



SUSINCHAIN
SUSTAINABLE INSECT CHAIN

SECTORAL ROADMAP AND POLICY RECOMMENDATIONS FOR SUPPORTING LARGE-SCALE COMMERCIALISATION OF HIGH-QUALITY INSECT PRODUCTS IN EUROPE

prepared by Civic Consulting, with input
from all Work Packages, and based on a
broad consultation process

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CHAPTER 1

INTRODUCTION

1. Introduction

This document presents the SUSINCHAIN roadmap to support the scaling of insect protein production in the EU.¹ The roadmap aims at providing a set of practical steps for enabling the transformation of the insect sector to a competitive EU industry that can contribute to EU protein sovereignty. In more detail, the objectives of the SUSINCHAIN roadmap are:

- To present **conclusions** regarding the upscaling of the insect sector at EU level, based on four years of research done in the framework of the SUSINCHAIN project;
- To contribute to the development of a **broad consensus** among stakeholders of steps that need to be taken across all policy areas and levels to establish the insect sector as new animal production system in the EU;
- To guide the implementation of these steps through **targeted policy recommendations**;
- To provide a **point of reference** for the sector and policy makers at EU and national levels to elaborate future policies to support the insect sector.

The roadmap is provided in the next chapter.

¹ The document complements Deliverables 1.5/1.6 (upcoming).



CHAPTER 2

ROADMAP AND POLICY

**RECOMMENDATIONS TO SUPPORT THE
SCALING OF INSECT PRODUCTION IN
THE EU**

2. SUSINCHAIN roadmap and recommendations

The SUSINCHAIN roadmap to support the scaling of insect production in the EU consists of a total of 20 steps that are grouped under six main headings. These are:

1. Strategies, lobbying and driving change
2. Industry collaboration (including with government)
3. Legislative measures
4. Research, development, and technological innovation
5. Sustainability and societal acceptance
6. Economic incentives and access to finance

The SUSINCHAIN roadmap and the accompanying detailed recommendations have been elaborated based on a comprehensive and multi-stage review, Delphi- and brainstorming process. The draft roadmap was discussed in detail by multiple working groups (focusing on different sections of the roadmap) at the final SUSINCHAIN stakeholder workshop on 31 May 2023, and refined on this basis. For more details on our approach for elaborating the roadmap, see Annex I.

A condensed presentation of the roadmap in tabular format is provided on the following pages. It includes an overview of the roadmap steps and the corresponding recommendations, as well as the priorities, targeted stakeholders and relevant levels of action as discussed during the workshop. For a detailed presentation of the roadmap by main heading, see Deliverables 1.5/1.6.

SUSINCHAIN roadmap to support the scaling of insect protein production in the EU

Step in roadmap	Priority	Key stakeholders	Level	Detailed recommendation (* indicates that recommendation is relevant for insects for food only)
Strategies, lobbying and driving change				
1. Recognise that insect sector is a new animal production system which needs to be supported accordingly, including by implementing the recommendations provided in this roadmap	High	All including industry (e.g. insect rearers, processors, users of insect products in the feed/food industry, sector organisations), retailers, government, researchers, consumers/ general public (including public interest NGOs)	EU/ national	1.1 In recent years, the <u>strategic importance of the insect sector</u> has been recognised at EU level in various policy documents, ¹ and several key regulatory milestones have been achieved. ² Building on this notable progress, the insect sector as a new animal production system needs to be <u>further developed and strengthened</u> in similar ways as other livestock sectors ³
	High		EU/ national	1.2 Stakeholders across the insect value chain at EU and national levels to <u>lobby for implementation of the steps and recommendations included in this roadmap</u> to support the scaling of insect protein production, including in the framework of relevant national strategies or roadmaps
2. Introduce dedicated and elaborated actions on insect proteins to EU Protein Strategy	High (related to step 1, above)		EU/ national	2.1 Add dedicated and elaborated actions on <u>insect proteins to the EU Protein Strategy</u> being developed (and possible national protein strategies) to reduce EU dependence on imported proteins
3. Creation of policy working groups on insect production involving relevant ministries and stakeholders	High (related to step 1, above)		EU/ national	3.1 Stakeholders across the insect value chain to lobby for the creation of <u>policy working groups on insect production</u> involving relevant ministries and stakeholders at national level. Examples are the Dutch insect coalition chaired by the Ministry of Agriculture, with involvement of researchers, sector organisations, companies and consumers, and the strategic platform for insects in Flanders, Belgium. ⁴ Equivalent action could be taken in other Member States and at EU level. A general aim of these policy working groups would be to initiate measures that facilitate the scaling of the insect sector, to diversify protein production and promote circularity in line with the objectives of the European Green Deal
Industry collaboration (including with government)				
4. Develop sector organisations/sector platforms in the Member States where they not yet exist	High	Industry, government, researchers	EU/ national	4.1 Development of <u>insect sector organisations</u> in the Member States where they not yet exist, that represent the interests of the insect sector towards policy makers, stakeholders and citizens ⁵ . Broader <u>insect sector platforms</u> could include government, research and sector organisations to promote dialogue and build trust, as is the case in some countries
5. Set up open access EU knowledge network or resource centre to distribute research results and best practices, including regarding veterinary issues	High (for consolidating public information)	Industry, government, researchers	EU	5.1 Set up an <u>open access EU knowledge network or resource centre</u> with and for the insect sector, with the objective to compile available, scattered information from EU and national research projects, initiatives, safety protocols, authorisation guidelines, best practice guides, policy documents, roadmaps, training manuals and programmes etc. and make accessible to the insect sector, researchers and the public sector across the EU. To avoid duplication, this should build on existing initiatives by e.g. EAAP ⁶ and IPIFF ⁷
			National first then EU	5.2 Promote <u>distribution of veterinary research results</u> regarding key insect diseases to address the lack of skilled veterinarians and <u>explore feasibility of designating an EU reference laboratory or centre for insect health and diseases</u> , to address veterinary knowledge gaps that will grow in importance as the insect sector becomes more mature ⁸

Step in roadmap	Priority	Key stakeholders	Level	Detailed recommendation (* indicates that recommendation is relevant for insects for food only)
6. Promote open innovation in the insect value chain and the development and use of standardised specifications for insect products	Medium to high	Industry, government, researchers	EU/national	6.1 Promote <u>open innovation in the insect value chain</u> and the circular bioeconomy in general by open research and co-creation programmes/grant schemes, collaboration networks, and sharing of research results at EU and national levels. Facilitate research (see below), including <u>research on the risks and opportunities associated with using certain feeding substrates</u> in insect production ⁹ and making publicly available information of safe usage of these substrates. Make sure that requirements in the insect value chain allow the <u>safe use of a greater variety of by-products</u> from the food industry, including smaller volume/seasonal by-product streams, to promote full circularity throughout Europe (see also below, legislation and research)
	Low	Industry	EU/ international	6.2 Promote the use of <u>standardised, voluntary (industry) specifications for most common insect products</u> (e.g. specifications of specific types of insect meals used as feedstuff regarding protein content, chitin content, dry matter etc) and <u>standard analytical protocols/procedures</u> ¹⁰
7. Safeguard that all insect producers can benefit from novel food authorisations and promote targeted consumer exposure through well-developed insect food products	Low	Industry, government, researchers	EU	7.1 Promote open access to data used for <u>novel food applications</u> under the Novel Food Regulation and high quality open access applications by groups of operators (or their national associations) to safeguard that all insect producers can benefit from novel food authorisations, to guarantee a level playing field for insect chain operators including SMEs across the EU, and to speed up the scaling process of the insect sector. Consider providing <u>EU research funding</u> for projects creating open access data that could be of use in the context of novel food applications (see also 13, below)*
	Medium to high	Industry, retailers	EU	7.2 Improve consumer acceptance of new food such as insects by exposing consumers to <u>well-developed insect products</u> , (e.g. in the framework of food fairs, tasting events). For this purpose, safeguard sufficient pre-testing of insect products for consumers to avoid negative experiences, taking into account best practices developed and consumer research conducted by SUSINCHAIN*
8. Promote EU and international exchange programmes related to insect farming and processing	Low (higher with respect to veterinarians)	Industry, government, researchers	EU	8.1 Promote <u>EU and international training and exchange programmes</u> related to insect farming and processing for veterinarians, agricultural students, researchers and other professionals
Legislative measures				
9. Develop a tailored legal framework for insect production for food and feed at EU level	High (bullets 1 to 3) Medium (bullets 4 and 5)	Industry, government, researchers	Mostly EU	9.1 Continue to <u>develop a tailored legal framework for insect production</u> ¹¹ for food and feed at EU level (and <u>where relevant for complementary/implementation measures, at national level</u>), including by: <ol style="list-style-type: none"> 1. Widening the categories of feeding substrates permitted for use in insect production, based on research on their safe use (for example, the use of former foodstuffs and catering waste with meat and fish as substrate) 2. Introducing specific food/feed safety criteria dedicated to insect (products) or otherwise clarifying which criteria apply where this is unclear. Relevant criteria are included e.g. in Commission Regulation (EC) 2073/2005 on microbiological criteria for foodstuffs (Annex I on food safety criteria and on process hygiene criteria)¹², as well as EU legislation on contaminants in food and undesirable substances in animal feed 3. Organic certification of insect production activities to allow the use of the EU organic production logo¹³

Step in roadmap	Priority	Key stakeholders	Level	Detailed recommendation (* indicates that recommendation is relevant for insects for food only)
				4. Improving and simplifying rules and border controls to allow safe and efficient export/import of insect products and live insects (eggs/larvae etc.) 5. Draft guidance levels for certain pesticides (e.g. cypermethrin and deltamethrin) with respect to commodities used in insect feeding substrates, such as wheat, carrots, etc., as research has shown that even legally permitted concentrations of pesticides in these commodities can result in significant reductions in insect growth and survival ¹⁴
10. Elaborate a legal framework for use of insects as waste converters for technical applications	Medium	Industry, government, researchers	EU	10.1 Elaborate a legal framework <u>for use of insects as waste converters for technical applications</u> (for non-food/non-feed products such as lubricants, glue, surfactants, chitin/chitosan etc). ¹⁵ In this context, create approaches for safeguarding separated processes for use of insects for technical applications, and prevention of mis-labelling and mis-use (e.g. specific traceability measures to ensure the control of risks to public and animal health). This could, for instance, be implemented by extending existing rules for e.g. zoo and fur animals, which may already be fed with certain non-category 3 animal by-products in the context of Regulation (EC) No 1069/2009
11. Safeguard effective and efficient authorisation and enforcement	High	Industry, government	National/ EU	11.1 Safeguard that <u>food and feed safety standards for both EU produced and imported insect products are enforced</u> throughout the EU
	Medium	Insect industry, government	EU/ national	11.2 Evaluate the practical application of recently introduced legislative requirements for <u>treatment of frass</u> for use as fertilizer and soil enhancer. Develop innovative, safe alternative treatments for frass, and consider their introduction as alternative to heat treatment. This could be concretely implemented by analogy of the 'Method 7' for Processed Animal Proteins in the context of Regulation (EC) No 142/2011, which is any processing method authorised by the competent authority where compliance with certain safety parameters are demonstrated by the operator
	Medium	Government, industry	National, local	11.3 Safeguard <u>efficient authorisation processes</u> in Member States at local level for insect value chain production sites, and disseminate best practices for competent authorities in this respect (incl. relevant guidance documents for local authorities developed at national level)
Research, development, and technological innovation				
12. Identify research needs, priorities and standards to support the scaling of insect production as new animal production system	High	All, especially insect industry, researchers, consumers (for acceptance of results)	EU/ national/ international	12.1 Identify <u>new or continuing research needs and priorities</u> for insect production-related topics, including: ¹⁶ <i>l. Insect safety and nutrition:</i> <ul style="list-style-type: none"> ○ Specific research issues related to food and feed safety, e.g. with respect to knowledge gaps concerning the safety of (authorised and not yet authorised) substrates and substrate mixtures as well as the influence of pre-treatments, effects of potential microbiological and chemical contaminations in the context of differing rearing and processing conditions; and the creation of publicly accessible data relevant for novel food applications where not yet available ○ Allergenicity, and its dependence on the choice of insect species, insect rearing/processing methods and precautions, handling of frass etc ○ Occupational safety and safety precautions, including in relation to allergenicity ○ Human health and nutritional benefits ○ Nutritional value of (authorised and not yet authorised) substrates ○ Digestibility studies for insects in relation to certain substrates and for animals or humans in relation to insect-based diets

Step in roadmap	Priority	Key stakeholders	Level	Detailed recommendation (* indicates that recommendation is relevant for insects for food only)
	High (except for the last bullet – transition – as this is expected to happen on its own as time passes)	Insect industry, researchers, consumers	EU/ national/ inter-national	<p><i>II. Insect production:</i></p> <ul style="list-style-type: none"> ○ Rearing and processing technologies ○ Insect housing design and welfare (including effects of diseases, contaminations affecting insect growth and survival, killing methods etc)¹⁷ ○ Development and further elaboration of specific standard methods for the chemical analysis of insects and related products ○ Biological risks (incl. viruses, fungi,...) and safety measures related to insect production to contribute to specific regulations, where appropriate ○ New insect species that are not yet commonly used (including for special purposes such as waste conversion) ○ Insect genetics (e.g. quantify effects of inbreeding, genetic biodiversity of captive and reared populations, improvement of efficiency, selection vs. bio-engineering) ○ One-health/veterinary issues (insect diseases and parasites) ○ Transition processes from conventional animal husbandry (e.g. pigs, poultry) towards insect production etc.
	High (except for last bullet, as this is already a normal procedure in feed industry)	Insect industry, researchers, consumers	EU/ national/ inter-national	<p><i>III. Utilisation of insect products:</i></p> <ul style="list-style-type: none"> ○ Diversification of end use of insect products, e.g. antimicrobial peptides, fatty acids, special bioactive compounds, chitin/chitosan and to investigate how to increase the yield of certain desired compounds ○ Soil health and fertility in the context of use of insect frass/parts as fertilizer to increase circularity ○ Simultaneous use of insect meals from several species in feed, to balance their different properties
	Medium to high	Insect industry, researchers, consumers	EU/ national/ inter-national	<p><i>IV. Sustainability and circularity</i></p> <ul style="list-style-type: none"> ○ Synergies in circularity, e.g. through the development of combined production systems of plants or livestock and insects (see below) ○ Updated life cycle assessment of insect protein production in comparison to other protein production systems, with the inclusion of economic aspects to better assess cost-efficiency of different approaches (see below)
	High	Researchers, insect industry	EU/ inter-national	12.2 Develop and elaborate research <u>standards and protocols</u> for specific types of insect research, e.g. analysis of feed conversion rates in the context of insect production, protocols for safety related research and research on nutritional composition, welfare guidelines etc., ideally at a global level
13. Provide EU funding for projects focusing exclusively on insects as a new animal production system that crucially contributes to protein sovereignty and circularity, and thereby promote open innovation	Medium	Government, researchers, industry	EU, national	13.1 Provision of <u>EU research funding</u> for projects focusing <u>exclusively on insects</u> as a new animal production system that crucially contributes to protein sovereignty and circularity by upcycling of underexploited biomass, e.g. through Horizon, Interreg, Life, and other relevant programmes, with all results made publicly available (e.g. in open access journals) ¹⁸
	High	All	EU/ inter-national	13.2 Promotion of <u>open innovation and co-creation</u> in the framework of publicly funded research projects, open sharing of datasets and research results; interaction with stakeholders before and in the research phase to safeguard that needs of stakeholders are considered. Use a variety of information channels and formats to distribute research results and related best practices ¹⁹ (and where relevant the underlying data) to all stakeholders, including small companies, in open access

Step in roadmap	Priority	Key stakeholders	Level	Detailed recommendation (* indicates that recommendation is relevant for insects for food only)
<i>and cluster building</i>	High	All	EU/ national	13.3 Promotion of <u>circular, resource-efficient collaborations</u> (circular bioeconomy) and <u>cluster-building</u> as part of the call for proposals for public research grants (e.g. by introducing related requirements in the call)
<i>14. Support and encourage at MS level the creation of demonstration and research farms/centres for insect production</i>	High	All	National	14.1 Support and encourage at MS level the creation of <u>demonstration/research farms or centres</u> for on-farm trials, training of farmers, SMEs etc. and dissemination of best practices to demonstrate insect production on a range of scales, utilising a variety of insect species and substrates, rearing techniques, equipment etc ²⁰
Sustainability and societal acceptance				
<i>15. Provide up-to-date tools to assess the sustainability of insect production and promote synergies in circularity by development of combined production systems involving insects</i>	Medium to high	Industry, retailers, researchers, government, consumers	EU/ national/ inter- national	15.1 Continue and update the work on a <u>standardised life cycle assessment of insect protein production</u> (developed under the SUSINCHAIN project) to provide up-to-date information and online tools to assess true carbon and environmental footprint of insect production in comparison to the footprint of other feed (e.g. fishmeal and soybean meal) and food products (e.g. with beef, pork and poultry as ingredients). ²¹ Make sustainability information (e.g. carbon footprint, circularity aspects) available to consumers through labelling and/or other accessible information sources (QR codes etc.)
	High	Industry, retailers, researchers, government, consumers	EU/ national/ inter- national	15.2 Support finding <u>synergies in circularity</u> to reach the objectives of European Green Deal, e.g. through the development of combined production systems of plants and insects (entomoponics ²²), livestock (poultry/pigs) and insects, mushrooms and insects, through technical applications of insect products (see above) as well as the use of insect frass in biogas production ²³
<i>16. Conduct country-specific education campaigns to inform consumers and stakeholders, and include tasting experiences of well-developed insect food products</i>	Medium to high	Industry, retailers, government, consumers	National/ EU	16.1 Conduct country-specific ²⁴ <u>education campaigns</u> to inform consumers and stakeholders on the sustainability benefits of insect proteins compared to currently used protein sources (e.g. soybean meal and fishmeal), the nutritional benefits of insects as food (especially compared to meat), their safety as food/feed ingredient in line with applicable legislation (e.g. novel food authorisation process), and ethical aspects related to animal welfare, public health, environmental impacts/sustainability and biodiversity, including the nutritional value of insect products in food & feed. Embedded in these education campaigns should be information regarding the broader context, such as circular food systems, waste reduction, and knowledge about the importance of insects in general, e.g. for environment, pollination etc.
	High	Industry, chefs (as role model), catering, retailers, consumers		16.2 Include in these campaigns practical tasting experiences of well-developed insect food products (see above) ²⁵
	Medium	Industry, government, consumers		16.3 Consider the integration of insects as alternative protein sources in national and international nutritional recommendations and guidelines (e.g., Food Pyramid, Food Wheel ²⁶)
Economic incentives and access to finance				
<i>17. Support farmers that diversify or transition from other forms of animal production to</i>	High	Government	EU/ National/ Regional	17.1 Integrate <u>agri-environmental measures</u> under the current Common Agricultural Policy (CAP) in the framework of national rural development programmes to support farmers who decide to diversify their activities by developing insect production or who want to transition from other livestock production systems to insects, ²⁷ and include specific measures to support this transition in the CAP post 2027 ²⁸

Step in roadmap	Priority	Key stakeholders	Level	Detailed recommendation (* indicates that recommendation is relevant for insects for food only)
<i>insects through adequate measures at EU and national levels, including in the framework of rural development and by safeguarding of access to finance for SMEs in the insect value chain</i>	High	Government	EU/ National/ Regional	17.2 Safeguard <u>access to and availability of finance</u> primarily for SMEs in the insect value chain, including through suitable EU instruments, such as the InvestEU Programme. A potential addition on EU and national levels could include the promotion and enhancement of cross-border and national grant schemes
	High	Government	EU/ National/ Regional	17.3 Introduce <u>support measures at MS level to transition</u> from other forms of animal production (e.g. pigs, cattle, mink) to insects (e.g. transition fund to guarantee/ leverage bank loans for livestock farmers that want to transition to insect production), possibly complemented by an EU-funded and coordinated scheme. Support measures are particularly relevant for start-ups and scale-ups, with small volumes and incipient demand, to mitigate high risks in being frontrunners in upscaling European insect businesses
<i>18. Avoid distortion of competition by existing support measures for agricultural development and biogas production</i>	Medium to high	Government, researchers Users of insect services	EU/ National	18.1 Review whether <u>existing financial and legal framework</u> at EU and MS levels to support agricultural development and biogas production result in unfair competition for environmentally preferred uses of biomass, such as upcycling through insect farming and strategies of waste conversion using insects, and adapt financial and legal framework accordingly (see also above) based on demonstration-level research
<i>19. Support the creation of production clusters or cooperative structures to scale up insect production</i>	High	Industry, sector organisations, government	EU/ National	19.1 Provision of coordination mechanisms to <u>support the creation of diversified production clusters or cooperative structures</u> involving businesses and stakeholders of different size and market readiness levels (including level-based groups that enable partners to join when reaching a certain scale), to scale up insect production and thereby support the development of a market for insect proteins to help the sector maturing
	High	Industry, sector organisations, government	EU/ National	19.2 Promote a culture of communication, collaboration, openness and transparency throughout the insect value chain ²⁹
<i>20. Introduce targeted economic incentives for use of insects as healthy and sustainable food ingredient</i>	Medium	Government, Insect industry, Consumers	EU/ National	20.1 Consider introduction of <u>targeted economic incentives for use of insects as healthy and sustainable food ingredients</u> (e.g. mass catering procurement requirement for governmental bodies regarding alternative proteins, VAT reduction or other fiscal measures to reduce or eliminate the price gap to conventional proteins, and to reflect 'true costs' including external costs accruing e.g. to the environment)*
	Medium to high	Government, Insect industry, Consumers	EU/ national	20.2 Implement information and promotion measures supporting the market introduction of food using insects as ingredients at EU and national level (see also above)

Final version of 18 July 2023. This SUSINCHAIN roadmap has been elaborated based on a comprehensive and multi-stage review, Delphi- and brainstorming process. The draft roadmap was discussed in detail by multiple working groups (focusing on different sections of the roadmap) at the final SUSINCHAIN stakeholder workshop on 31 May 2023, and refined on this basis.

¹ The strategic importance of the insect sector has been recognised, for example, by the 'Farm to Fork Strategy' (COM(2020) 381 final), EU action Plan for the Development of Organic Production (COM(2021) 141 final/2), Guidelines for Sustainable and Competitive EU Aquaculture (COM(2021) 236 final), as well as a recent draft EP report on a European Protein Strategy (2023/2015(INI)) Committee on Agriculture and Rural Development, and European Parliamentary Research Service report, EU feed autonomy - Closing the gaps in European food security, Members' Research Service PE 739.328 – February 2023.

² Such as the authorisation for using processed animal protein derived from insects in fish feed in 2017 and its extension to poultry and pig feed in 2021, EU novel food authorisations for edible insects, setting of EU standards for the valorisation of processed insect frass as fertilizer in 2021.

³ During the stakeholder workshop participants pointed out that lobbying activities could as a priority focus on insects as feed as this was seen as having a greater acceptance in the population. It was also highlighted that lobbying should highlight that insect based products not only include proteins, but also oil, frass and other insect products (see also recommendation 12.1 III). Other suggestions for lobbying included to focus on new insect feeding substrates such as manure

to increase circularity and as a waste management strategy (including by promoting decentralised insect rearing by SMEs to use local waste). Finally, it was highlighted that lobbying should also focus on financial incentives for insect production (see also recommendations 17.1 to 20.1).

⁴ Belgium's Strategic Platform for Insects (SPI), is a platform that brings together researchers, policy makers and sector representatives on the topic insect breeding. The platform is joining forces to stand out as a strong Insect Community in Belgium (with focus on Flanders), see <https://lv.vlaanderen.be/dier/insecten/insecten-kweken-en-verwerken>.

⁵ Insect sector organisations currently exist at EU level (IPIFF) and in Member States such as the Netherlands (Venik), Belgium (BiiF), Germany (Arbeitsgruppe „Speiseinsekten Deutschland“, BalproVerband), Portugal (Portugal Insect), France (FFPIDI), Czech Republic (SVZH). IPIFF has established a 'National Network' of associations representing insect producers in the different Member States (see <https://ipiff.org/national-network>). During the stakeholder workshop, it was highlighted that increased collaboration/cooperation between insect farmers, SMEs, and others within the sector at national level could be expected to ease bureaucratic burdens and related costs for small farmers.

⁶ <https://www.eaap.org/study-commissions/insects/>.

⁷ <https://ipiff.org/>.

⁸ See also recommendation 8.1 regarding exchange and training programmes, which were considered most important for veterinarians. There are currently close to 40 EU reference laboratories in the areas of animal health and food and feed safety, including for bivalve molluscs, fish and crustacean diseases and honeybee health, see https://food.ec.europa.eu/horizontal-topics/european-union-reference-laboratories_en. A possible EU reference laboratory or centre for insect health and diseases could potentially also provide taxonomic expertise regarding farmed insects and guide the analysis of protein profiles to detect mislabelling etc.

⁹ IPIFF supports relevant research efforts through its knowledge platform on 'new feeding substrates' (which gathers insect producing companies, academic actors and actors active along the insect value chain).

¹⁰ During the discussions at the stakeholder workshop it was highlighted that the benefit of voluntary (industry) specifications for products would be greater for smaller companies than for large producers / feed companies.

¹¹ A tailored legal framework for insect production might also provide specific rules for specific insect species, where relevant, to accommodate the different characteristics of the farmed species.

¹² Commission Regulation (EC) 2073/2005 on microbiological criteria for foodstuffs provides for specific food categories and microorganisms the analytical methods, the microbiological limits, and actions to be taken when the criterion is not met, and other relevant information. IPIFF has also provided recommendations (proposed microbiological criteria) in its Guide on Good Hygiene Practices (<https://ipiff.org/wp-content/uploads/2019/12/IPIFF-Guide-on-Good-Hygiene-Practices.pdf>). This document was endorsed by the EC's Standing Committee on Plants, Animals, Food and Feed (PAFF), section 'biological safety of the food chain' on 6 October 2022 and by the PAFF, section 'animal nutrition' on 14 November 2022 (see summary reports of the respective meetings accessible through https://food.ec.europa.eu/horizontal-topics/committees/paff-committees_en).

¹³ While activities in this respect are ongoing, currently insect products cannot be marketed with the EU organic production logo (in contrast, certain imported insect products, e.g. from Canada, can carry an organic label).

¹⁴ Undesirable substances in animal feed (including certain pesticides) are currently regulated in Directive 2002/32/EC. Maximum residue levels of pesticides in or on food and feed of plant and animal origin are provided in Regulation (EC) 396/2005.

¹⁵ The Animal by-products Regulation (Regulation (EC) 1069/2009), provides in Article 18 (Derogations) that a competent authority may authorise the use of certain animal by-products for special feeding purposes, incl. for fur animals, and also for maggots and worms for fishing bait. So far, it does not include any possibility to allow for a derogation for feeding of insects raised for industrial (non-feed/non-food) purposes.

¹⁶ For a complementary perspective, see IPIFF, Building bridges between the insect production chain, research and policymakers, v2 May 2022 (<https://ipiff.org/wp-content/uploads/2019/12/IPIFF-researchpriorities-HorizonEurope.pdf>)

¹⁷ During the stakeholder workshop participants highlighted the growing importance of insect welfare, and that more research is needed as soon as possible.

¹⁸ During the stakeholder workshop participants highlighted that the insect sector is still young, so that more and continuous research is very important. Research projects focusing exclusively on insects, but also combined projects with insects as a part of a broader scope (e.g. of alternative proteins) are needed. Funding should focus on both large and broad projects (like SUSINCHAIN), but also smaller specific projects. Diversification in calls and projects is considered necessary.

¹⁹ An example for the dissemination of best practices presenting research results in an accessible manner are the best practice sheets elaborated by the SUINCHAIN project, see <https://susinchain.eu/project-outcomes/best-practice-sheets/>.

²⁰ An example is the Insect Pilot Plant (Geel, Belgium: <https://www.insectpilotplant.be/>). Other examples for research organisations or universities that conduct research on insect production and provide support to farmers, where possible, include KU Leuven (BE), Inagro (BE), Department of Agricultural, Forest and Food Sciences, University of Turin (IT). Other examples from other sectors are: Food Pilot (Melle, Belgium: <https://www.foodpilot.be/nl/>) and Feed Design Lab (Wanssum, the Netherlands: <https://feeddesignlab.nl/en/>). During the stakeholder workshop, participants emphasised the importance of institutions of this type to help smaller players to select, learn, and investigate further steps for scaling up, as not every company has the capacity to do this on its own and therefore open access facilities are considered to be of high importance.

²¹ Participants of the stakeholder workshop indicated that for sustainability assessments multidisciplinary approaches are key, and that the scope of analysis should consider, where possible and appropriate, the combination of insect production with crop production (entomoponics, see recommendation 15.2), and its integration in the energy production system (e.g. the use of process/waste heat for insect production or the use of insect frass for biogas production).

²² Entomoponics is tested at one of the SUSINCHAIN partners, INAGRO See <https://inagro.be/projecten/entomoponics>.

²³ Finding synergies in circularity was considered by participants of the stakeholder workshop to be a task with a global dimension, but also a process where national and EU/international associations can play an important role, with the aim to avoid fragmentation between countries and (global) regions.

²⁴ Consumer research conducted in the framework of the SUSINCHAIN project indicates that information campaigns will need to be country specific to be effective, see Deliverable 1.4 on the SUSINCHAIN website.

²⁵ Participants of the stakeholder workshop suggested that relevant products for tasting could incorporate small amounts of insects in well-known products (also by mixing insects proteins with other known protein sources, i.e. hybrid products), to reduce acceptance barriers and safeguard a positive consumer experience. It was also noted that campaigns should differentiate between different insect species, and should educate consumers about the quality and characteristics of each species used.

²⁶ For more details, see e.g. <https://www.fao.org/nutrition/education/food-dietary-guidelines/background/sustainable-dietary-guidelines/en/>. An example for a food wheel is provided under <https://www.fao.org/nutrition/education/food-dietary-guidelines/regions/portugal/en/>.

²⁷ Note that insect production is not limited to rural areas and can also be based in urban and industrial areas (close to food and feed processing facilities).

²⁸ During the stakeholder workshop participants suggested that support measures should include an emphasis on proven and reliable business cases, which demonstrate a secured return on investment to (new) producers. It was also emphasised that support for farmers to transition to insect production will require increasing access to grants for innovation at farm level also at national, regional and sectoral level.

²⁹ According to participants of the stakeholder workshop, a culture of cooperation would be furthered by standard agreements in the sector as well as some level of coordination between farmers while respecting fair competition, especially in planning production, to avoid dumping or disposal. They referred to Regulation (EU) No 1308/2013 establishing a common organization of the markets for agricultural products, which allows for the establishment and recognition of certain branches or sector organizations in the agricultural sector, following for instance a cooperative model.



Annexes



Annex I – Approach for developing the roadmap

This section presents the approach for developing the SUSINCHAIN roadmap to support the scaling of insect production in the EU. It consisted of the following steps:

- Interviews with insect chain operators
- Research on existing national roadmaps or similar strategic documents
- Delphi and brainstorming process to elaborate a draft roadmap
- Stakeholder workshop on the draft roadmap

Each step is described in the following sub-sections.

Interviews with insect chain operators

As described in detail in Deliverable 1.1, we conducted a total of 19 interviews with selected insect chain operators (companies), to explore specific barriers for upscaling in-depth, that were identified through the survey and the first SUSINCHAIN stakeholder workshop in October 2020. During these interviews, we also obtained a first understanding of the opportunities and barriers as well as of the trends and uncertainties affecting the insect sector, which were further explored in a scenario workshop, conducted in June/July 2022 (see Deliverable 1.3).

The interviews confirmed the practical value of a roadmap to support the scaling of insect production in Europe, and provided a first set of potential steps that could be included after further elaboration. For more details on the specific suggestions by the interviewed operators, see Deliverables 1.1 and 1.5/1.6.

Research on existing national roadmaps or similar strategic documents

In a second step, we identified existing roadmaps or similar strategic documents for the development of the insect sector at national level, through literature and internet research, as well as through the use of the SUSINCHAIN network of experts in key EU Member States and beyond, including insect chain operators and business associations. In total we identified three relevant documents from the Netherlands, France and the UK. These were:

- NL: Venik, Wageningen University, *Agenda for development and innovation in the Dutch insect chain*, October 2020²
- FR: CGAAER Report n°18079 - *Diversification de la ressource protéique en alimentation humaine et animale*, April 2019
- UK: ADAS and Michelmores: *Development of a roadmap to scale up insect protein production in the UK for use in animal feed*. Technical Report prepared for WWF-UK and Tesco, June 2021³

The three documents were reviewed in depth and key roadmap steps/recommendations were extracted in a tabular format. This document is provided as Annex II.

Delphi and brainstorming process to elaborate a draft roadmap

The tabular presentation of national roadmaps prepared in the previous step was then used as the basis for a comprehensive Delphi- and brainstorming process:

1. First, two senior members of the WP1 project team (CIVIC and NGN) discussed during several online meetings the relevance of specific steps/recommendations included in the national roadmaps at EU level. Subsequently, gaps were discussed, i.e. potential elements of an EU roadmap that were not yet included in any of the national roadmaps, either because they were not relevant at national level, or because they were omitted for other reasons.
2. In a second stage, the resulting first draft was circulated to all WP1 members and to the leaders of the other WPs, for their written comments.
3. This prepared the basis for an in-depth face-to-face brainstorming session of SUSINCHAIN WP leaders during a regular WP leader meetings held in January 2023 in Porto. The draft roadmap was considerably changed and extended on this basis.
4. Finally, to provide an opportunity for additional reflection and review of previous suggestions in line with a Delphi-like approach, as well as to fill specific gaps identified during the WP leader meeting, separate in-depth interviews were conducted, both with specific WP leaders that had been involved in the previous brainstorming process, and with an external stakeholder organisation (IPIFF). On

² <https://venik.nl/onewebmedia/Agenda%20development%20&%20innovation%20of%20Dutch%20insect%20chain.pdf>

³ https://www.wwf.org.uk/sites/default/files/2021-06/the_future_of_feed_technical_report.pdf

this basis, the draft roadmap was finalised for a presentation to a broader range of stakeholders.

Stakeholder workshop on the draft roadmap

The final SUSINCHAIN stakeholder workshop was conducted online on 31 May 2023, to allow a broad set of stakeholders to participate. The aim of the workshop was to present best practices for insect production, processing and use, as well as to discuss the draft roadmap to support the scaling of insect production in Europe, elaborated on basis of the results of the SUSINCHAIN project. Registered participants included the following stakeholder groups: Company, Research centre, University, Policy Makers, Associations/cluster/network and other stakeholders (e.g. individuals). Of the registered participants, more than 50% were from companies, with an additional 35% coming from universities or research centres, indicating that the targeted groups were well reached. At the workshop, more than 80 participants were present.

The workshop included a presentation of the roadmap, and a total of six parallel working groups, which reflected the six main headings of the roadmap (see chapter 2 above). Each working group was led by at least two members of the SUSINCHAIN team, and took place twice (one session before the lunch break and one session directly thereafter), so that each participant could discuss steps and related recommendations regarding two main headings of the roadmap, and provide suggestions for additions and refinements, which were considered when elaborating the final version of the SUSINCHAIN roadmap.

Annex II – Key steps/recommendations from national roadmaps or similar strategic documents

National roadmaps or related similar studies/documents to support the scaling of insect protein production, used as starting point for SUSINCHAIN EU roadmap

	UK	NL	FR
Document	<i>ADAS and Michelmores (2021): Development of a roadmap to scale up insect protein production in the UK for use in animal feed. Technical Report prepared for WWF-UK and Tesco</i>	<i>AGENDA FOR DEVELOPMENT AND INNOVATION IN THE DUTCH INSECT CHAIN, October 2020</i>	<i>CGAAER n°18079 - Diversification de la ressource protéique en alimentation humaine et animale, Avril 2019</i>
Scope	<i>Insects for feed</i>	<i>Insect chain in general</i>	<i>Alternative proteins</i>
Strategies, lobbying and driving change	<ul style="list-style-type: none"> Stakeholders across the insect biomass value chain to lobby Government and drive the implementation of the roadmap to support the scaling of insect protein and enhance the environmental credentials of animal feed produced and consumed in the UK (Recommendation 1) Agricultural industry and UK Government to develop and publicise a UK protein strategy to position the requirement for protein in feed (Recommendation 10) 		<ul style="list-style-type: none"> Add an insect component to the National Protein Strategy being developed to reduce protein dependence in the feed sector (R2)
Industry collaboration (incl. with government)	<ul style="list-style-type: none"> Development of a formal body/organisation in the UK which represents the interests of the insect production sector towards UK policy makers, UK stakeholders and citizens (Recommendation 11) Retailers to encourage the use of insect protein as feed within their supply chain and to release a public statement of intent (Recommendation 12) The development of a Publicly Available Specification to create structure and consistency within the insect value chain (Recommendation 13) (good practice definition, led by BSI) 	<ul style="list-style-type: none"> ORGANISATION: TO CREATE A JOINT POINT OF CONTACT [OF THE INSECT INDUSTRY] FOR THE GOVERNMENT, NGOS AND OTHER PARTIES AS WELL AS A COMMON AGENDA, AND TO DEVELOP AGREEMENTS/STANDARDISATION WITHIN THE CHAIN (Objective 1) FOOD SAFETY & QUALITY: TO DRAFT PROTOCOLS THAT ENSURE THE FOOD SAFETY OF ANIMAL PRODUCTS DERIVED FROM INSECTS USED IN HUMAN FOODSTUFFS AND ANIMAL FEED. THESE PROTOCOLS RELATE TO THE CONTROL AND PREVENTION OF POSSIBLE CHEMICAL, MICROBIAL, VIRAL AND ALLERGENIC RISKS (Objective 2) FOOD SAFETY & QUALITY: TO DRAFT DOSSIERS FOR NOVEL FOOD REGULATIONS (Objective 5) VETERINARY SERVICES IN THE INSECT INDUSTRY: TO PROVIDE INSECT BREEDERS WITH EXPERT ADVICE ON OPERATIONAL MANAGEMENT AND HEALTH CARE ON THE FARM AND ENSURE THAT THEY ARE ABLE TO CARRY OUT DIAGNOSTICS FOR KEY INSECT DISEASES IN SPECIALISED LABORATORIES (Objective 8) REGULATIONS: TO ENSURE THAT INSECT BREEDERS AND PUBLIC BODIES ARE AWARE OF WHICH REQUIREMENTS INSECT FARMS MUST MEET IN ORDER TO OBTAIN AN ALL-IN-ONE PERMIT FOR PHYSICAL ASPECTS. THE RELEVANT INFORMATION SHOULD BE INCLUDED IN INFOMIL (Objective 10) CONSUMERS AND SOCIETY: TO PROMOTE TIMELY, OBJECTIVE AND TRANSPARENT COMMUNICATION REGARDING THE BENEFITS AND DISADVANTAGES OF INSECT BREEDING AND ETHICAL ASPECTS RELATED TO ANIMAL WELFARE, PUBLIC HEALTH, ENVIRONMENTAL IMPACT AND BIODIVERSITY, INCLUDING THE POSITIVE VALUE OF INSECT 	

		<p>PRODUCTS IN THE FOOD AND FEED OF HUMANS AND ANIMALS RESPECTIVELY (Objective 15)</p> <ul style="list-style-type: none"> • TRAINING AND EDUCATIONAL DEVELOPMENT: TO ENSURE AN OVERVIEW OF THE PROVIDERS OF EDUCATION AND TRAINING FOR INSECT BREEDING IN THE NETHERLANDS AND FLANDERS IS AVAILABLE; CAPACITY, COMPLEMENTARITY, LEVEL. IN THE SHORT TERM, TRAINING IN INSECT BREEDING WILL BE AVAILABLE AT THE PRACTICAL (SECONDARY VOCATIONAL EDUCATION) LEVEL AND CURRICULA AT A HIGHER PROFESSIONAL AND ACADEMIC LEVEL WILL BE IN THE PIPELINE. TO SET UP KNOWLEDGE NETWORKS WITH INSECT BREEDERS AND RESEARCHERS REGARDING SPECIFIC ISSUES (Objective 16) 	
Legislative measures	<ul style="list-style-type: none"> • To amend existing legislation, or the introduction of legislation specifically addressing the farming of insects for protein in animal feed (cross referencing existing legislation as necessary). (Recommendation 2) • The introduction of legislation permitting the use of insect derived processed animal protein to be used in feed for farmed poultry and pigs intended for human consumption (Recommendation 3) • Future agricultural funding / subsidy schemes to specifically cater for innovative farming methods including the rearing of insects for protein for use in feed. This should include a recognition that the production of insect protein for animal feed is an agricultural activity (Recommendation 4) • Food Standards Agency to be mandated to research the risks associated with using certain substrates as feed in insect production for animal feed. Thereafter, where appropriate, legislation widening the categories of substrate permitted for use in insect protein production (Recommendation 5) • Legislative amendment to permit food business operators to supply permitted materials into feed chain (dual registration option) (Recommendation 6) • Develop regulations and standards for use of frass as fertiliser and soil enhancer to support a domestic market, in order to diversify revenue stream and strengthen business model (Recommendation 7) 	<ul style="list-style-type: none"> • REGULATIONS: TO ENSURE THAT INSECT PRODUCTS THAT COMPLY WITH CURRENT QUALITY REQUIREMENTS (GMP+) MAY BE USED IN PRODUCTION ANIMAL FEED IN THE NETHERLANDS IN ANY CASE, BUT PREFERABLY AT THE EU LEVEL AS WELL (Objective 9.1) • REGULATIONS: TO ENSURE THAT FOOD WASTE AND MANURE PRODUCTS THAT COMPLY WITH ANIMAL FEED SAFETY REQUIREMENTS MAY BE USED AS FOOD FOR INSECTS, WITH INSECT PRODUCTS BEING AUTHORISED FOR ANIMAL FEED PURPOSES (Objective 9.2) 	<ul style="list-style-type: none"> • Modify the French ICPE regulations concerning the breeding of insects for animal feed so that the procedure for authorizing the construction of an industrial production site can be completed within a timeframe compatible with the competitiveness of the sector (R3)
Research, development, and technological innovation	<ul style="list-style-type: none"> • Develop a research agenda that supports an increase in scientific literature and evidence on insect production and its use in animal feed. Where possible, this research should be made publicly available (Recommendation 8) • Support and encourage on-farm trials that are reflective of commercial considerations to demonstrate insect production on a range of scales, utilising a variety of species and substrates (Recommendation 9) • Development of an insect protein technology roadmap that specifically outlines a pathway for how innovation in insect 	<ul style="list-style-type: none"> • FOOD SAFETY & QUALITY: TO DEVELOP SUSTAINABLE PROCESSING TECHNOLOGIES AIMED AT GUARANTEEING THE QUALITY AND SAFETY OF FOOD MADE FROM INSECTS (Objective 3) • FOOD SAFETY & QUALITY: TO IDENTIFY THE FOOD SAFETY RISKS WHEN USING SUBSTRATES FOR INSECTS THAT MAY CONTAIN ANIMAL PROTEINS, SUCH AS RESIDUAL STREAMS FROM THE FOOD INDUSTRY, RETURNED PRODUCTS FROM SUPERMARKETS, HOUSEHOLD KITCHEN WASTE SUCH AS VEGETABLES, FRUIT AND FOOD WASTE, AND FOOD WASTE 	<ul style="list-style-type: none"> • Promote European research programs aimed at the development of predictive models of the allergic risk of food proteins, and in particular that of insect proteins and legumes (R1) • Confirm the acceptability of incorporating insect meal into livestock or pet food by a new consumer opinion survey (R4)

	<p>production equipment, technology, processes and facilities will be developed to increase capacity and efficiencies, as well as drive down overall costs associated with capital and operation expenditure (Recommendation 19)</p>	<p>FROM THE RESTAURANT AND CATERING INDUSTRY (Objective 4)</p> <ul style="list-style-type: none"> • FOOD SAFETY & QUALITY: INSECT FRASS: TRANSPORT, PROCESSING AND SALES OPPORTUNITIES (Objective 6) • VETERINARY AND CONTACT ZOOONOTIC SAFETY: TO IDENTIFY THE VETERINARY RISKS (INCLUDING TRANSMISSION OF NOTIFIABLE DISEASES FOR THE INSECTS THEMSELVES AND THE ANIMALS THAT EAT THE INSECTS OR INSECTMEAL) AND THE CONTACT ZOOONOTIC RISKS AND OCCUPATIONAL DISEASES ARISING FROM THE USE OF CURRENT AND ALTERNATIVE STREAMS AS A SUBSTRATE FOR THE CULTIVATION OF INSECTS, SUCH AS RESIDUAL STREAMS FROM THE FOOD INDUSTRY, MANURE, RETURNED PRODUCTS FROM SUPERMARKETS AND KITCHEN WASTE (SWILL) (Objective 7) • RESEARCH AND DEMONSTRATION CENTRE: TO ASCERTAIN WHETHER THE CREATION OF A RESEARCH AND DEMONSTRATION CENTRE FOR INSECT BREEDING IS FEASIBLE AND DESIRABLE (Objective 17) 	
Sustainability	<ul style="list-style-type: none"> • To conduct a standardised life cycle assessment of insect protein production to understand its true carbon and environmental footprint, which can then be compared with the footprint of fishmeal and soybean meal (Recommendation 14) (partly done by SUSINCHAIN) • Development of UK-level marketing strategy to educate consumers and promote the social and environmental benefits of insect farming compared with alternative proteins (e.g. soybean meal and fishmeal) (Recommendation 15) 	<ul style="list-style-type: none"> • CLIMATE AND CIRCULARITY: TO IDENTIFY AND IMPLEMENT KEY INDICATORS FOR A SUSTAINABILITY ANALYSIS (Objective 11) 	
Economic incentives and access to finance	<ul style="list-style-type: none"> • Implementation of a platform or mechanism to support collaboration and investment, which enables private investors to have confidence in funding the commercialisation of insect production on a larger scale (Recommendation 16) • Government to consider short-term fiscal incentives to enable insect protein to be cost-competitive (Recommendation 17) • Review whether existing financial and regulatory structures to support AD result in unfair competition for feedstock with higher-value, environmentally preferred uses, such as insect farming (Recommendation 1) 	<ul style="list-style-type: none"> • MARKET AND ECONOMY: TO PROFESSIONALISE THE [INSECT] CHAIN, DEVELOP ECONOMIC OPPORTUNITIES AND ACCELERATE CIRCULAR AGRICULTURE AS WELL AS THE PROTEIN TRANSITION (Objective 12) • MARKET AND ECONOMY: TO PROFESSIONALISE A RAPIDLY GROWING CHAIN AND ENCOURAGE OPTIMAL CONDITIONS IN A MARKET THAT IS CHARACTERISED BY GROWTH SPURTS (Objective 13) • MARKET AND ECONOMY: TO OBTAIN SUFFICIENT INSIGHTS REGARDING ACCESS TO FUNDING FOR (START-UP) INSECT BREEDERS AND FOR A BUSINESS MODEL FOR TRANSITIONING BUSINESSES FROM OTHER SECTORS (Objective 14) 	



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