These two scenarios propose a picture of agriculture and diets for 2050 that meets the challenges of reducing GHG emissions, preserving biodiversity, closing the nitrogen cycle6, health, maintaining a certain export capacity and, to a lesser extent, the challenges of adapting to climate change and managing water resources.

While there are some points of contradiction between these different scenarios, such as the proportion of agricultural production used for non-food purposes, they all agree – or at least do not disagree – regarding several general recommendations for the evolution of the food system (**Table 1**). The sustainable food system is therefore characterised by a reduction in the production and consumption of animal products in favour of plant products, an overall diversification of production and the implementation of low-input Agro-Ecological practices that recycle resources. In this respect, it is similar to the 'Territorialized Food System' promoted and described by Jean-Louis Rastoin (Rastoin 2020)with health, social and environmental crises. An alternative prospective scenario (territorialized food systems.

6 Nitrogen is an essential nutrient in crop production. At present, much of the nitrogen is supplied to the French agricultural system in synthetic mineral form, while there is widespread leakage to the atmosphere and to ground and surface waters. Closing the nitrogen cycle means managing the resource in such a way that the French agricultural system is self-sufficient in terms of supply, while limiting leakage into the environment.

TABLE 1: MAIN POINTS OF CONSENSUS BETWEEN THE THREE SCENARIOS

Overall reduction in the production and consumption of animal proteins (meat, dairy products, eggs) • Livestock production is generally associated with a significant environmental footprint. Reducing this production is the main lever for reducing greenhouse gas emissions in the food chain in France. • The National Nutrition and Health Program 2019-2023 recommends a reduction in the consumption of charcuterie and non-poultry meats.
Reduction of plant protein imports • France imports large volumes of plant proteins, particularly soybeans for animal feed. These products are suspected of being associated with deforestation in certain countries of origin, which is synonymous with significant greenhouse gas emissions. Reducing these imports would therefore reduce the GHG footprint of food consumption. • Reduction of these imports is consistent with the objective of food sovereignty, i.e. the ability to satisfy essential national needs through domestic production.
Reduction in the use of synthetic nitrogen products and conventional plant protection products • Synthetic nitrogen products are intended to meet the challenge of maintaining soil fertility and are generally derived from the combination of nitrogen, which is abundant in the air, and hydrogen. The use of these products has disadvantages however, when they are applied to the soil: some of the nitrogen applied is surplus to requirements (leakage) and pollutes water and the air. The application of mineral nitrogen is also the main source of nitrous oxide (N_2O) emissions, a powerful greenhouse gas. • Plant protection products or pesticides – herbicides, insecticides and fungicides – are used to control pests and are derived from various production processes. The use of conventional plant protection products is associated with a significant loss of biodiversity and a deterioration in the health of the farmers who use them. Their residue in food products is also suspected of having negative effects on consumer health.
Diversification of crop rotation and lengthening of rotations • A rotation is a succession of crops on the same agricultural plot. Extending rotations consists of lengthening the return time of the same crop by introducing new ones. This lengthening can allow better management of diseases and nutrient cycles. • Crop diversification plays a role in risk management in the face of various hazards, particularly climatic ones.
Increased production and consumption of legumes and their introduction into field crop rotations • The increased production of legumes in France will compensate: • Consumers for the loss of protein caused by a reduced consumption of livestock products. • Livestock for the loss of protein caused by reducing protein imports. • Soils for the loss of nitrogen caused by the reduction of synthetic nitrogen products. • Integrating legumes into field crop rotations and increasing their production, is in line with the objective of diversifying crop rotations and lengthening rotations previously mentioned.
Increase in the proportion of agricultural land dedicated to Agro-Ecological Infrastructure • Agro-Ecological Infrastructures (AEI) are areas that are intentionally not harvested, with the aim of serving as a refuge or food source for biodiversity. They can be hedges, grass strips, meadow orchards, copses, wetlands, etc. • AEIs provide environmental services such as carbon storage, erosion control and sometimes river protection.
Reduction of losses, waste, overconsumption and recovery of incompressible food waste • Losses and wastage are regarded as agricultural products that create negative environmental impacts without generating any benefits. Overconsumption corresponds to unnecessary intake from a nutritional point of view. The priority is therefore to reduce these losses, wastage and overconsumption throughout the food chain. • Part of this loss and waste is incompressible, so the second step is to recycle this food waste into fertilizer and/or energy.

Increase in local production and consumption of fruit and vegetables

- In France, as on all continents, the average consumption of fruit and vegetables is below the nutritional recommendations.
- France imports half of the fresh fruit and vegetables it consumes and 80% of these imports come from the European Union of 28 Member States. Despite there being a general consensus regarding the objective of food sovereignty in fruit and vegetables, the scale of such sovereignty – both national and European – is still being debated. It seems however, generally desirable that the nutritional deficit in fruit and vegetables should be made up for, by increasing domestic production rather than by increasing imports.

It should be noted however, that these recommendations do not cover all dimensions of sustainability, in particular the economic dimension. For example, they do not make specific recommendations concerning the economic organisation of a farm such as the number of jobs, the size of the farm or the level of remuneration of employees and farm managers. This economic dimension is not considered because the models on which these scenarios are based only represent material flows (cereals, milk, meat, nitrogen, etc.) and not financial flows. The authors of these scenarios are working together to enhance their work on these areas.

In addition, these scenarios – TYFA and Afterres in particular – **focus primarily on the primary production link** and provide little insight into the changes required in the other links. Some changes can be mechanically deduced: for example, if the scenarios recommend using less synthetic fertilizer or plant protection products, we can deduce that we should also produce less. However, many questions remain, especially in relation to the changes to be made in the food processing, distribution and seafood sectors. (See **Box 2**).

BOX 2: ISSUES NOT COVERED BY THE SELECTED SCENARIOS

At the input production **stage**, the SNBC, TYFA and Afterres scenarios all recommend the development of Agro-Ecological practices, but little information is provided about the orientation to be taken by seed producers, animal breeders and veterinary care providers. They do not explicitly state a position regarding the development of alternative products or services to conventional practices for soil fertility management and crop and livestock protection. These products and services include so-called 'precision farming' solutions, which do not aim to change the nature of inputs but to reduce their use (biocontrol solutions, digestates from methanizers, etc). The volumes and production methods of these products and services are not specified in these scenarios, nor is their use on farms.

Although the three scenarios chosen are very precise in their vision of agricultural production, **some grey areas remain. Firstly**, the ideal distribution of the different types of production on the territory, particularly the distribution of livestock in France, remains unknown. Secondly, all the economic and social issues related to agricultural enterprises (size, number of employees, land use, income level, location, mechanisation etc.) are not modelled. Thirdly, some sub-sectors, such as fishing and aquaculture, hunting and insect production are not studied either. In addition, some types of agricultural production with specific issues, such as viticulture and permanent crops, are not given specific recommendations. Finally, some common practices such as irrigation or deep ploughing are not clearly recommended.

With regards to animal welfare, the scenarios do not address particularly criticised practices such **as live castration**, crushing of male chicks, or preventive beak and feather trimming. These scenarios also diverge on certain points, notably the importance to be accorded to the substitution of ruminant meat with white meat, the use of on-farm mechanization for energy production, and on the modalities of this production.

The selected scenarios do not provide explicit recommendations for processing and distribution. Recommendations can **be extrapolated from those made at the production and consumption levels. For example**, from the imperative to reduce the consumption of ultra-processed products, we can deduce a reduction in the number of third-party processing facilities.

The scenarios do not however address the general questions relating to:

- Volume – what percentage of the food must be purchased raw and then cooked? Processed by the agri-food industries? Served in restaurants?
- Production methods – which processes can be used? Which products?
- Location – is there a need for a fine network of processors and restaurant **owners**, or to have highly concentrated sectors?
- They are also silent on more specific issues such as the development of alternatives **to traditional animal proteins (plant-based products**, insect-based products, cultured meats, etc.). The scenarios are relatively precise in terms of volume of imported and exported products, however these recommendations have a strong focus on climate and environmental objectives and less on issues such as food resilience and global food security.

On the consumer side, while diets are accurately described in terms of their general **composition (fruit and vegetables**, meat, cereals, etc.), many other characteristics of eating behaviours are not developed. As an example, the level of food processing and the proportion of so-called 'ultra-processed' foods are not clearly defined. The same applies to the social organisation of the preparation and consumption of meals: who prepares the meals? where are the meals eaten? how long does it take? These questions are not addressed in the scenarios.

1.3. Assessing the sustainability of funding: conceptual and practical obstacles

Having a clear and consensual definition of the French sustainable food system is not enough. It is also necessary to be able to evaluate the contribution of certain financing or, conversely, to evaluate the opposition to the transition to this sustainable system. Two major problems then arise. On the one hand, when evaluating the finance in relation to the sustainability objectives, it is important to have access to precise information concerning both the amount of financing required and its destination. On the other hand, unlike some other sectors such as energy, where the transition consists of replacing fossil fuels entirely with low-carbon energies, the transition of the food system is more complex and is best described in terms of thresholds and balances.

1.3.1. Incomplete information

Assessing the sustainability of sustainable food financing would ideally involve comparing current levels of financing with levels of financing that are considered sustainable. This ideal methodology has two prerequisites. It requires an assessment of the right level of financing for food chain investments and revenues. Firstly, an assessment of the right level of financing for food chain investments and revenues is required. For example, it would be necessary to determine the level of annual investment required in the organic legume processing industries corresponding to the preferred direction of the three scenarios. (See section). Secondly, quite a considerable amount of information regarding the recipients of the funding provided is required. When it comes to organic pulse processing, it would be necessary to isolate the investments in these specific processing chains.

For household food expenditure, this methodology can be applied, since we have both precise and quantified expenditure targets (for meat, fruits and vegetables, etc.) and equally precise data on actual current expenditures.

However, for all other types of financing, this methodology cannot be used at this time. To our knowledge, there has been no evaluation of the investment and operating subsidy needs of the French food chain. We are starting this minimal assessment work on investment needs in livestock sectors in partnership with IDDRI, BASIC, Solagro and AScA and hope to obtain results by the first half of 2022.

Consequently, for all types of financing except for household food expenditures, we have opted for an analysis based on the financing grant source (the State, commercial banks, local authorities, etc.). We then evaluate the *allocation criteria* of these funding sources. In other words, we do not judge the effectiveness of a funding against different sustainability objectives (biodiversity preservation, health, GHG emission reductions, etc.). Rather, we compare the directions defined by the funding criteria with the directions recommended by the three scenarios we have selected.

The criteria for awarding funding may not however, be publicly available or may be too vague (funding of 'sustainable', 'high environmental performance', 'green' projects, etc.). In this case, we have tried to fill in the missing information through interviews whenever possible.

It is also possible that, although the allocation criteria are available and precise, the scenarios do not allow us to judge sustainability. This is either because the scenarios disagree on this point, or because their scope does not cover the object of the financing. When the criteria were unavailable or vague and/or when the scenarios were incomplete, we considered the criteria for funding with an 'unknown' effect from the point of view of *sustainability*.

One of the major limitations of this evaluation, which focuses on the criteria for allocating funding as opposed to the effects of the funds, is the potential gap between the two. An example is the payment for Areas facing Natural Constraints (ANCs), an aid from the 2nd pillar of the Common Agricultural Policy (CAP), co-financed by the general budget of the French State. An analysis by criteria implies referring to Regulation (EU) 1305/2013, Title III, Chapter 1, Article 31 targeting these payments to 'farmers located in mountain areas and other areas with natural constraints or other specific constraints.' Comparing this aid criteria with the consensus points of the three retained scenarios – which do not provide precise recommendations in terms of farm location – it is not possible for us to derive conclusions on the contribution of the ANCs to the transition of the food system. In reality, ANCs in France benefit livestock farms almost exclusively and therefore constitute a form of implicit subsidy to mountain farming. If the allocation criteria had been formulated in this manner, then it would have been possible to compare them with the consensus points in the three scenarios.

Funding whose criteria are a priori favourable to the food transition does not necessarily have a positive or even a negative impact. For example, the regulations of the Common Agricultural Policy (CAP) cite objectives of preserving biodiversity and reducing greenhouse gas emissions. Many reports, however, have struggled to detect significant positive effects of CAP support on these issues (Alliance Environnement 2019; Alliance Environnement and Thünen Institute 2017; European Court of Auditors 2017; Mottershead *et al.* 2019; European Court of Auditors 2021).

This assessment of funding criteria rather than actual outcomes implies that the results are seen as an assessment of the *intentions of* the funding sources, rather than an assessment of their *actual actions*. For example, an institution may fund projects that are consistent with a sustainable food system, even though it has not established explicit and prescriptive criteria to ensure that all its funding is targeted in this way. Alternatively, it is possible that, as described, funding that is deemed to be conducive to sustainable development on the basis of its allocation criteria does not necessarily yield the expected results.

1.3.2. A transition made of balances

In a context in which the transition objective corresponds to a set of balances, the lack of sustainable funding creates a second obstacle. As described by the points of consensus for the three scenarios we have selected, the transition of the food system will not result in a total replacement of certain activities with others. For example, it is not a question of replacing all livestock farms with field crop farms producing legumes, but rather of balancing the two.

The same applies to synthetic inputs. The point of consensus between the three scenarios is a significant reduction in their use. Only IDDRI's TYFA scenario envisages the total abandonment of synthetic mineral fertilisers and conventional pesticides. The French sustainable food system is therefore expressed more in terms of minimum thresholds to be reached, or maximum thresholds not to be exceeded. Yet, if we do not have a monetary estimate of these thresholds, how can we evaluate whether a financing is deficit or surplus?

As a means of overcoming these obstacles, we have attempted to define the points of consensus among the three selected scenarios in relation to the current situation, using the term 'sustainability markers'.

The sustainability markers are specific directions on which the three scenarios have achieved consensus – or at least, are not directly opposed – which have been formulated to evaluate the financing (cf. **Table 6** in the Appendix). 108 sustainability markers have been derived from the three scenarios, either directly or by extrapolation.

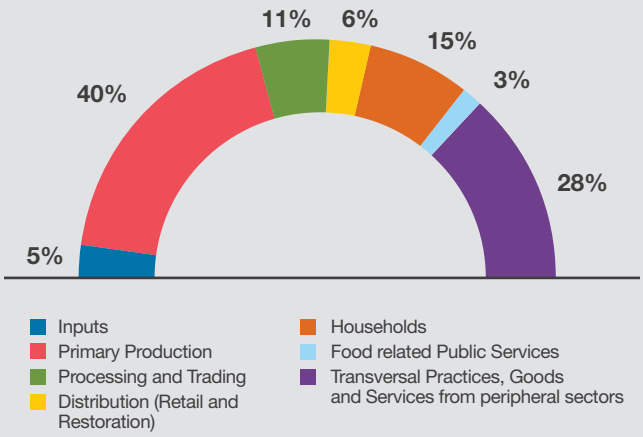
An example of a marker drawn directly from the scenarios would be the reduction in the *use* of conventional fertilizers and pesticides and its extrapolation would be the reduction in the *production* of synthetic fertilizers and pesticides. Due to the focus of the scenarios selected, these markers are more often related to primary

production than to other links in the food chain Figure 2.

The funding criteria are evaluated against these sustainability markers as follows:

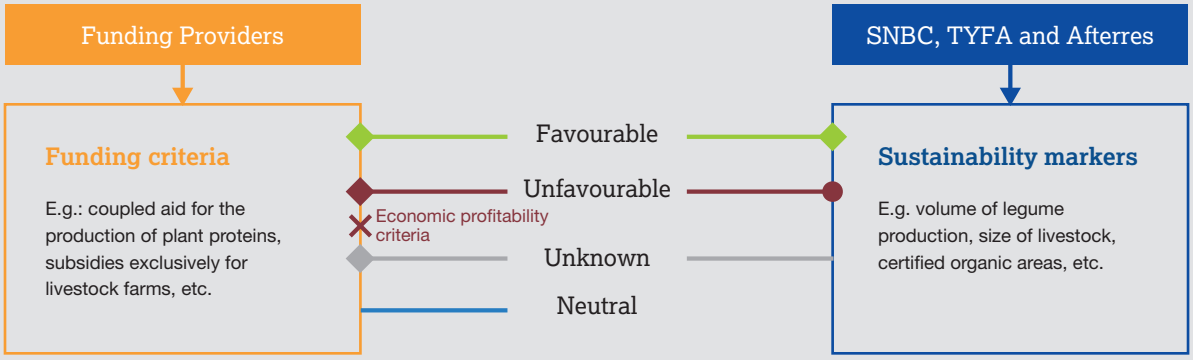
- If the criterion for funding is consistent with a sustainability marker, then the funding is considered transition friendly.
  - Example: Increasing plant protein production in France is a marker of sustainability. Therefore, any funding to support the production of plant proteins is seen as favourable to the food transition.
- If the award criteria indicate opposition to a sustainability marker, then the funding is considered unfavourable for the transition.
  - Example: The sustainability marker for animal product production highlights an overall decrease. Therefore, any funding specifically for the production of animal products would be considered unfavourable.
- Funding that is shown to be based solely on economic profitability criteria is also considered to be unfavourable to the transition. In the current environment, allocating funding solely based on the project's economic profitability generally entails funding the status quo, thereby slowing down the transition.
  - Loans allocated solely based on traditional profitability and risk management criteria are also considered unfavourable for the transition.
- Some funding is not directly related to transition issues and is therefore considered neutral.
  - Some of the administration's operating costs, such as health checks, monitoring of epizootics, expenditures on IT tools for distributing CAP aid etc, are considered neutral as these do not relate to transition issues.

FIGURE 2: BREAKDOWN OF CONSENSUS SUSTAINABILITY MARKERS BY FOOD CHAIN LINK – 108 MARKERS.



Note: Most sustainability markers are specific to the link in the food chain where they appear. The marker 'Volumes of legumes produced in France' for instance, relates to the primary production link. There are however, some markers that apply independently of the link in which they appear, such as 'Volumes of organic waste produced' or Use of fossil fuels'. These markers have been placed in a category called 'Transversal practices, goods and services from peripheral sectors'.

The following is a summary of this methodology:



Often, the criteria for awarding the same funding refer to multiple sustainability markers, however, it is not possible to divide the funding into sub-amounts for each of these sustainability markers. In such cases, the following rules are adopted:

- if all the criteria for this funding are considered neutral, the entire funding is considered neutral;
- if at least one criterion is considered favourable while all others are considered neutral, then the funding is considered favourable;
- if at least one criterion is considered to have an unknown effect while all others are considered neutral or favourable, then the funding is considered unknown;
- if at least one criterion is considered unfavourable, then the funding is considered unfavourable.

As an example, consider the CAP green payment (**Table 7** in the Appendix).

Having studied the European regulations governing it, we have identified 13 distinct allocation criteria. Out of these 13 criteria, one goes beyond the scope of our study as it concerns forests and forestry. We were able to link 9 of the remaining 12 criteria to sustainability markers that we identified from the scenarios selected.

The criteria that we were not able to link to this matrix of markers are therefore considered as having an unknown impact. Two of these criteria are linked to markers for which there is no consensus on the recommended evolution within the three scenarios selected: they too are considered as having an unknown impact.

Finally, among the 7 criteria attached to consensus markers, a total of six are considered favourable because their supposed effect is consistent with the recommended evolutions, while only one is considered unfavourable since the supposed effect is below the recommended evolutions. The total funding of green payments is therefore considered unfavourable because at least one of these criteria is considered unfavourable.

However, the methodology we have used fails to reflect the balances that define a sustainable food system. In fact, as long as the recommendations of the selected scenarios recommend reducing the production volumes of a product, then any financing specifically intended for the production of this product will be considered unfavourable. This is the case, for example, for livestock products.

To be able to really take these balances into account, it is necessary for each activity to have the level of financing that corresponds to its sustainable level. With such information, it would then be possible to use a methodology similar to that used for the evaluation of the sustainability of household expenditure. Even when the same activity is financed by multiple mechanisms or actors, it may still be difficult to determine which financing levels match the required levels and which are surplus.

The other limitation of this methodology is how simplistic its approach is when looking at financing whose allocation criteria refer to several sustainability markers. In the example presented, the allocation criteria of a significant financing (CAP) payment refer to approximately ten criteria, but it is considered as unfavourable based on only one of them. The improvement of this part of the methodology is not evident at this stage.

1.3.3. The special case of household spending

Assessing the sustainability of household expenditures is not without complications, even though we can directly compare current expenditures with normative amounts derived from an average between the Afterres and TYFA scenarios. The problem is that a single, non-consensual parameter – the sustainable proportion of organic products in the total quantity purchased – heavily influences the results.

In the case of household expenditures, we compared the actual expenditure with the recommended expenditure (see **Box 3** for data sources and calculation methods).

For each food group (cereals, sugar, alcohol, poultry meat, etc.), we compare the quantities actually purchased to those recommended – based on the hypothesis of dividing losses and wastage by two – and the share of this food group consumed organically compared to the Afterres and TYFA recommendation (70% of organic products). The actual amount of conventional and organic products that is compatible with the recommendations is considered favourable and any excess amounts consumed are considered unfavourable.

BOX 3: SOURCES AND METHODS FOR CALCULATING HOUSEHOLD DATA

The recommended expenditures are expressed in terms of absolute quantities of food types (dairy, meat, fruit and vegetables, etc.), shares of organic agriculture (OA) products in the total quantities of each food type, and reduction of losses and wastage at the consumer level.

The levels of absolute quantities and shares of OA are defined as the average of the recommendations of the Afterres and TYFA scenarios. The reduction of losses and waste is increased to -50% compared to the current situation, according to the national objective (Law n°2020-105 of 10 February 2020). By combining these three parameters, the recommended diet is expressed for each type of food in absolute quantities of conventional and organic products.

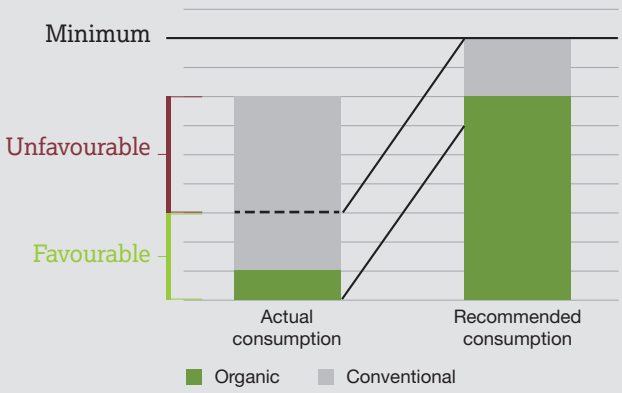
Food expenditure over the period 2014-2018 is taken from the Comptes de la Nation (Insee 2020). The quantities purchased in 2014 are calculated as the sum of the quantities ingested in 2014 from the INCA 3 survey (Anses 2017). The quantities of waste at the consumption level, are taken from the loss and waste shares (INCOME consulting, AK2C, and ADEME 2016) and considered as stable over the period 2014-2018.

To obtain the quantities purchased in 2018, we divide the 2014 expenditures by the 2014 quantities purchased to obtain the prices for that same year. We then apply to these prices the indicators of change from the National Accounts (Insee 2020), in order to obtain the prices of 2018. We then divide the expenditures by the 2018 prices to obtain the quantities purchased.

To distinguish the quantities of conventional and organic products, we refer to the market shares of organic products in 2018 (Agence Bio 2020). To determine the prices of organic and conventional products, we perform a calculation based on the average price calculated for 2018, the market shares of organic and the price gap between organic and conventional products from a report by Eco2initiative and WWF (2017).

Figure 3 illustrates this mechanism schematically for a product whose total consumption must increase in order to reach a minimum value (such as fresh fruits and vegetables or pulses). Similarly, the same type of decision is applied to products whose total consumption cannot exceed a certain threshold. There is only one distinction: in the first case, the consumption deficit is not counted as an unfavourable expenditure since no expenditures occur, whereas in the second case, the excess over the maximum limit is considered an unfavourable expenditure.

FIGURE 3: METHODOLOGY FOR ASSESSING HOUSEHOLD EXPENDITURE, EXAMPLE OF A MINIMUM THRESHOLD OF TOTAL CONSUMPTION



The distinction between current expenditures that are favourable and unfavourable to a transition of the food system is strongly dependent on key parameters, such as the share of products from organic agriculture. The current share is about 3% of the total quantities purchased, while the target we have defined is about 70% (an average between the recommendations of the Afterres and TYFA scenarios). Therefore, the share of conventional products considered compatible with a sustainable food system is 30% of the quantities purchased.

Overall, putting aside the issue of plate composition, it is estimated that 33% of household food expenditure is already compatible with the scenarios: 3% of organic products and current 30% of conventional products. If we had defined the share of organic products compatible with a sustainable food system as 50% instead of 70%, then the portion of household food expenditures considered favourable would have been 53%. The sensitivity of the other two parameters, i.e. the composition of the plate (in fruit and vegetables, cereals, etc.) as well as the reduction in losses and waste, is less significant, as the window of possibility is far smaller.

Therefore, we do not consider this methodology to be suitable for assessing the sustainability of household food expenditures: substantial amounts are qualified as favourable or unfavourable almost solely on the basis of a parameter that is not considered consensual. The presence of this obstacle raises the question of whether such a methodology is relevant when assessing the sustainability of other types of financial flow, in the event that assessments of financing needs are available.

2. Results

The results presented in this study relate to the year 2018. In consequence, they do not consider the directions taken by the various recovery plans in response to the Covid-19 crisis. They are also based on the analysis of the food system financing flows that we have performed (I4CE 2021). At the centre of this analysis is the distinction between:

- Financing of investments: assets or means of production that are determining factors in the choice of production processes for several years.
- Revenue financing: sales, subsidies and other revenues that are used to pay for the current operational functioning of the companies.

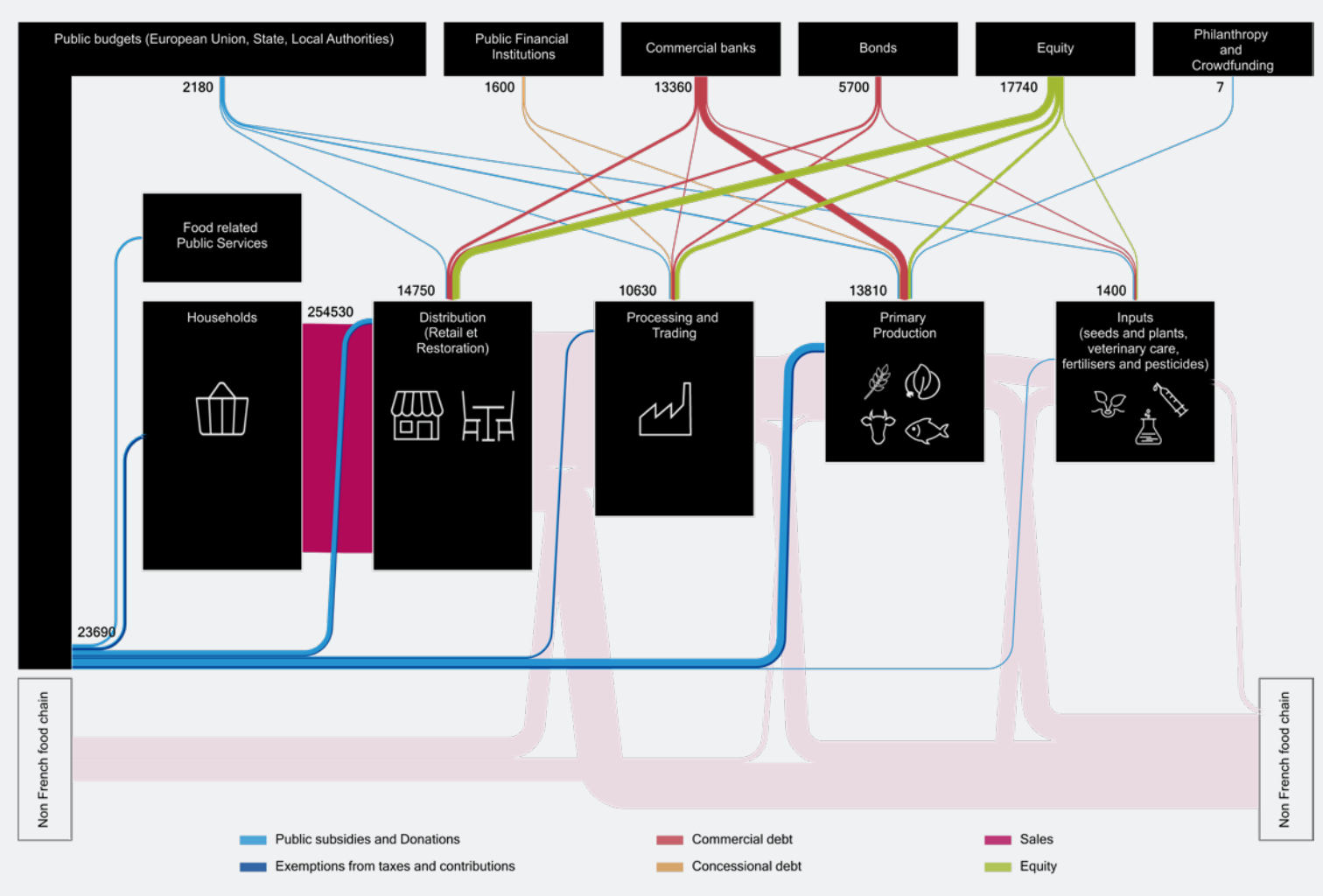
Each of these two types of financing influences the direction taken by the companies in its own way and we believe that they should be mobilised jointly in order to activate the financial lever for the transition of the food system.

It is important to be reminded that our methodology does not permit us to evaluate the actual effects of the funds received, but rather the supposed effects of the funds based on the allocation criteria with which they are associated. This is with the exception of household food expenditures. It is therefore not possible to interpret the results presented here as an evaluation of the effectiveness of the funding, rather as an evaluation of the formulation of the intentions of the funding provider.

2.1. Food chain financing summary

Figure 4 shows the financing flows of the food system. The simplified food chain is in the centre of the diagram, with external financing grant providers at the top and peripheral links at the bottom left and right. The arrows are proportional to the amounts. Those from left to right correspond to income financing, while those from top to bottom correspond to investment financing.

FIGURE 4 : SANKEY DIAGRAM OF FINANCING FLOWS IN THE FRENCH FOOD SYSTEM IN 2018



Source: (I4CE 2021)

In 2018, the French food chain received nearly 280 billion euros in revenue which falls under our scope (excluding sales outside the French food chain). 90% came from household food expenditure and 7% from public income support – the rest corresponding to the avoided costs of tax and contribution exemptions.

In addition, around 41 billion euros of investment was financed in the French food chain in 2018. Around 18 billion euros of this was financed by equity (self-financing or via the contribution of external capital), an amount similar to the debt taken on to finance the investment. Lastly, public subsidies finance 2 billion euros of these investments. The primary production and distribution sectors accounted for approximately 70% of investments in 2018. The processing and trading sector is responsible for 25% of the investments and input production for the remaining 3%.

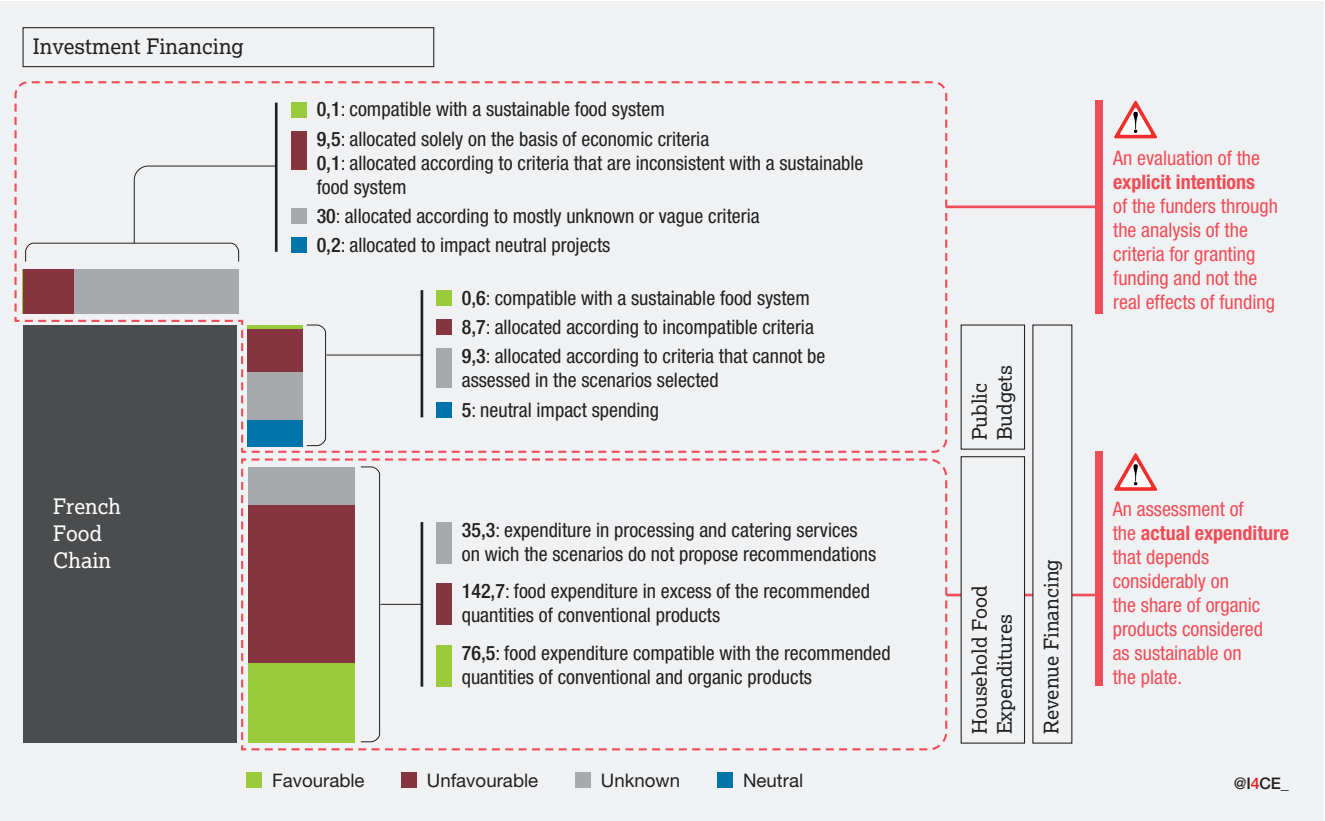
Public budgets represent a minority share in both income and investment financing; however, they are not negligible. Public subsidies can sometimes be a determining factor in the economic viability of certain farms for example. Public funding can also generate leverage effects in the process of obtaining financing for investments.

2.2. In Summary: a preponderance of financing incompatible with sustainability issues

Overall, income financing is predominantly unfavourable to a sustainable food system, while investment financing is dominated by criteria whose assumed effect is unknown (**Figure 5**). However, **these overall figures should be interpreted with caution, considering the limitations of the methodology used**.

Firstly, for all of the financing excluding household food expenditure, the evaluation is of the criteria for *allocating* the financing, and not on the actual *effects* of the financing. Secondly, only part of the total financing of the French food system is represented here; in particular, short-term loans, income derived from exports, non-food outlets, and insurance indemnities are not included.

FIGURE 5: THE SUSTAINABILITY OF FOOD CHAIN FINANCE IN 2018



In addition, household expenditure – accounting for 90% of income financing – is assessed using a different method based on actual products purchased. This method makes the distinction between favourable and unfavourable expenditure particularly dependent on the estimated 'sustainable' level of organically produced products on the household plate. The level is set here at 70%, the result of an average of the recommendations of the Afterres and TYFA scenarios. A share set at 50% would have brought the favourable and unfavourable household expenditures to comparable shares. Conversely, a share set at more than 70% would have resulted in an even higher proportion of unfavourable expenditure.

9.5 billion euros of unfavourable financing are considered unfavourable because their allocation is based exclusively on private profitability[7] criteria. It should also be noted that the majority of financing has an unknown effect, making it difficult to determine the contribution of investment financing to the transformation of the French food system.

2.3. Public budgets

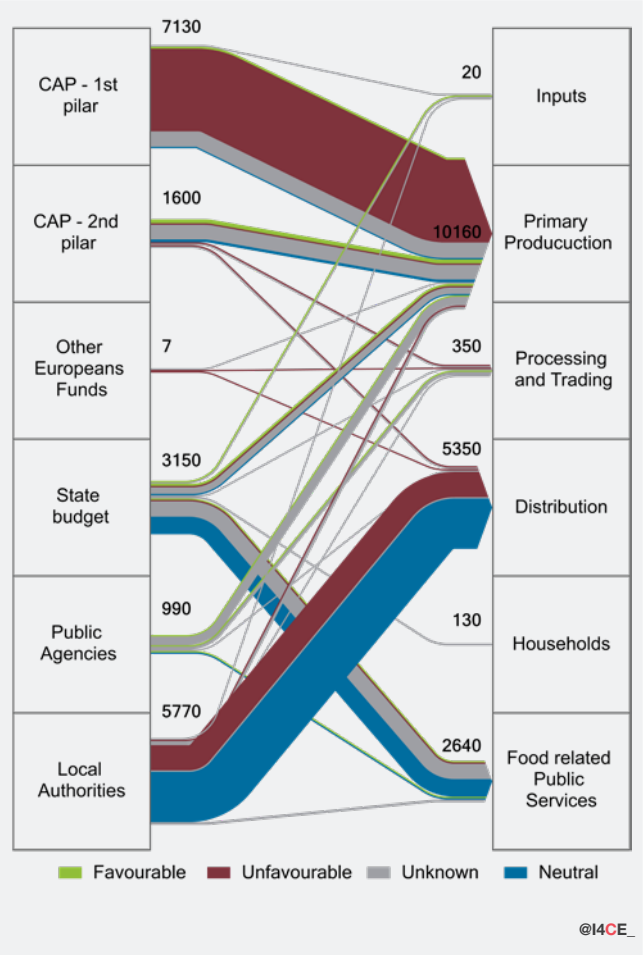
2.3.1. Public subsidies

Our calculations show a total of 0.7 billion euros of subsidies whose allocation criteria are favourable to a sustainable food system, 7.7 billion euros that are unfavourable, 5.1 billion euros whose criteria or scenarios do not allow for an evaluation, and 5.2 billion euros for which the criteria have no direct effect on the sustainability issues (**Figure 6**).

The majority of the financing that is perceived as inconsistent with the objective of transitioning to a sustainable food system pertains to direct aid and green payments from the CAP as well as municipal subsidies for primary school canteen meals.

The financing considered as neutral corresponds globally to the payment of salaries and operating costs of public administrations. However, a large number of criteria could not be evaluated, either because they concerned issues that could not be addressed by the scenarios we selected or because the published criteria were too vague to be associated with sustainability markers (e.g. sustainable projects, economic and environmental performance, etc.).

FIGURE 6: SUSTAINABILITY OF PUBLIC GRANT CRITERIA IN 2018 (IN MILLION EUROS)



7 Private profitability refers to the cost/benefit calculation carried out within the company's parameters. This is opposed to a more complete profitability, taking into account costs or benefits that are expressed outside the parameters of the company, such as the costs of water purification paid by taxpayers.

TABLE 2: THE SUSTAINABILITY OF PUBLIC GRANT CRITERIA IN 2018

Amounts (euros)	Details
0.7 billion	Mainly Agri-Environmental and Climate Measures (AECM) and aid for converting to and maintaining organic farming under the 2nd pillar of the CAP, as well as coupled aid for the production of legumes and allocations for young farmers under the 1st pillar of the CAP.
7.7 billion	Nearly 6 billion euros of this total amount correspond to direct payments and green payments under the 1st pillar of the CAP, whose criteria concerning the diversity of rotations appear incompatible with the definition of sustainable agriculture. 1.8 billion euros correspond to subsidies for primary school meals by municipalities, due to criteria concerning the composition of the plate that are considered insufficient compared to the recommendations of the scenarios adopted (the evaluation covers 2018, before the Egalim law came into force). Finally, the 0.9 billion euros of coupled payments for animal production under the 1st pillar of the CAP are considered unfavourable because the supposed effect of their allocation criteria is to maintain or even increase the size of herds, when the recommended evolution is an overall decrease.
5.1 billion	The payment for Areas facing Natural Constraints (ANCs) under the 2nd pillar and the specific schemes for small farmers under the 1st pillar of the CAP represent the bulk of the funding considered to have an unknown impact, with a combined total of 1.7 billion euros. 1.7 billion euros – The criteria for allocating the ANCs are based on the location of farms. This is a subject which cannot be defined using the selected scenarios. Similarly, the supposed effect of the small farmers' scheme is difficult to identify from its allocation criteria and has therefore been considered as 'unknown'. 0.7 billion euros – received in subsidies by companies in the food chain outside gross agricultural production according to national statistics. The remainder refers primarily to criteria that cannot be assessed for compatibility with sustainability issues. This can be due to the incompleteness of the chosen scenarios or their contradictions (in particular, the production of energy in farms).
5.2 billion	Most of the financing considered as neutral corresponds to the personnel costs of school canteens which was subsidised by the municipalities. In 2018 this was approximately 3.5 billion euros. The remainder corresponds essentially to various State operating costs. These include the following: compensation for exemptions from social security contributions in the State budget or for refusal of community clearance, costs related to the payment of subsidies, operating costs of various agencies (Water Agencies, FranceAgriMer, Agence Bio, etc.), costs related to fisheries control, health controls, and other controls, particularly in livestock farming.

2.3.2. Exemptions from taxes and contributions

The tax and contribution exemptions for companies in the food chain are mainly driven by criteria that cannot be assessed in the scenarios we have chosen. Almost all of the remaining 15% are considered to be inconsistent with sustainability issues (**Figure 7**).

FIGURE 7: SUSTAINABILITY OF THE CRITERIA FOR THE ALLOCATION OF TAX AND CONTRIBUTION EXEMPTIONS IN 2018 (IN MILLION EUROS)

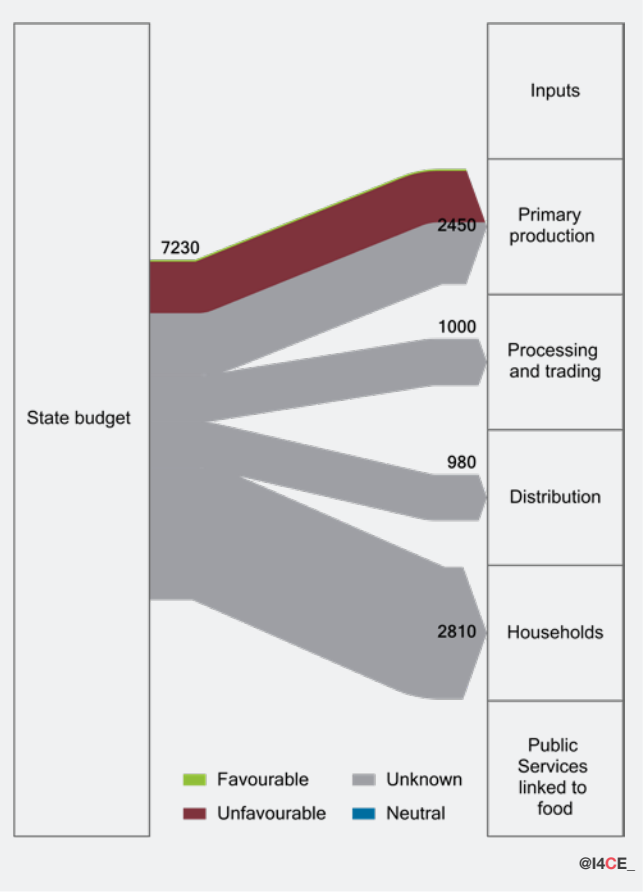


TABLE 3: SUSTAINABILITY OF THE CRITERIA FOR GRANTING TAX AND CONTRIBUTION EXEMPTIONS IN 2018

Amounts (euros)	Details
37 million	These exemptions, which are considered 'favourable', correspond to two measures: tax credits for farmers using organic production methods and reduced tax rates for forestry work by farmers.
1.1 billion	This total is comprised of three exemptions: • 850 million euros – exemption from domestic consumption tax (TIC in French) on diesel fuel under conditions of use (this is attributed solely to gross agricultural production for purposes of simplification). • 240 million euros – TIC exemption on fossil products for use by farms. • 6 million euros (in 2018) – VAT reduction on butcher's animals and charcuterie
6.1 billion	Most of the exemptions considered as having an 'unknown' impact correspond to the VAT reduction on food products for consumption on the spot (2.8 billion euros), the tax credit for competitiveness and employment (CICE, 1.4 billion euros) and a tax reduction on revenues from private and public collective catering (1 billion euros). The lack of a complete description of a sustainable food system prevented us from being able to link these to sustainability marker.

2.4. Financing of investment excluding grants

Non-grant investment financing is marked by a large majority of financing with unknown effects, as well a large proportion of financing considered incompatible with th/e transition to a sustainable food system (**Figure 8**).

Information on the allocation criteria for bond holders and equity holders is particularly difficult to obtain, given the multitude of parties involved. This is less of a problem for commercial banks, whose market is more concentrated, but it still requires interviews for each institution because the required information (amounts of loans granted per year in France and per link) is rarely publicly available.

FIGURE 8: THE SUSTAINABILITY OF NON-GRANT INVESTMENT FUNDING ALLOCATION CRITERIA IN 2018 (IN MILLION EUROS)

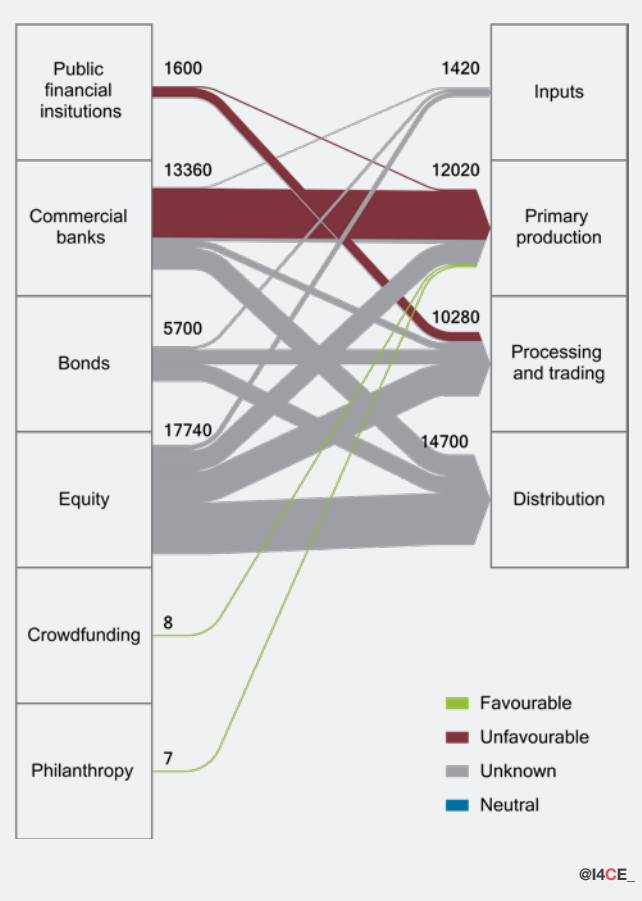


TABLE 4: SUSTAINABILITY OF PRIVATE INVESTMENT FINANCE ALLOCATION CRITERIA IN 2018

Amounts (euros)	Details
15 million	15 million euros – almost equal parts donations from foundations, loans and donations from participatory financing platforms.
9.6 billion	Almost all of this financing (9.5 billion euros) corresponds to commercial and concessional loans issued on the basis of a single criterion of private profitability. This involves the profitability of the company itself, only comparing its profits with its costs. It does not take into consideration any profits or costs that might be received or borne directly by the company. We consider this funding to be detrimental to the emergence of a sustainable food system because the use of such allocation criteria is equivalent to funding a status quo that does not address sustainability challenges. 9.5 billion euros are allocated to projects that are not sustainable. However, the criteria used for selecting projects are not compatible with the necessary system change. The remaining 0.1 billion euros refer to investment grants designated based on criteria that were considered unfavourable.
28.9 billion	28.9 billion euros could not be evaluated due to a lack of information on the criteria used to allocate this funding.

2.5. Household expenditure

It is important to remember that household food expenditure is evaluated by comparing the quantities actually purchased with the recommended quantities for each type of food (meat, cereals, fruit and vegetables, etc.). In addition, each production method (conventional or organic farming)[8].

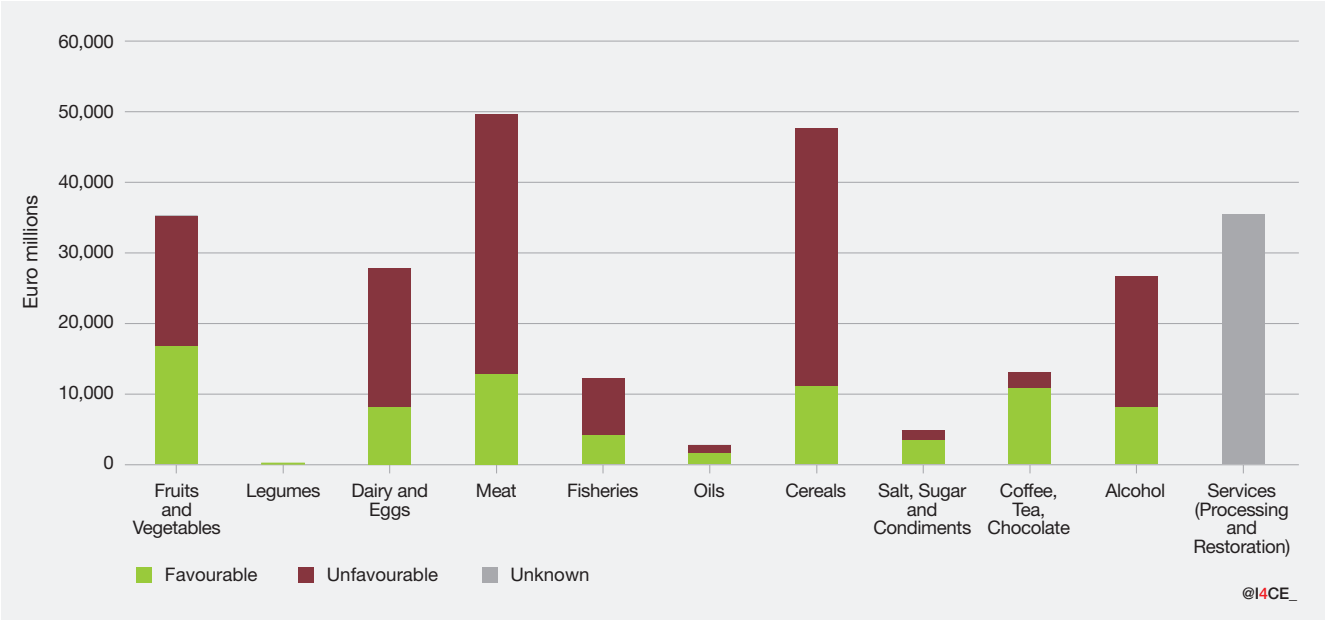
The recommended quantities for each type of food are based on an assumption of a 50% reduction of losses and wastage at the consumer level. The thresholds for each type of food and production method are derived from the averages of the recommendations of the Afterres and TYFA scenarios and the threshold for organic products is therefore set at approximately 70%.

The quantities are then multiplied by average retail prices to obtain expenditures. Any quantities purchased above the defined thresholds are considered unfavourable. The proportion of expenditure considered favourable is then highly dependent on the minimum proportion of organic products set.

Overall, we estimate that 30% of household food expenditures are favourable to a sustainable food system, 55% are unfavourable and 15% are sales and food service expenditures that the scenarios we have selected do not allow us to evaluate in relation to sustainability issues.

The proportion of favourable and unfavourable expenditures varies slightly by food type, the current share of organic products in purchases and by whether the total quantities purchased are in deficit or surplus to recommendations (**Figure 9**).

FIGURE 9: SUSTAINABILITY OF HOUSEHOLD FOOD EXPENDITURES IN 2018 (EUROS)



Note: The food categories "Salt, sugar and condiments" and "Coffee, tea, chocolate" are not subject to a specific recommendation of organic production in the Afterres and TYFA scenarios, so we only apply criteria of consumed quantities

TABLE 5: SUSTAINABILITY OF HOUSEHOLD FOOD EXPENDITURE IN 2018

Amounts (euros)	Details
76 billion	76 billion euros relates to the part of household food expenditure that is compatible with a sustainable diet. It defines both the composition of the plate in terms of major food categories, the efforts to reduce losses and waste at the consumer level and the minimum share of organic farming products.
143 billion	143 billion euros of household expenditure exceed the thresholds defined for sustainable food.
35 billion	The remaining 35 billion euros refers to the share of catering and food processing services included in the price of prepared meals, which we have valued at retail prices. The scenarios we have chosen do not allow us to evaluate this expenditure in relation to sustainability issues.

8 The scenarios do not propose thresholds for the production methods of the categories 'salt, sugar and condiments' and 'coffee, tea, chocolate', so only the quantity thresholds are applied.

Discussion

In this study, we have proposed a method for evaluating the extent to which the financing that flows through the food system contributes to its transition towards a more sustainable development model. We have been able to draw some conclusions from the results we have obtained, although they still need to be analysed in greater detail.

In addition to the results, we hope this study will assist in opening up a debate on the method for evaluating the financing of the food system in light of the challenges associated with sustainable development.

Lessons to be learned

Firstly it is important to note that, when multiple sustainability objectives are being targeted simultaneously, there is a certain consensus in the literature regarding what the main characteristics of sustainable agriculture and food are. This schematic representation provides an initial assessment of the criteria for financing the French food system. It needs to be refined further however, by taking into account socioeconomic issues, defining guidelines at the territorial level, and preparing recommendations beyond the agricultural sector alone for example.

As a result of the methodology we have employed, we are able to draw some specific conclusions concerning public funding, for which we have a great deal of information. A significant percentage of the criteria for the allocation of public funds appear to be inconsistent with the transition to a sustainable food system, while a very small percentage appear consistent with this objective.

When considering investments financing excluding subsidies, the majority of the private financing of investments we studied could not be evaluated in relation to their stake in sustainability due to a lack of information about the origins of the grant providers and the factors that influenced their decisions.

In terms of the criteria that could be evaluated, they were considered incompatible with the transition because they were exclusively based on private profitability requirements.

Lastly, although the methodology used does not allow for the distinction to be made between ‘favourable’ and ‘unfavourable’ percentages of household food expenditure, the figures still appear to be significantly different from the objectives.

A method under debate

Our aim in this report is not merely to provide these relatively general lessons, but to shed light on the methodological obstacles that hinder an evaluation of food system financing in relation to the challenges of a sustainable transition. We have summarised these various obstacles below.

An evaluation such as this, requires defining the food system and measuring the financing that flows through it in a comprehensive manner. It is therefore necessary to compile data from various sources, of different natures and with different perimeters and it is not always easy to make them consistent. The evaluation we propose here is therefore only partial because it was not possible for us to access and process all the data, given the time and resources available to us.

Subsequently, it is necessary to define the characteristics of the sustainable food system from which the current food system is assessed. This is a complex exercise because of both the multiple dimensions of sustainability (environmental, social, economic) and because of the complexity of the food system. The literature on which we rely focuses primarily on the agricultural component and the only examples of scenarios combining sustainability issues of different kinds have so far been limited to environmental and nutritional issues.

As soon as the parameters of the food system are defined and the objectives clearly stated, the question arises of how to accurately assess the sustainability of the various funding flows. Access to data on what is actually financed or on what is supposed to be financed becomes a particularly constraining parameter for the implementation of this evaluation. Perfect information however, would not eliminate all obstacles.

It will also be necessary to define conceptually a method to evaluate the share of funding, both favourable and unfavourable, to a transition that is consists of balances rather than a strict replacement of one activity by another.

This requires knowing the financing needs of each activity in the context of a transition to a sustainable food system – the transition needs are not always identical to the needs of a system that has reached a state of equilibrium.

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Annexes

TABLE 6: CONSENSUS SUSTAINABILITY MARKERS FROM THE NCBS, TYFA AND AFTERRES

Link	Marker - object	Marker - sustainable development
Production of inputs	Resistance of the varieties produced to pests and climatic extremes	Increase
	Production volumes of conventional synthetic pesticides	Decrease
	Volumes of organic crop protection products and services (mating disruption, biocontrol, etc.)	Increase
	Production volumes of antibiotics for livestock (land-based and aquaculture)	Decrease
	Production volumes of conventional nitrogen and phosphate fertilizers	Decrease
Primary production	Areas dedicated to cereal production	Decrease
	Introduction of oilseeds, coarse grains and temporary grassland in main grain rotations	Maintenance
	Rotation profile for field crops	Rotations of at least 4 varieties, including protein crops and coarse grains over at least 6 years
	Location of protein crop production	In all territories
	Areas dedicated to the production of main grains (soft wheat, maize, barley)	Decrease
	Areas for the production of grain and silage cereals for animal feed	Decrease
	Areas for grain corn and silage production	Decrease
	Areas used for the production of coarse grains (oats, rye, durum wheat, buckwheat, millet, etc.)	Increase
	Areas under sugar beet production	Maintenance
	Areas used for oilseed production	Maintenance
	Areas for the production of protein crops (fodder and seed legumes), oilseeds and grass	Increase
	Introduction of protein crops (forage or grain legumes) in field crop rotations	Increase
	Areas used for fruit and vegetable production	Increase
	Use of heated greenhouses	Decrease
	Location of fruit and vegetable varieties	According to the pedoclimatic characteristics of the territories
	Use of conventional synthetic pesticides	Decrease
	A method of applying nitrogen and phosphate fertilizers so as to	Reduce nitrate and phosphorus pollution
	Use of conventional synthetic nitrogen and phosphate fertilizers	Decrease
	Substitution of conventional nitrogen and phosphate fertilizers mainly by	Agroecological practices (soil conservation, crop associations, etc.)
	Size of monogastric and ruminant livestock	Decrease
	Protein surpluses in animal rations	Total abandonment
	Volume and efficiency of manure collection	Increase
	Antibiotic use in farm animals	Decrease
	Living conditions of farm animals	Improvement
	Size of the ruminant herd	Decrease
	Use of mixed breeds of ruminants (milk and meat)	Increase
	Share of grassland products in ruminant rations	Increase

Link	Marker - object	Marker - sustainable development
Primary production *(following)*	Composition of ruminant rations	In order to reduce enteric fermentation
	Size of the monogastric herd	Decrease
	Practice of overfishing	Decrease
	Types of agricultural production for non-food and non-energy uses	Co-products not suitable for food use only
	Net destruction of non-productive areas of ecological interest (hedges, forests, ponds, etc.)	Total abandonment
	Destruction of habitats of protected species	Total abandonment
	Productive areas of ecological interest (buffer strips, nitrogen fixing crops, catch crops, etc.)	Increase
	Location of areas of ecological interest	In all territories
	Presence of trees in cultivated areas and grasslands	Increase
	Location of the agroforestry	In all territories
	Certified organic areas	Increase
	Number of farms with High Environmental Value certification, especially level 3	Increase
	Use of agroecological practices	Increase
Food processing and trading	Volumes collected for primary processing of fruit and vegetables	Maintain or decrease
	Adjustment of storage capacities for gross agricultural production	According to the 'How Much' markers of the 'Gross Agricultural Production' link
	Water efficiency in processing	Increase
	Volumes of meat collected for primary processing into charcuterie	Decrease
	Refined grain volumes	Decrease
	Volumes of ultra-processed foods produced	Decrease
	Water efficiency in processing	Increase
	Use of palm oil in product formulation	Decrease
	Oilseed and protein crop imports from countries at risk of deforestation	Decrease
	Import volumes of fruit and vegetables	Decrease
	Export volumes of milk and dairy products	Maintenance
Distribution and sales	Promoting healthy products with less environmental impact	Increase
	New food distribution establishments on non-artificial surfaces	Total abandonment
	Bulk buying services	Increase
	Proportion of food products sold in stores	According to the markers defined in the 'Supply' links
	Composition of menus served in restaurants	According to the markers defined in the 'Supply' links
	Share of food from organic farming	Increase
Households	Animal protein consumption	Decrease
	Consumption of deli meats	Decrease
	Poultry meat consumption	Decrease
	Consumption of ruminant meat (beef, mutton, goat)	Decrease
	Egg consumption	Maintain or slightly decrease
	Butter and cheese consumption	Decrease

Link	Marker - object	Marker - sustainable development
Households *(following)*	Consumption of fresh fruit and vegetables	Increase
	Legume consumption (chickpeas, lentils, beans, etc.)	Increase
	Consumption of nuts	Increase
	Consumption of simple grains	Decrease
	Whole grain consumption	Increase
	Varieties of whole grains consumed	Diversification
	Sugar consumption	Decrease
	Consumption of ultra-processed products	Decrease
	Volumes of certified organic products	Increase
Research, education, training	Research, R&D and observation	Consistent with other markers
	Teaching	Consistent with other markers
	Training and consulting	Consistent with other markers
Cross-cutting practices, and goods and services from peripheral sectors	Volumes of fossil energy produced	Decrease
	Volumes of renewable energy produced (fuels, electricity, heat)	Increase
	Volumes of renewable gas produced	Increase
	Volumes of renewable heat produced	Increase
	Energy requirements	Decrease
	Use of fossil fuels	Decrease
	Energy efficiency	Increase
	Airplane	Decrease
	Truck	Maintenance
	Boat	Maintenance
	Train	Increase
	Individual vehicles	Decrease
	Individual vehicles	Decrease
	Public transport	Increase
	Bike	Increase
	Number and efficiency of storage facilities for raw agricultural production	Increase
	Total volume of losses and wastage of agricultural products suitable for animal or human consumption	Decrease
	Total volume of petroleum-based agricultural and food waste plastics	Decrease
	Eco-design of food chain services to reduce organic and non-organic waste	Increase
	Share of organic waste recovered	Increase
	Share of non-organic waste recycled	Increase
	Share of non-organic waste incinerated	Decrease
	Share of non-organic waste in landfills	Decrease
	Volumes of food packaging produced	Decrease
	Volumes of petro-sourced plastic packaging produced	Decrease
	Eco-design of packaging in the food chain	Increase
	Volumes of packaging from recycled materials produced	Increase
	Marketing, advertising and information/awareness campaigns	Consistent with other markers

TABLE 7: EXAMPLE OF QUALIFICATION OF CAP GREEN PAYMENT CRITERIA

	Green payment criteria	Durability marker	Assumed evolution when reading the criterion	Evolution recommended by the scenarios	Qualification
CROP DIVERSIFICATION	Where the farmer's arable land covers between 10 and 30 hectares [...] that arable land shall comprise at least two different crops. The main crop shall not cover more than 75% of that arable land. Where the farmer's arable land covers more than 30 hectares [...] that arable land shall comprise at least three different crops. The main crop shall not cover more than 75 % of that arable land and the two main crops shall not together cover more than 95 % of that land.	Rotation profile for field crops	Two to three different crops in the rotation, potentially similar (durum wheat / soft wheat)	Rotations of at least 4 varieties, including protein crops and coarse grains over at least 6 years	Unfavourable
	In particular, the following holdings are excluded: • of which more than 75 % of the arable land is given over to the production of grass or other herbaceous forage, or set aside or subject to a combination of these uses, provided that the arable land not covered by these uses does not exceed 30 hectares. • of which more than 75 % of the eligible agricultural area is permanent grassland, used for the production of grass or other herbaceous forage, or for growing crops under water for a large part of the year or for a large part of the crop cycle, or is subject to a combination of these uses, provided that the arable land not covered by these uses does not exceed 30 hectares.	No corresponding marker	Unknown	X	Unknown
PRESERVATION OF PERMANENT GRASSLANDS	'Member States shall designate environmentally sensitive permanent grassland in areas covered by Directives 92/43/EEC [Habitats Directive] or 2009/147/EC [Birds Directive], including peatlands and wetlands within those areas [...] Member States may decide to designate other sensitive areas outside the areas covered by Directives 92/43/EEC or 2009/147/EC, including permanent grassland on carbon-rich soils Farmers shall not convert or plough permanent grassland within the areas designated by Member States*.'	No corresponding marker	X	X	Unknown
	'Member States shall ensure that the ratio of the area under permanent grassland to the total declared agricultural area does not decrease by more than 5% compared to a reference ratio to be established by Member States in 2015.'	Permanent grassland and non-productive areas of ecological interest (hedges, forests, ponds, etc.)	Maintenance	No consensus	Unknown
ESTABLISHMENT OF AREAS OF ECOLOGICAL INTEREST (EIS)	'Where the arable land of a holding covers more than 15 hectares, farmers shall ensure that, as from 1 January 2015, an area corresponding to at least 5% of the arable land of the holding [...] constitutes an area of ecological interest.*' 'By 1 August 2014 at the latest, Member States shall decide that one or more of the following areas are to be considered as areas of ecological interest: (a) set-aside land; (d) buffer strips, including buffer strips covered by permanent grassland provided that they are separate from the adjacent eligible agricultural area; (f) strips of eligible hectares bordering forests.'	Permanent grassland and non-productive areas of ecological interest (hedges, forests, ponds, etc.)	Maintenance	No consensus	Unknown
	'(b) terraces; (c) topographical features, including features adjacent to the farm's arable land [...].*'	Productive areas of ecological interest (buffer strips, nitrogen fixing crops, catch crops, etc.)	Increase	Increase	Favourable
	'(e) hectares under agroforestry which receive or have received support under Article 44 of Regulation (EC) No 1698/2005 and/or Article 23 of Regulation (EU) No 1305/2013.*'	Presence of trees in cultivated areas and grasslands	Increase	Increase	Favourable

Green payment criteria		Durability marker	Assumed evolution when reading the criterion	Evolution recommended by the scenarios	Qualification
ESTABLISHMENT OF AREAS OF ECOLOGICAL INTEREST (EIS)	'(g) areas planted with short rotation coppice without the use of mineral fertilisers and/or plant protection products; (h) wooded areas [...]'	Out of scope	X	X	X
	'(i) areas bearing catch crops or cover crops established by planting and germinating seed [...]'	Substitution of conventional nitrogen and phosphate fertilizers mainly by	Agroecological practices (soil conservation, crop associations, etc.)	Agroecological practices (soil conservation, crop associations, etc.)	Favourable
	'(j) areas bearing nitrogen-fixing plants.'	Areas for the production of protein crops (fodder and seed legumes), oilseeds and grass	Increase	Increase	Favourable
	The same exclusions apply as for crop diversification.	No corresponding marker	Unknown	X	Unknown
	'(k) areas with Miscanthus; (l) areas with Silphium perfoliatum; (m) areas of melliferous fallow land (composed of species rich in pollen and nectar).'	Areas for the production of protein crops (fodder and seed legumes), oilseeds and grass	Maintenance Increase	Increase	Favourable
	'The use of plant protection products shall be prohibited on all areas referred to in paragraphs 2 [set-aside land], 9 [areas with catch crops or green cover crops] and 10 [areas with nitrogen fixing crops] and on areas used for agricultural production referred to in paragraph 7 [strips of eligible hectares bordering forests].'	Use of conventional synthetic pesticides	Decrease	Decrease	Favourable
Overall qualification of the green payment award criteria.					Unfavourable

* Regulation (EU) 1307/2013

** Regulation (EU) 2017/2393 Article 3(9)

*** Delegated Regulation (EU) 2017/1155, Article 1(4)(d) 8. and (e) 10b

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