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# SECTORPLAN

AGENDA 2020-2024 FOR DEVELOPMENT  
AND INNOVATION OF THE DUTCH INSECT  
CHAIN, FROM PRODUCTION TO PRODUCT



# AGENDA FOR DEVELOPMENT AND INNOVATION IN THE DUTCH INSECT CHAIN

October 2020



## FOREWORD

The purpose of this agenda and vision on the insect chain is to foster support and encourage the further development of the insect chain. By now, many of us are aware that food production in the Netherlands must undergo further development in order to reduce the impact on the environment. This process involves the development of more circular or climate-neutral solutions that are in balance with nature.

Insects play an indispensable role in nature – for example, as pollinators of flowers, food for other animals, biological controls and decomposers of organic matter – while insects can similarly contribute to sustainable and responsible food for people like us.

At present, commercial insect breeding takes place in the Netherlands on a small and large scale for food, animal feed and technical purposes. The Netherlands is the global leader in terms of insect breeding. With production steadily increasing and demand on the rise, the scientific community, in addition to government authorities and other stakeholders, is fully engaged in the industry. We believe this has created the momentum for development and innovation within the insect chain to be structured and shaped further.

The agenda that we have drawn up provides stakeholders with a set of guidelines that will allow them to strengthen the insect chain in the years to come. Thanks to the sustainable nature of insects, and the unprecedented possibilities and opportunities they could provide, ambition, daring and enthusiasm abound, which is exactly what is needed in this fledging industry.

At the same time, this growth has also resulted in greater exposure, leading to questions which do not always have a clear answer. This agenda provides a structure to build a more transparent and future-proof insect chain.

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## DOCUMENT STRUCTURE

This agenda on development and innovation within the Dutch insect chain is a first step towards a further road map to achieve a healthy and safe insect industry.

**Chapter 1 – *Insects and circular agriculture*** – describes the evolution of the Dutch insect industry and the role of insects in the circular economy.

**Chapter 2 – *Vision*** – sets out the long-term goals and ambitions.

**Chapter 3 – *Current research*** – outlines the research that is currently being undertaken as well as any corresponding questions to be answered.

**Chapter 4 – *Agenda*** – lists the challenges identified by the industry in the short term, with action plans being drawn up for the next three to five years to flesh out those tasks and challenges in detail.

**Chapter 5 – *Moving forward*** – explains how the agenda should be developed into a road map and what the implications of this are.

This memorandum was drafted by the Association of Dutch Insect Breeders (Venik), the Wageningen University & Research (WUR) Laboratory of Entomology and Wageningen Livestock Research and aims to set out the key challenges, as well as the approach to them.

The authors relied on a number of supporting documents, including the report entitled *Ontpopping van de insectensector* (The Emerging Insect Industry) published by the Council on Animal Affairs (*Raad voor Dierenaangelegenheden*, RDA).

The 'Insect Task Force' made a number of key contributions to this agenda. This task force consists of the Dutch Food Retail Association (CBL), HAS University of Applied Sciences, the Ministry of Agriculture, Nature and Food Quality (LNV), Nevedi, the Netherlands Food and Consumer Product Safety Authority (NVWA), the Dutch Society for the Protection of Animals, Wageningen Food Safety Research (WFSR), WUR Food Quality and Design, the Netherlands Nutrition Centre and Wageningen Bioveterinary Research (WBVR). The composition of the Insect Task Force is set out in Appendix 1.

This agenda is explicitly intended to invite stakeholders to participate in its implementation.

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## 1. INSECTS AND CIRCULAR AGRICULTURE: EVOLUTION OF THE INDUSTRY

Insects bring the food chain back into balance with nature and form a natural and critical link in our ability to close cycles. As a result, they provide a significant opportunity for the development of circular agriculture: a system of food production that involves minimal use of raw materials and resources, in which residual streams become available that are then used as raw materials for another link in the chain. Insects fit seamlessly into circular agriculture, with residual streams from the agricultural and food processing industries suitable for use as food for those insects. This will lead to the production of high-quality proteins and fats for the animal feed and food industry, chitin for the pharmaceutical industry and the production of manure, which, in turn, can be used as fertiliser in the horticultural industry. Insect breeding is aimed at reducing the consumption of raw materials and reducing the pressure on the environment, taking into account responsible production methods in relation to humans, animals and the environment. This agenda provides guidelines for the steps required to achieve a healthy and responsible growth of the emerging insect chain in the direction of a transparent and sustainable future for the industry.

### **Insect breeding**

Insects need little water and space during the breeding process. They grow rapidly and efficiently, are able to use organic residual streams as sustenance and produce a small amount of greenhouse gases. As such, insect breeding is a lot more sustainable than the production of any other animal protein.

More than 10 years after the introduction of insects in the Memorandum on Sustainable Food and the Innovative Protein Chains programme (national government, 2009), there is an ever-increasing public interest in the development of a sustainable insect chain. Efficient, circular and sustainable protein production for food and animal feed purposes are the key drivers behind the emergence of the insect industry. The Netherlands plays a leading role in the innovation and development of the insect industry worldwide. In the opinion of the Minister of Agriculture, Nature and Food Quality, insects as production animals have a promising future due to the potential role they could play in closing cycles (national government, 2019). Consequently, the Minister has assigned a key role to insect breeding in the National Protein Strategy (national government, 2020) as a regional protein source for food and animal feed.

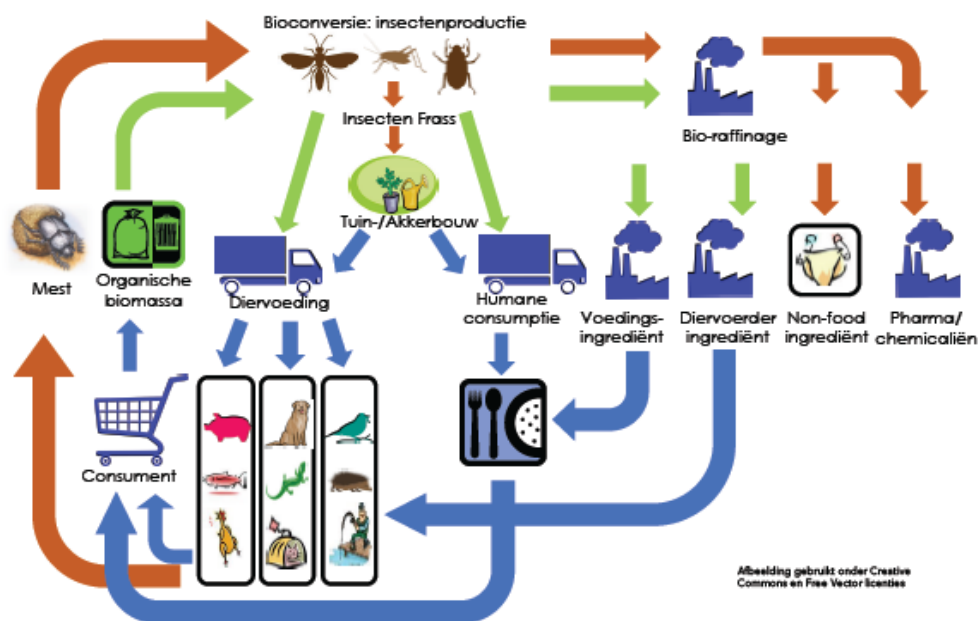
### **Insect breeding: contributing to the circular economy and biodiversity**

On the one hand, insect protein is regarded as an alternative to the import of high-protein vegetable raw materials from third countries and fishmeal to feed more evolved animal species. The use of insect protein will help combat overfishing of the oceans and deforestation and will thereby contribute to combating the loss of biodiversity.

On the other hand, the insect species that are used for breeding are natural waste processors, including of organic residual streams and manure. At present, insects derive most of their food from vegetable food waste. There is significant potential for other organic streams to be used as food for insects. Not all organic residual streams, however, are permitted as food for insects under the law.

Insect breeding has the potential to close cycles and make a vital contribution to a circular economy. The insects can subsequently become an ingredient in our own food or form a base ingredient in high-protein animal feed. By reusing food waste and putting it back into the food chain, insects serve to close the food cycle.

The circular vision for the insect industry is shown in this diagram.



Bioconversion: insect breeding

Insect frass  
 Horticulture/arable farming  
 Biorefinery  
 Manure  
 Organic biomass  
 Animal feed  
 Human consumption  
 Food ingredient  
 Animal feed ingredient  
 Non-food ingredient  
 Pharma/chemicals  
 Consumer

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Figure: Closing cycles – the circular insect chain

### Why insects?

The potential of insects

- Becoming less dependent on vegetable and animal protein sources from third countries and oceans
- Nutritious high-quality protein with a low dependence on land and water

- Local and circular upgrading of food waste and other organic residual streams
- Fully circular, with the 'residual stream' of chitins and excreta likewise to be used as a natural insect manure (frass) and soil improver

### 1.1 INSECT BREEDING IN THE NETHERLANDS

The Netherlands has a leading role in Europe when it comes to research and innovations in the insect chain. Up until 10 years ago, insect breeding in the Netherlands was limited and focused mainly on supplying prey for keepers of pets (birds, reptiles, amphibians, fish and a number of mammal species). The insect species in the Netherlands that are primarily bred for use in animal feed and for human consumption are mealworms, lesser mealworms, fly larvae, crickets and grasshoppers.

Outside Europe, there are various cultures that have traditionally used insects for human consumption. These insects, however, are harvested from nature in season rather than being bred.

In recent years, the insect industry has been developing and professionalising rapidly, with major investments having taken place and a number of production sites with significant capacity having been started up. Farmers, particularly from the pig and fur animal industry, have expressed interest in switching, while the original insect breeders have identified opportunities for new markets. Other agricultural businesses, especially poultry farms, regard insect breeding as an opportunity to expand their operations. For that reason, the industry is both highly dynamic and highly diverse at present, in terms of size, the animal species and food sources used and the market.

The Association of Dutch Insect Breeders (Venik) is the trade association that has represented the interests of Dutch breeders since 2008. Appendix 2 provides a brief overview of the current state of the insect industry in the Netherlands.

### 1.2 DEVELOPMENT OF THE INSECT MARKET

At present, demand for insects and insect products outstrips supply. A constant supply of larger volumes of consistent quality and a competitive price is essential to ensuring the regular use of insects in animal feed. The first steps towards major markets, such as aquaculture and the ingredients industry (including for foodstuffs), are on the horizon.

This will require scaling of the insect chain. As a consequence, a number of new and existing businesses are currently investing in large-scale insect breeding. Appendix 3 provides information on market expectations.

### 1.3 INSECTS AND REGULATIONS

Live insects may be used for animal feed. A limited number of insect species are permitted for human consumption, pending the approval of novel food dossiers. Currently, processed insects (protein, fats and other raw materials) have a limited field of application. In the EU, processed insect protein is authorised in pet food and in aquaculture. It is expected that processed insect protein will also be authorised as a high-protein raw material for poultry feed from 2021. In the years to follow, the pig industry will also become accessible to processed insect protein. Hydrolysed insect protein and insect fats, if purified and therefore free of protein, are already authorised for use in the feed of all farm animals. Appendix 4 provides an overview of the uses of insects in feed and food.



The Letter to Parliament on the Insects for Feed, Food and Pharma Green Deal states that the Dutch government is making efforts to expand the field of application for insects. Meanwhile, developments are under way in the relevant legislative framework at the European level. National and regional implementation is critical for key issues, such as beneficial locational advantages (including all-in-one permits for physical aspects), the use of frass and the use of residual streams like manure to feed insects that are produced for non-food applications (Huitema, 13 December 2018).

The result of these efforts is that the use of insect protein in animal feed is one step closer at the EU level and is expected to become authorised for use in feed for poultry and pigs in the short term, provided that insects are bred on authorised substrates. This is the crucial juncture at which the Netherlands is able to play a leading role in a European context in terms of research into the safety of authorising low-grade residual streams from the food chain and from agriculture and farming as a substrate for insects, bringing circular agriculture one step closer.

#### 1.4 THE FUTURE OF THE DUTCH INSECT INDUSTRY

In today's small and diverse insect industry with high internal and external expectations, clarity regarding laws and regulations and stable development opportunities is essential. The current regulations on the breeding and processing of insects are insufficient to be able to guarantee sustainable development,

given that current players have long-term ambitions and goals. The necessary 'no regret' steps to be taken in the short term can be distilled from those goals, after which the industry will have entered the next phase of development and be able to develop a more detailed, long-term vision for the industry/chain.

## 2. VISION: LONG-TERM GOALS AND AMBITIONS (2030 AND BEYOND)

By 2030, the insect industry will be an indispensable link in circular agriculture, process one third of local organic residual streams, be energy and carbon neutral, have replaced half of the fishmeal in animal feed produced in the Netherlands with insect protein, and be an example to other animal industries as a result of far-reaching modernisation and innovations in the field of food safety compliance and public health.

The targets we have set ourselves are:

- The development and supply of products of a good and consistent quality for human consumption, feed for production animals and pet food.
- Production methods and products that are safe from a public health, animal health, welfare and biodiversity perspective.
- An insect industry that operates based on a fair earnings model and provides workers in the industry with a safe and enjoyable working environment.
- Insect breeding and processing activities that result in minimal damage to the environment and aim to be climate and energy neutral.
- A social charter regarding the production conditions (including the welfare of the insects), resulting in the industry having a 'licence to produce'.
- Insect breeding occupies a valued and accepted position within the food chain as a result of a 100% use of nutrients from organic residual streams.
- Frass is accepted as a valued fertiliser with real gains for insect breeders.
- The Netherlands operates at the forefront of knowledge development in relation to insect breeding and has set up a global supply chain.

### 3. CURRENT RESEARCH

#### 3.1 NATIONAL SCIENCE AGENDA

The WUR Laboratory of Entomology is currently working with a number of parties, including Wageningen Livestock Research, Wageningen Food Safety Research, the University of Groningen, the NVWA, Rabobank and other partners in the insect industry, on a research programme established under the National Science Agenda (January 2020–December 2023) that focuses on insects as feed for poultry (WUR, 2019): 'Insects as sustainable feed for a circular economy: interdisciplinary approach to value chain development (INSECTFEED)'.

The main themes of the research programme are as follows:

1. Circular economy: how insects can be cultivated as a type of 'miniature livestock' to serve as sustainable animal feed in a circular economy.
2. Insect welfare: research into the health, welfare and intrinsic value of insects kept for breeding purposes.
3. The welfare and health of poultry fed with insects.
4. Economy: the economic robustness of the new insect industry
5. The safety of insects used in animal feed

#### 3.2 NWO CIRCULAR ECONOMY PROGRAMME

The WUR Laboratory of Entomology, working alongside the Netherlands Institute of Ecology (NIOO-KNAW), the WUR Business Economics research group and partners from the private sector, has been working on the research programme 'Closing the Loop' (2018–2021).

This programme has focused on studying the impact of the residual stream from the insect industry (so-called 'frass', the 'manure' resulting from insect breeding) on the soil ecology and the growth and health of cabbage plants.

#### 3.3 EUROPEAN AGENDA

##### Insect Doctors

The European 'Insect Doctors' programme focuses on the development of a network and training programme that aims to develop knowledge of and the ability to diagnose infectious diseases, as well as effect relevant treatment, in insect breeding systems through research conducted by PhD candidates.

More information can be found at <https://www.insectdoctors.eu/en/insectdoctors/about.htm>.

This European network and the acquired knowledge may lead to crucial input with regard to animal health in the insect industry. In addition, the diagnosis of insect diseases is still in its infancy, as determined in the WUR project VetSect of Wageningen Bioveterinary Research in 2019.

##### SUSINCHAIN

The European project 'SUSINCHAIN – Sustainable Insect Chain' was launched on 1 October 2019, with a duration of four years. This project, involving 35 European partners, is coordinated by Wageningen Livestock Research. The aim of this project is to contribute to the protein transition in

human nutrition and animal feed by removing the main barriers to an economically viable insect value chain. Within the project, activities are being carried out in the following work packages:

1. Market opportunities and barriers, including consumer acceptance
2. Scale-up of insect breeding
3. Insect processing
4. Insects as animal feed
5. Insects for human consumption
6. Safety in the insect value chain
7. Decision support system for sustainable insect value chains

#### 4. AGENDA: WHAT ARE THE NEXT STEPS?

##### 4.1 ORGANISATION






The sustainable development of the insect industry will require organisation at the breeder level in any case, but ideally at the level of the chain as well. It is crucial that a form of registration is put in place for insect breeders and that it is clear which permit requirements insect breeders must meet.

The organisation to be set up will consult and liaise with public bodies (at the national, provincial and municipal levels), NGOs and other parties on behalf of breeders and other affiliated members with regard to shared issues. The relevant organisation will also ensure transparency in the chain.

As a prelude to a formal organisation for breeders and the chain, an informal task force would be able to pave the way and draw up a joint vision and agenda. Venik, WUR (WLR and the WUR Laboratory of Entomology) and LNV took the lead in this regard by establishing a task force of this kind, which met on four occasions in 2019.

As a point for attention, the insect industry is highly diverse in terms of the size of business, the phase of life of those businesses (relatively high number of start-ups), production purpose (feed, food, pharmaceuticals, 'waste processor') and the insect species used for breeding. This will have to be taken into account when setting up the organisation.

##### OBJECTIVE 1





	<b>OBJECTIVE 1:</b> TO CREATE A JOINT POINT OF CONTACT FOR THE GOVERNMENT, NGOS AND OTHER PARTIES AS WELL AS A COMMON AGENDA, AND TO DEVELOP AGREEMENTS/STANDARDISATION WITHIN THE CHAIN.
	<b>CHALLENGE:</b> TO ORGANISE THE INSECT INDUSTRY AND IDENTIFY STRATEGIES AIMED AT ACHIEVING SUCCESSFUL COOPERATION WITHIN THE INSECT INDUSTRY, INCLUDING STAKEHOLDERS, WITH THE AIM OF EFFECTIVELY SCALING UP THE ENTIRE CHAIN, INCLUDING IN TERMS OF STABLE PRODUCT QUALITY AND RELIABLE SUPPLY.
	<b>STAKEHOLDERS:</b> VENIK, INSECT BREEDERS THAT ARE NOT AFFILIATED WITH VENIK, POTENTIAL CUSTOMERS AND SUPPLIERS (I.E. FARM EQUIPMENT, FEED FOR THE INSECTS), LNV.
	<b>INITIATOR:</b> VENIK IN CONSULTATION WITH LNV AND WUR (WLR, WUR LABORATORY OF ENTOMOLOGY, WU FOOD QUALITY AND DESIGN IN CONSULTATION WITH BUSINESS MANAGEMENT AND ORGANISATION).
	<b>TIMELINE:</b> IN 2021, A BINDING DECLARATION WILL BE REQUESTED FROM THE MINISTRY OF ECONOMIC AFFAIRS AND/OR A PRODUCERS' ORGANISATION (PO) OR TRADE ASSOCIATION (TA) WILL BE SET UP.

##### 4.2 FOOD SAFETY AND QUALITY, ZONOSSES AND RISKS OF ANIMAL DISEASES





Insect breeding has been taking place for years without any food safety or veterinary incidents. Nevertheless, there are still a large number of unknown factors, including in relation to the processing of insects.

###### 4.2.1 FOOD SAFETY AND QUALITY


##### OBJECTIVE 2



	<b>OBJECTIVE 2:</b> 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.
	<b>CHALLENGE:</b> TO ENSURE THE FOOD SAFETY AND QUALITY OF INSECT (INSECT PRODUCTS) FOR HUMAN FOODSTUFFS AND ANIMAL FEED.
	<b>INITIATOR:</b> WFSR IN CONSULTATION WITH NEVEDI. THE NVWA AND VENIK WILL BE CO-READERS TO THE DRAFTING OF THE PROTOCOLS AND GUIDANCE.
	<b>TIMELINE:</b> BY 2021, AN ACTION PLAN WILL HAVE BEEN DRAFTED REGARDING HOW AND FOR WHICH LINKS IN THE CHAIN SUPPLY CHAIN COMPLIANCE CAN BE REALISED FOR INSECTS (INSECT PRODUCTS). THE AVAILABLE KNOWLEDGE AND MODELS FOR OTHER ANIMAL PRODUCTS AND PROCESSING TECHNOLOGIES WILL BE DRAWN ON FOR THAT PURPOSE.

### OBJECTIVE 3




	<b>OBJECTIVE 3:</b> TO DEVELOP SUSTAINABLE PROCESSING TECHNOLOGIES AIMED AT GUARANTEEING THE QUALITY AND SAFETY OF FOOD MADE FROM INSECTS.
	<b>CHALLENGE:</b> TO IDENTIFY APPLICABILITY AND LIMITING FACTORS IN RELATION TO PROCESSING. TO GAIN AN INSIGHT INTO THE IMPACT OF MILD, ALTERNATIVE PROCESSING TECHNOLOGIES AND FRACTIONATION FOR BROADER, MORE TARGETED APPLICABILITY OF INSECTS IN PRODUCTS AIMED AT THE PROCESSING OF INSECTS, IN WHICH OPTIMAL SAFETY IS ACHIEVED IN CONJUNCTION WITH RETAINING HIGH-QUALITY PROTEIN FRACTIONS AND ORGANOLEPTIC PROPERTIES.
	<b>INITIATOR:</b> WUR FOOD QUALITY AND DESIGN IN CONSULTATION WITH VENIK, THE CBL AND THE NETHERLANDS NUTRITION CENTRE.
	<b>TIMELINE:</b> ACTION PLAN TO BE FINALISED IN 2021.

### OBJECTIVE 4





	<p><b>OBJECTIVE 4:</b> 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 FROM THE RESTAURANT AND CATERING INDUSTRY.</p> <p>IN ITS RISK ASSESSMENT, THE NVWA BURO (2020) CONCLUDED THAT LARVAE OF THE BLACK SOLDIER FLY, LARVAE OF THE HOUSEFLY, MEALWORMS AND SMALL MEALWORMS THAT ARE CULTIVATED ON SO-CALLED FORMER FOODSTUFFS MAY BE USED SAFELY – UNCEER CERTAIN CONDITIONS – AS AN INGREDIENT FOR ANIMAL FEED.</p>
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	<b>INITIATOR:</b> WFSR IN CONSULTATION WITH NEVEDI, WASTE MANAGEMENT COMPANIES, MUNICIPALITIES, WLR, WBVR AND THE NVWA.
	<b>TIMELINE:</b> BY MID-2021, A PARTNERSHIP WITH OTHER BUYERS OF RESIDUAL STREAMS WILL HAVE BEEN REALISED TO CONDUCT A JOINT ANALYSIS OF FOOD SAFETY RISKS AND TO IDENTIFY AND DEVELOP OPTIMAL APPLICATION METHODS.

#### OBJECTIVE 5

	<b>OBJECTIVE 5:</b> TO DRAFT DOSSIERS FOR NOVEL FOOD REGULATIONS.
	<b>INITIATOR:</b> INDIVIDUAL BUSINESSES
	<b>TIMELINE:</b> BY 2021, IT SHOULD BE CLEAR WHAT TYPE OF DOSSIERS MUST BE CREATED FOR NOVEL FOOD REGULATIONS AND AN ACTION PLAN AIMED AT ACHIEVING THIS WILL HAVE BEEN DRAFTED.


#### OBJECTIVE 6





	<b>OBJECTIVE 6:</b> INSECT FRASS: TRANSPORT, PROCESSING AND SALES OPPORTUNITIES.
	<b>STAKEHOLDERS:</b> VENIK, THE NVWA, BUYERS OF FOODSTUFFS FOR HUMAN CONSUMPTION, NEVEDI, LNV, THE MINISTRY OF HEALTH, WELFARE AND SPORT, THE RIVM, WUR (PSG, WFBR, FOD, WFSR, WBVR).
	<b>INITIATOR:</b> THE WUR PLANT SCIENCES GROUP AND VENIK.
	<b>TIMELINE:</b> BY 2021, IT SHOULD BE CLEAR WHAT THE ROLE AND POSITION OF INSECT FRASS AND THE MARKET OPPORTUNITIES ARE.

#### 4.2.2 VETERINARY AND CONTACT ZOOLOGICAL SAFETY

As in other farm animal sectors, the veterinary safety in relation to the cultivation of insects has been a key focus area. Any effects of skin contact with insects by professionals in the industry must likewise be examined in order for this aspect of safety to be safeguarded further. This will require risk assessments.

#### OBJECTIVE 7:







	<b>OBJECTIVE 7:</b> 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 ZOOLOGICAL 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).
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	<b>CHALLENGE: 1.</b> TO IDENTIFY THE VETERINARY RISKS (INCLUDING TRANSMISSION OF NOTIFIABLE DISEASES FOR THE INSECTS THEMSELVES AND THE ANIMALS THAT EAT THE INSECTS OR INSECTMEAL) AND INTERVENTION PROCEDURES.  <b>CHALLENGE: 2.</b> TO IDENTIFY CONTACT ZOOLOGIC RISKS AND OCCUPATIONAL DISEASES, AS WELL AS INTERVENTION PROCEDURES.
	<b>STAKEHOLDERS:</b> ALL LIVESTOCK SECTORS, VENIK, GD ANIMAL HEALTH, THE NVWA, NEVEDI, WUR (WBVR, WFSR, WUR LABORATORY OF ENTOMOLOGY, WUR LABORATORY OF VIROLOGY), THE RIVM.
	<b>INITIATOR:</b> WBVR IN CONSULTATION WITH WFSR.
	<b>ACTION PLAN:</b> CARRY OUT A RISK ASSESSMENT, ORGANISE AN EARLY WARNING SYSTEM, DRAFT A PREVENTION POLICY/PROCEDURES AND SET UP A NOTIFICATION DESK. COMPLETED BY 2021.

#### 4.2.3 VETERINARY SERVICES IN THE INSECT INDUSTRY

At present, there is no institutional knowledge accumulation in the insect sector in relation to animal health and disease prevention.

#### OBJECTIVE 8:

	<b>OBJECTIVE 8:</b> 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.
	<b>CHALLENGE:</b> TO SET UP A VETERINARY CARE SYSTEM FOR THE INSECT INDUSTRY.
	<b>STAKEHOLDERS:</b> INSECT BREEDERS, VENIK, WUR (WUR LABORATORY OF VIROLOGY, WBVR), THE NVWA, UU.
	<b>INITIATOR:</b> WUR (WBVR IN CONSULTATION WITH THE WUR LABORATORY OF VIROLOGY).
	<b>TIMELINE:</b> FOLLOW-UP IN EU STUDIES FROM 2021 AND CURRENT STUDY (VETSECT, 2019).
	<b>ACTION PLAN:</b> TAKE STOCK OF THE STATE OF PLAY IN RELATION TO INSECT DISEASES WORLDWIDE AND IN RELATION TO LABORATORIES. USE AS A BASIS FOR EDUCATION (INCL. VETERINARY MEDICINE), RESEARCH, ACCESSIBLE SERVICES AND KNOWLEDGE IN THE FIELD OF INSECT HEALTH.

#### 4.3 REGULATIONS

In recent years, Dutch insect breeders, working alongside research institutions and the national government, have succeeded in putting regulatory issues on the European agenda (Green Deal B092 and the recent BuRO risk assessment). We wish to continue this work in the years to come and








underpin it with relevant research data. At present, national and EU regulations hamper the potential use of insect products in production animal feed. Circular agriculture is also hampered, because various substrates used to breed insects as production animals are not authorised.


Changes to the regulations are crucial to advancing circular agriculture. This will require evidence in the form of research into the safety of the insects bred on former foodstuffs and, perhaps, into some non-food/feed applications. Similarly, manure is a perfectly suitable substrate that is already on the menu of various insect species in nature. Limiting and cost-elevating factors in this regard include TSE and animal feed regulations.





In addition, there is very limited knowledge on the integration of insect farms into the environment (all-in-one permit for physical aspects). Guidelines for municipalities specifically for insect farms (with insect farms to be explicitly included in Infomil) would be a welcome boost to the industry.

**OBJECTIVE 9:**

	<p><b>OBJECTIVE 9.1:</b> 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.</p> <p><b>OBJECTIVE 9.2:</b> 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.</p>
	<p><b>CHALLENGE 9.1:</b> TO CONDUCT RESEARCH TO SUBSANTIATE CHANGES TO EU REGULATIONS ON THE USE OF INSECT PRODUCTS IN PRODUCTION ANIMAL FEED.</p> <p><b>CHALLENGE 9.2:</b> TO CONDUCT RESEARCH TO SUBSTANTIATE CHANGES TO EU REGULATIONS ON THE FEEDING OF INSECTS WITH RAW MATERIALS APPROPRIATE TO CIRCULAR AGRICULTURE (FOOD WASTE, MANURE PRODUCTS).</p>
	<p><b>STAKEHOLDERS:</b> VENIK, NEVEDI, POULTRY SECTOR, PIG SECTOR, LNV, WBVR, WFSR, THE NVWA.</p>
	<p><b>INITIATOR:</b> VENIK IN CONSULTATION WITH NEVEDI. FURTHER COLLABORATION WITH THE POULTRY SECTOR MAKES SENSE, GIVEN THAT THE SECTOR PLAN FOR THE POULTRY SECTOR INCLUDES THE USE OF INSECTS.</p>
	<p><b>TIMELINE:</b> ACTION PLAN BY MID-2021.</p>







**OBJECTIVE 10:**

	<p><b>OBJECTIVE 10:</b> 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.</p>
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	<b>CHALLENGE:</b> TO ACHIEVE CLARITY REGARDING THE REQUIREMENTS FOR INSECT FARMS IN RELATION TO ALL-IN-ONE PERMITS FOR PHYSICAL ASPECTS.
	<b>STAKEHOLDERS:</b> ENVIRONMENTAL AGENCIES, MUNICIPALITIES, PROVINCES, FARMERS/TRANSITIONING ENTREPRENEURS, INSECT BREEDERS.
	<b>INITIATOR:</b> VENIK IN CONSULTATION WITH WLR.
	<b>TIMELINE:</b> IN 2021, VENIK WILL CONSULT WITH PERMIT AUTHORITIES ON WHAT INFORMATION IS AVAILABLE AND ON WHAT INFORMATION SHOULD BE MADE AVAILABLE.






#### 4.4 CLIMATE AND CIRCULARITY

##### OBJECTIVE 11






	<b>OBJECTIVE 11:</b> TO IDENTIFY AND IMPLEMENT KEY INDICATORS FOR A SUSTAINABILITY ANALYSIS.
	<p><b>CHALLENGE:</b> TO GAIN AN INSIGHT INTO THE SUSTAINABILITY ASPECTS OF THE VARIOUS PRODUCTION SYSTEMS:</p> <ol style="list-style-type: none"> <li>1. REQUIRED RAW MATERIALS FOR FEED (TYPES, ORIGIN)</li> <li>2. INTEGRATION INTO THE FOOD SYSTEM</li> <li>3. USE OF LOW-GRADE AND UNUSED RESIDUAL STREAMS AS A SUBSTRATE FOR INSECTS</li> <li>4. ENERGY CONSUMPTION</li> <li>5. EMISSIONS SUCH AS AMMONIA, NITROUS OXIDE AND METHANE</li> <li>6. CARBON FOOTPRINT</li> <li>7. USE OF CO-PRODUCTS, LIFE CYCLE ANALYSES, ENVIRONMENTAL SCENARIO STUDIES AND ECONOMIC SCENARIO STUDIES</li> <li>8. DIFFERENCES BETWEEN VARIOUS FARMING SYSTEMS (SPECIES, SUBSTRATE AND PRODUCTION SYSTEMS) IMPACT ON ENVIRONMENT AND PRODUCTION EFFICIENCY</li> </ol>
	<b>STAKEHOLDERS:</b> VENIK, NGOS, LNV, BUYERS, WUR (WLR, WU APS), HAS UNIVERSITY OF APPLIED SCIENCES.
	<b>INITIATOR:</b> WU APS, WUR LABORATORY OF ENTOMOLOGY, HAS UNIVERSITY OF APPLIED SCIENCES.
	<b>TIMELINE:</b> FOLLOWS NATIONAL SCIENCE AGENDA AND EU STUDIES AS OUTLINED IN CHAPTER 3.
	<b>ACTION PLAN:</b> ENCOURAGE (STUDENT) RESEARCH AS A FIRST STEP PENDING THE RESULTS OF LARGER STUDIES, E.G. THOSE CONDUCTED FOR THE NATIONAL SCIENCE AGENDA AND THE EU.

#### 4.5 MARKET AND ECONOMY



##### OBJECTIVE 12:




	<b>OBJECTIVE 12:</b> TO PROFESSIONALISE THE CHAIN, DEVELOP ECONOMIC OPPORTUNITIES AND ACCELERATE CIRCULAR AGRICULTURE AS WELL AS THE PROTEIN TRANSITION.
	<b>CHALLENGE:</b> THE EARNING POTENTIAL OF INSECT BREEDERS. INSECT BREEDERS ARE AT THE HEART OF CIRCULAR AGRICULTURE AND PROTEIN TRANSITION. FOR THAT REASON, IT IS VITAL TO ENSURE THAT LEADERS IN (INDUSTRIAL) INSECT BREEDING, WHICH HAVE ALREADY INVESTED SIGNIFICANT CAPITAL, ACHIEVE A RETURN ON INVESTMENT AND TO SUPPORT TRANSITIONING BUSINESSES FROM TRADITIONAL AGRICULTURAL SECTORS WITH APPROPRIATE MEASURES.
	<b>STAKEHOLDERS:</b> INDIVIDUAL (START-UP) INSECT BREEDERS.
	<b>INITIATOR:</b> NGN IN CONSULTATION WITH WE CR AND REGIONAL PARTIES (AGRIFOOD CAPITAL, FOOD VALLEY REGION AND GREENPORT VENLO).
	<b>TIMELINE:</b> SEEK ALIGNMENT WITH THE CIRCULAR AGRICULTURE TRANSITION FUND IN 2021.

#### OBJECTIVE 13:

	<b>OBJECTIVE 13:</b> TO PROFESSIONALISE A RAPIDLY GROWING CHAIN AND ENCOURAGE OPTIMAL CONDITIONS IN A MARKET THAT IS CHARACTERISED BY GROWTH SPURTS.
	<b>CHALLENGE:</b> DEVELOPMENT AND PROSPECTS FOR THE INSECT PRODUCT MARKET.
	<b>STAKEHOLDERS:</b> INDIVIDUAL INSECT BREEDERS, SUPPLIERS AND BUYERS IN THE CHAIN.
	<b>INITIATOR:</b> NGN IN CONSULTATION WITH INDIVIDUAL BREEDERS, WE CR AND REGIONAL PARTIES (AGRIFOOD CAPITAL, FOOD VALLEY REGION AND GREENPORT VENLO).
	<b>TIMELINE:</b> ACTION PLAN BY 2021.







#### OBJECTIVE 14

	<b>OBJECTIVE 14:</b> TO OBTAIN SUFFICIENT INSIGHTS REGARDING ACCESS TO FUNDING FOR (START-UP) INSECT BREEDERS AND FOR A BUSINESS MODEL FOR TRANSITIONING BUSINESSES FROM OTHER SECTORS.
	<b>CHALLENGE:</b> TO DEVELOP AND UPDATE TECHNICAL AND ECONOMIC INDICATORS AND GAIN AN INSIGHT INTO MARKET REQUIREMENTS, EXPECTATIONS AND MARKET TRENDS.  DUE TO THE LACK OF TECHNICAL AND ECONOMIC INDICATORS, IT IS DIFFICULT FOR FINANCING INSTITUTIONS TO PROVIDE FUNDING FOR CRUCIAL

	INVESTMENTS AND FOR (START-UP) ENTREPRENEURS TO OBTAIN IT. MARKET REQUIREMENTS IN TERMS OF MINIMUM PRODUCTION VOLUMES AND QUALITY ARE UNKNOWN, AS IS THE SIZE OF THE MARKET FOR ANIMAL AND HUMAN FOOD AND FEEDSTUFFS IN THE NETHERLANDS AND ABROAD (EXPORT OPPORTUNITIES).
	<b>STAKEHOLDERS:</b> THE FINANCIAL SECTOR, AGRICULTURAL ORGANISATIONS, INSECT BREEDERS, BUYERS, LNV, WECR, WLR, WUR BUSINESS ECONOMICS RESEARCH GROUP, WUR LABORATORY OF ENTOMOLOGY.
	<b>INITIATOR:</b> WUR BUSINESS ECONOMICS RESEARCH GROUP IN CONSULTATION WITH VENIK.
	<b>TIMELINE:</b> BY 2021, AN INITIAL EXERCISE WILL HAVE BEEN CARRIED OUT TO CLARIFY WHETHER PUBLIC-PRIVATE SECTOR RESEARCH INTO THE FURTHER DEVELOPMENT OF KEY INDICATORS IS FEASIBLE. THE RESULTS WILL BE MADE AVAILABLE IN 2022.

#### 4.6 CONSUMERS AND SOCIETY

##### OBJECTIVE 15

	<b>OBJECTIVE 15:</b> 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 PRODUCTS IN THE FOOD AND FEED OF HUMANS AND ANIMALS RESPECTIVELY.
	<b>STAKEHOLDERS:</b> INSECT BREEDERS, VENIK, BUYERS, NGOS, DUTCH SOCIETY FOR THE PROTECTION OF ANIMALS, NETHERLANDS NUTRITION CENTRE, WUR (WUR LABORATORY OF ENTOMOLOGY, WLR, WECR, WUR HUMAN NUTRITION, FOOD QUALITY AND DESIGN, WBVR), HAS AND AERES UNIVERSITIES OF APPLIED SCIENCES.
	<b>INITIATOR:</b> VENIK.
	<b>TIMELINE:</b> FOLLOWS NATIONAL SCIENCE AGENDA AND EU STUDIES AS OUTLINED IN CHAPTER 3.
	
	<p><b>ACTION PLAN:</b> GIVEN THE LACK OF KNOWLEDGE ON A NUMBER OF ASPECTS CONCERNING INSECTS, RESEARCH AND RISK ASSESSMENT IN A NUMBER OF AREAS IS CRUCIAL:</p> <ul style="list-style-type: none"> <li>• WELFARE AND INTRINSIC VALUE OF INSECTS: INSIGHT INTO THE DEGREE OF SENSITIVITY/PERCEPTION OF THE VARIOUS INSECT SPECIES IN RELATION TO PRODUCTION OPTIMISATION.</li> <li>• WELFARE AND BREEDING REGULATIONS THAT TAKE INTO ACCOUNT THAT SENSITIVITY.</li> <li>• IMPACT ON BIODIVERSITY (ESCAPE OF EXOTIC SPECIES). PREVENTION OF RISKS OF ESCAPE OF INSECTS, ECOLOGICAL PROSPECTS AND THE</li> </ul>

	<p>POTENTIAL OF INSECTS AS A SOURCE OF INFECTION TO HUMANS AND ANIMALS.</p> <ul style="list-style-type: none"> <li>• NUTRITIONAL VALUE OF RESIDUAL STREAMS TO INSECTS.</li> <li>• NUTRITIONAL VALUE OF INSECTS TO HUMANS AND ANIMALS (INCL. IMPACT ON HEALTH AND IMMUNE RESPONSE).</li> <li>• PROCESSING OF INSECTS INTO HUMAN FOODSTUFFS IN RELATION TO NUTRITIONAL VALUE.</li> <li>• ADDED VALUE OF FEEDING LIVE INSECTS TO POULTRY.</li> </ul> <p>THE EXISTING RESEARCH PROGRAMMES UNDER THE NATIONAL SCIENCE AGENDA AND THE EU FOCUS ON A NUMBER OF THE AFOREMENTIONED ISSUES. BY 2021, IT SHOULD BE CLEAR WHAT ADDITIONAL RESEARCH IS REQUIRED.</p>
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#### 4.7 EXPERTISE AND LABOUR






##### 4.7.1 TRAINING AND EDUCATIONAL DEVELOPMENT

There is a demand for insect products. Insect breeding may be an intriguing opportunity for farmers who wish to switch or diversify (multi-purpose farming), such as pig or mink farmers who wish to terminate operations.

In order to do so, they must be able to form an idea of the various types of insect breeding and a number of key indicators must be available.

Coordination between various domestic and foreign initiatives in relation to training and education in the insect chain with a view to achieving sufficient volume and continuity is crucial in this regard.

#### OBJECTIVE 16

	<b>OBJECTIVE 16:</b> 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.
	<b>CHALLENGE:</b> TO REALISE TRAINING OPPORTUNITIES FOR INSECT BREEDING IN A BROAD SENSE (I.E. INCLUDING TRAINING VETERINARIANS TO PROVIDE ADEQUATE CONSULTANCY SERVICES).
	<b>STAKEHOLDERS:</b> PROSPECTIVE INSECT BREEDERS AND OTHER INTERESTED PARTIES, LNV, THE MINISTRY OF EDUCATION, INSECT BREEDERS, HAS UNIVERSITY OF APPLIED SCIENCES, UU (FACULTY OF VETERINARY MEDICINE).
	<b>INITIATOR:</b> UNIVERSITIES OF APPLIED SCIENCES (HAS, AERES), NGN AND VENIK.
	<b>TIMELINE:</b> BY 2021, AN INVENTORY OF THE EDUCATION AND TRAINING PROGRAMMES IN THE EU AND ELSEWHERE WILL HAVE BEEN DRAWN UP. ESTIMATE THE NUMBER OF TRAINING PLACES REQUIRED. SET UP A RELEVANT CURRICULUM FOR AGRICULTURAL SECONDARY VOCATIONAL (MBO) PROGRAMMES AND CONSULT WITH HAS UNIVERSITY OF APPLIED SCIENCES AND UU REGARDING WHETHER THEY ARE WILLING AND ABLE TO SET UP






	CURRICULA FOR THE INSECT INDUSTRY, RESULTING IN AN IMPLEMENTATION PLAN FOR 2021 AND BEYOND. CONSULT WITH EXISTING BUSINESSES ON WHETHER THEY WISH TO CONTRIBUTE TO EDUCATION.
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#### 4.7.2 RESEARCH AND DEMONSTRATION CENTRE

In the past, research and/or practice centres to demonstrate new technologies existed in almost all industries. Although these have largely disappeared or been subsumed into larger entities, the insect industry stands to learn from those experiences.

The viability and form of a potential research and demonstration centre for insect breeding must be examined.

#### OBJECTIVE 17

	<b>OBJECTIVE 17:</b> TO ASCERTAIN WHETHER THE CREATION OF A RESEARCH AND DEMONSTRATION CENTRE FOR INSECT BREEDING IS FEASIBLE AND DESIRABLE.
	<b>CHALLENGE:</b> CURRENT FACILITIES FOR INSECT RESEARCH AT WUR AND HAS UNIVERSITY OF APPLIED SCIENCES ARE ON A SMALL SCALE AND DO NOT REPRESENT CURRENT PRACTICE.
	<b>STAKEHOLDERS:</b> VENIK, ENTREPRENEURS AND EDUCATION, RESEARCH, GOVERNMENT, CIVIL-SOCIETY AND CONSUMER ORGANISATIONS.
	<b>INITIATOR:</b> WUR AND HAS UNIVERSITY OF APPLIED SCIENCES IN CONSULTATION WITH REGIONAL PARTIES (AGRIFOOD CAPITAL, FOOD VALLEY REGION AND GREENPORT VENLO)
	<b>TIMELINE:</b> JOIN FORCES IN 2021; INVESTIGATE HOW AND WHERE A FUTURE-PROOF CENTRE OF EXPERTISE CAN BE SET UP, WHETHER PHYSICALLY OR VIRTUALLY, AND IN WHAT TYPE OF PARTNERSHIP.

## 5. MOVING FORWARD

This agenda for the insect industry has a limited horizon, given that the insect industry is developing rapidly but lacks organisation and participation at present. It is vital that organisational development within the insect industry results in a long-term vision, with review and adjustment of the industry agenda on that basis at least every two years and subsequent adjustments to be made by the authors of this vision and agenda.

In order to implement the ambitions and necessary 'no regret' steps outlined in this agenda, as well as further plans, the sector is expected to require a budget of several millions of euros, both for the short and long term. The research budget has already been funded to a large extent, thanks to private, national and European contributions. As regards the realisation of the additional plans, we are currently engaged in talks with parties regarding further implementation in this regard. In addition, we are also seeking alignment with the Circular Agriculture Transition Fund, LNV and Ministry of Economic Affairs programmes, regional funds, stakeholders in other sectors and local authorities with a view to encouraging the healthy, safe and professional development of the insect industry within circular agriculture.

The Vision of the Dutch Insect Industry symposium (Wageningen, 10 October 2019) showed that there is a high demand for meetings in which knowledge can be exchanged and priority issues in terms of organisational and knowledge development can be tackled jointly (by the insect industry, public bodies and knowledge institutions). Such meetings should provide sufficient flexibility for networking. The organisers of such events should take into account the high degree of diversity in the insect industry. Relatively frequent themed meetings are required to ensure a support base and contributions from the insect industry. We propose that Dutch stakeholders be updated on the progress of this agenda and on the most recent research results on the first Thursday of November each year.



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[http://www.europarl.europa.eu/doceo/document/P-8-2018-003756-ASW\\_NL.html](http://www.europarl.europa.eu/doceo/document/P-8-2018-003756-ASW_NL.html)
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## APPENDIX 1: COMPOSITION OF THE INSECT TASK FORCE

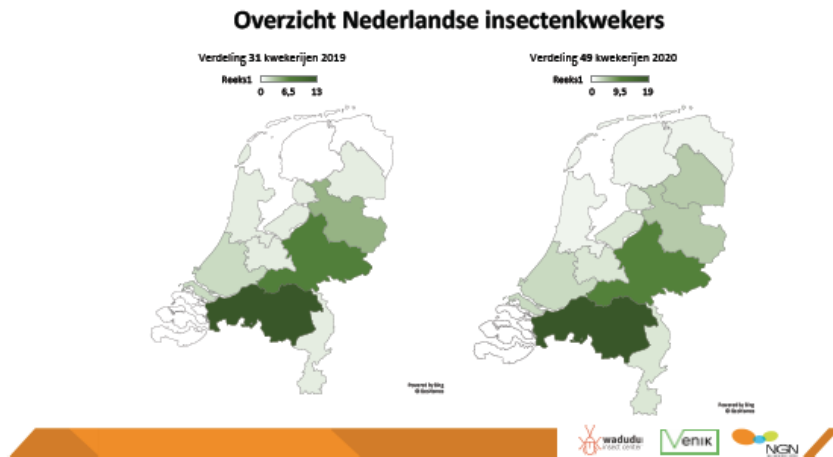
- CBL
- Dutch Society for the Protection of Animals
- HAS University of Applied Sciences
- IPIFF – Protix
- Ministry of Agriculture, Nature and Food Quality
- Nevedi
- NVWA
- Venik – Koppert Biological Systems
- Venik – NGN
- Venik – Protifarm
- Venik – Wadudu
- Netherlands Nutrition Centre
- Wageningen Bioveterinary Research
- Wageningen Food Safety Research
- Wageningen Livestock Research
- WUR Food Quality and Design
- WUR Laboratory of Entomology



## APPENDIX 2: DEVELOPMENT OF THE INSECT INDUSTRY IN THE NETHERLANDS

### Development of the insect industry in the Netherlands between spring 2019 and spring 2020

A market survey in the spring of 2019 (Entomospeed, 2019) showed that 31 insect farms were then operating in the Netherlands (see Figure 1), with the largest concentration of insect farms being located in the province of North Brabant. This survey was carried out again in the spring of 2020.



#### Overview of Dutch insect breeders

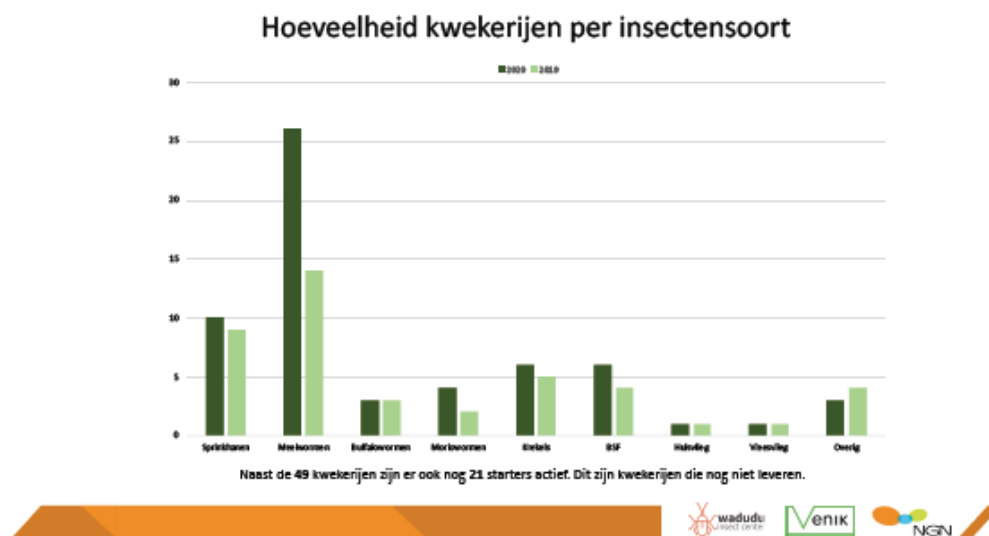
Distribution of **31** farms in 2019

Series 1

Distribution of **49** farms in 2020

Series 1

Figure 1: The geographical distribution of insect farms across the Netherlands



Number of farms by insect species

In addition to the 49 farms, there are a further 21 start-ups. These are farms that do not yet supply insects.

Locusts  
Mealworms  
Lesser mealworms  
Morio worms  
Crickets  
BSF  
Housefly  
Blowfly  
Other

**Table 1:** Number of farms by insect species in the Netherlands; some farms produce several of the species listed.

NB: 65 prospective breeders were trained in 2019.

## APPENDIX 3: USES FOR INSECTS IN FEED, FOOD AND INSECT MANURE

### Technical possibilities to use insects in food and animal feed

Insects as a new source of protein are promising in the context of the Sustainable Development Goals (SDGs) of the United Nations as well (Dicke 2018). In a recent study, the Council on Animal Affairs concluded that an insect industry is emerging, which has the potential to play a key role in the development of a circular economy (RDA, 2018).

#### Insects as food

Although insects are already part of the staple diet of approximately 2.5 billion people all around the world, various indicators show that insects have the potential to become a generally accepted part of the diet of Western societies as well, including in Europe.

1. Insects contain nutrients that are vital to human nutrition: they are rich in proteins and contain essential amino acids, fatty acids, vitamins and minerals.
2. Edible insects have a well-balanced composition, with the right nutrients to meet the nutritional needs of humans.

The Netherlands Nutrition Centre has an information page on the human consumption of insects: <https://www.voedingscentrum.nl/encyclopedie/insecten.aspx>.

#### Insects in animal feed

In a feasibility study, Veldkamp et al. (2012) concluded that it would be technically feasible to use insects as a high-protein raw material in feed for poultry and pigs. The Food and Agriculture Organisation of the United Nations (FAO 2013) believes that insects are becoming increasingly important as a food and as a raw material for feed.

Recent studies have shown that insects have a number of properties that make them highly suitable for use in animal feed. Insects have a high protein content and are rich in other useful nutrients, such as fats, minerals and vitamins. More and more studies show that the consumption of insects by farm animals and pets entails health benefits. Certain components in insects, such as chitin, lauric acid and antimicrobial peptides, may have antimicrobial effects or boost the immune system if they are fed to farm animals, pets and aquaculture animals. Initial exploratory studies into these positive effects are currently ongoing. In the event of positive outcomes, this research must be used to contribute to the reduction of antibiotic use in livestock farming.

1. Protein concentration levels in insect proteins meant for animal feed vary between 55% and 75%.
2. Insects are characterised by a higher feed efficiency. As such, they may prove to become a highly valuable source of feed for farm animals (FAO 2013; Veldkamp et al. 2012).
3. Insects are part of the natural diet of various animals, such as carnivorous fish, poultry and pigs (as an example, insects may meet up to 70% of the dietary needs of trout).

WUR has published a dossier on insect breeding on its website: <https://www.wur.nl/nl/Dossiers/dossier/Insecten-als-voedsel-en-veevoer.htm>

#### Insect frass

The residual stream resulting from insect breeding, the so-called frass, appears to have a number of good uses, particularly due to the fact that it contains (1) easily absorbable nutrients (nitrogen, phosphorus and potassium) and (2) microorganisms that stimulate the growth of plants (PGPMs) and increase the resistance of plants to insects and microbial pathogens. These properties will result in benefits for crop growers.

## APPENDIX 4: MARKET DEVELOPMENT AND MARKET EXPECTATIONS FOR THE INSECT INDUSTRY

ABN-AMRO (ABN-AMRO 2016) concluded that an interesting insect market is developing in Europe – not only in terms of food (human foodstuffs), but particularly in terms of feed (animal feed).

The book 'Insects as food and feed: from production to consumption' (Arnold van Huis and Jeffery Tomberlin, 2017) provides a comprehensive overview of the status of insect breeding. The website <https://www.wur.nl/nl/Dossiers/dossier/Insecten-als-voedsel-en-veevoer.htm> provides information on insects as a food for humans and a feed for animals.

A recent study carried out by the International Platform of Insects for Food and Feed (IPIFF 2018) shows that the insect industry has an enormous potential for growth in Europe in the years to come (Figure 1). Figure 2 shows the expected development in employment in the insect industry.

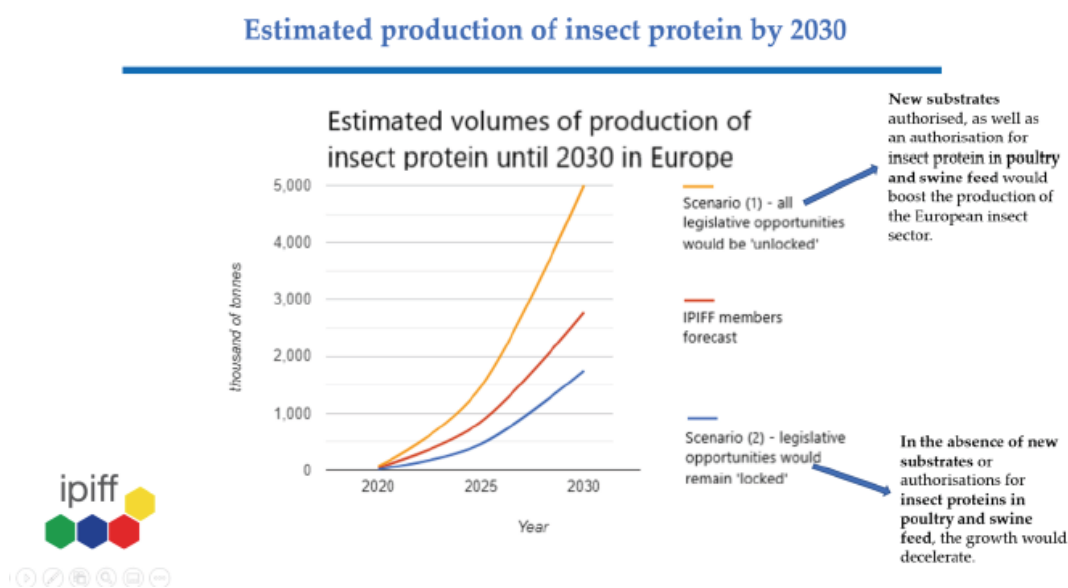


Figure 1. Expected production volumes of insect protein in Europe up to 2030 (x 1,000 tonnes) (IPIFF 2020)

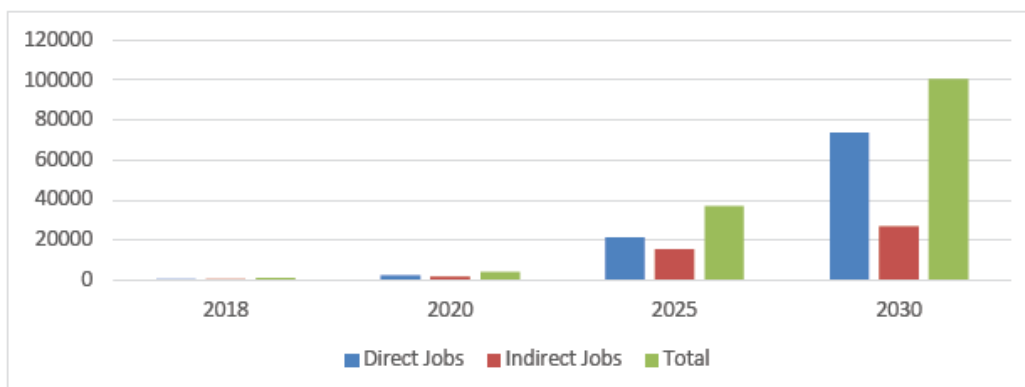


Figure 2. The expected growth of the European insect industry in terms of the number of jobs and higher investments in the insect industry will result in more employment in Europe (IPIFF 2018)