

SUSTAINABLE COMPETITIVE ADVANTAGES AND TRACTION

Entopro has public and private support, and many of these organisations have provided a letter of support. They can be found here:

<https://drive.google.com/folderview?id=0B3memrXWr119XzJyTEJ3aXBtVk0&usp=sharing>

Technical Competency

Entopro has a 50:50 JV with Bugs for Bugs, Australia's largest beneficial insect rearing company that has been working closely with DAFQ on horticultural crop protection, market development and hosting PhDs and undertaking further research work for over 35 years. Their facilities are state of the art and so is their knowledge and expertise of Australian insect rearing conditions and optimisation.

Commercial Traction: Outputs

Entopro have entered into non-circumvention agreements with two major feed companies; Ridley Agri Products Pty Ltd and Feedworks. The focus will be on further commercial trials and product development

Commercial Traction: Inputs

Entopro have entered into non-circumvention agreements with three of Australia's largest waste management companies; JJ Richards, Veolia and Cleanaway.

Governmental Interest and Support

Entopro have discussed the project and its attributes with Queensland Minister for the Environment Stephen Miles once at the Australian Organics Recycling Association, where CEO Kaitlyn Tregenza was invited to present the idea to his Chief of Staff and Waste Management team in Brisbane. The support of the Queensland EHP team has thus far proved beneficial to traction and navigating government internally. There have been three meetings since with relevant parties in Brisbane and Toowoomba.

Entopro have presented the concept to Biosecurity Queensland and personally presented the concept to the Deputy Director-General, Agriculture, at Department of Agriculture, Fisheries & Forestry, Mr. Malcolm Letts. We have spoken as well with the Queensland Chief Health Officer's team regarding the potential collaboration on health impacts and further research.

Entopro have conducted ongoing planning committees with the Toowoomba Region City Council, State Development Department and Trade and Export Development Department, Department of Agriculture and Biosecurity and the relevant councillors in Toowoomba to plan and execute the project in Toowoomba. Discussions with their waste management team regarding logistics are ongoing but promising regarding an ideal rollout of collections services.

Entopro have developed solid relationships and formal arrangements for research with 8 universities in Australia to tackle various aspects (Animal (layers, broilers, barramundi, salmon, swine, feedlots) nutrition & feed trials, industrial ecology & closed loop sustainability, fertiliser and soil enhancement trials, chemical extraction of lipids and oils and protein enhancement, insect rearing processes and genetics, robotics and automation capabilities), where Entopro would retain full IP of the research conducted and the overall project.

Entopro have traction with 200 free range organic poultry farms along the east coast of Australia who are willing and interested to trial the product. To test this, we have organised an import permit to import mealworms, super worms and black soldier fly larvae from China to generate income and develop the market whilst conducting the animal trials and building the infrastructure.



**Queensland
Government**

GO TO MARKET STRATEGY: IMPORTED INSECT PRODUCTS

Pet and Hobbyists

There is a long lead-time between now and production capacity from the pilot project of up to 1 year. In the meantime Entopro has applied for an import licence and secured supply of black soldier fly larvae, mealworms, super worms and crickets for sale into the pet feed for backyard chicken and hobbyists and small-scale producers.

The pet food market is the low hanging fruit in this industry for two reasons. 1. Entopro has done an incredible amount of work on the customer and market development, and 2. The work done on nutritional trials and research with universities for animal health and nutrition especially in poultry and aquaculture/aqua-ponics.

This product will most likely be ready to launch by September. Pre-sales will open in August. This will ensure traction in the market and revenue.

Branding, Website

The branding, including the product name, website, packaging type and design is all being finalised for the end of August launch. The e-commerce website is being constructed and designed.

Packaging

Packaging is a huge point for entering retail and we have spent 2 months working on the packaging design and sourcing the best materials. Packages will be recyclable and recycled, using only sustainable materials. They will be resealable and high quality for freshness. We will not use silica beads or small plastic beads for freshness due to environmental concerns with such bags. We will sell the product in 100g, 500g, 1kg, 5kg packets. Bulk packets for larger enterprises will be available too.

To compete with the existing competitor, Pekish, selling mealworms through Pet Barn, packaging will be key. Their packets are cheap and cater to a market that already know the value of mealworms and buy it from outside knowledge of the market. The package Pekish use is uninspiring, brown, cheap and poorly designed. These packs are sold for \$14.95 per 100g. We know that this is possible to beat, particularly as we will offer them a range of insects including the most sought after black soldier fly larvae, crickets and super worms.

Other competitors sell via their own websites but with similar disregard for design of both the website and package. When selling to the pet market and trying to expand the demographic using insect treats, the design and user experience is paramount.



Customer Development

When Entopro first launched and joined the Founders Institute, CEO and Founder Kaitlyn Tregenza spoke with 200 organic free-range chicken farmers to gauge the appetite of the end users. It was overwhelmingly positive. A key point however was that price would be an issue.

Due to production delays and a slight hiccup associated with breeding, we have luckily been able to see that Future Green Solutions in WA, who received consulting by a founding member of Entopro prior to joining the team, has maintained his production through the winter months and is selling his live larvae for \$250 per kilo. He assures me that he is selling out production, nonetheless at this extremely high price, especially during the winter months when backyard productions are impossible due to limited climate control.

Entopro will continue to develop a customer database of end-users comprised of backyard hobbyists, permaculture activists, aquaponics, etc enthusiasts by mid August. We hope to develop a list of 1000 end user potential customers for nurturing campaigns by end of August by using data scraping and internet research techniques.

Strategic Partnerships and Alliances

Entopro has reached out to a number of smaller pet stores to interview owners regarding the insect as feed market. According to them it is a growing but niche business due to the price of the insects. Our plan is to position ourselves with packaging indicating a luxury product, far superior to our competitors', and yet price ourselves to meet or beat our competitors.

Social media presence

Social media will also attract a lot of potential customers to us. We hope to attract customers through a solid social media campaign, posting good, informative posts and videos to Facebook (primary audience lives of Facebook), Twitter, Instagram and Snap Chat.



Dog treats

Entopro have discussed with Charles Sturt University, University of Queensland and University of New England a student project to develop a dog treat for manufacture in Australia using a variety of different insects in various shapes with an extremely high nutritional value, something considerably lacking in Australian pet foods.

Human Grade Products

If we consider the success of the North American and EU markets and the overall movement of the industry to 2023, it is likely that Australia will also hop on the entomophagy bandwagon too, especially considering the growing organic, macro, sustainability and 'paleo' trends and the traction some micro companies are having in the market in Australia.

Right now in Australia there are a handful of very small businesses selling insect products. There are 4 known in Sydney (The Cricket Bakery, Eco Bar, Edible Bug Shop and Primal Collective that is a 'paleo' online market place), 1 in Brisbane (Bugsy Bros). The Edible Bug Store has been growing and selling edible bugs for a number of years and they're based in Parramatta. They recently received funding from Boost Juice founder Janine Allis on Shark Tank. Except the edible bug store, none are working on this business full time or investing heavily into market development. They are however opening a few people's eyes here and there to the possibility. Their small traction in the market has proven to be a potential opportunity in the future.

The easiest market for entry is into the gym/protein fitness market, with protein shakes and protein bars and balls. The second focus is on the gluten free and paleo market, looking at pastas, breads, flours, cakes/biscuits, and chips. The final market is the ready to eat market. Like vegan and vegetarian ready to eat meals, this range would be for sustainable eaters and adventurers.



Protein for shakes

The critical element with shakes is the nutritional elements especially protein and macro minerals digestibility and, second to that is taste. To expand the market beyond gym junkies looking for protein bulk, towards women especially, taste and branding is critical. The range will be gluten free, GMO free, Chemical free, soy free, nut free, plant and wheat free, and 100% natural, sustainable and low impact protein. Flavours include plain (very limited flavour of crickets and mealworms are slightly nutty), chocolate/cocoa, strawberry and banana.

Bars and Balls

Entopro is investigating buying a recipe for cricket protein bars from a start-up in the US that has just been acquired, without the intention of buying the bars. There are three flavours that tested incredibly well in the US market.

We have also been talking to chefs, food scientists and nutritionists to develop our own recipe. Protein balls are a popular addition to any paelo/ health nut's daily diet right now and have been selling well at the Brisbane markets most weeks as proof of traction.

Gluten Free and Paleo Substitutes

The price point of entry into the gluten free, organic and paleo market is high and rarely does a company satisfy all three elements. It caters specifically to high-income earners with seriously high disposable incomes and a penchant for health and well-being. It is a luxury, niche market.

Pasta ranges, flour alternatives, ready bottled juices and protein drinks and ready made high protein cakes and breads would be appealing to this market. Avenues for sale are in boutique markets and health food stores, supermarket chains and independent grocers as well as online or market sales.

Pre-prepared Meals

This is taking off well in the Netherlands in burger patties, nuggets and other ready to eat meals that use insects instead of or soy. The idea is that it is more sustainable than a vegetarian or vegan diet and therefore appealing to environmentalists



Customer Development

There are three sides to the customer development: restaurants (chefs, owners), food manufactures selling health food (CEOs/Directors/GMs) and the people who would buy them.

We must test the willingness of the people to try this, and then use this market data in our favour to convince the restaurants and health food stores to try it. We identify the easiest option as the restaurants because they can always buy and experiment with them and test the market by people ordering or not ordering. Fundamentally behind all of this is whether or not people will like and eat them though. People have the final say and control of the market.

5 restaurants that already serve insects on their menu in major capital cities throughout Australia were called and interviewed as to the reactions of customers. Feedback was overall positive from customers, however insects were usually used as garnishes or novelty points in the dish rather than the main ingredient itself. Nonetheless the dishes were ordered and enjoyed by many.



GO TO MARKET STRATEGY FOR ENTOPRO BSF PROJECT

Regional and Rural Towns and Cities

As the city or town itself is one of our major stakeholders, and can determine whether the project goes ahead smoothly and with support or not.

Entopro's concept is to minimise the requirement to truck and ship protein from production to use points, therefore, we want to launch our first project in Queensland's food bowl - the Toowoomba region. Currently farmers pay more to truck protein from Brisbane to Toowoomba, than it costs to land it at Brisbane port from Peru. This makes inland farmers less competitive domestically and internationally. Toowoomba is in a unique position with its international airport to be able to connect domestic production freight easily with international markets.

Our focus will be regional farming hubs that need sustainable and high value protein to grow their economies. These areas typically don't have good solutions for pre-consumer organics and thus send majority to landfill. Toowoomba will be a model for future projects. This will enable more farmers to adopt organic farming practices and protect our food chain from chemicals.



Entopro will consult to local businesses in the region and town as well on the net benefits of upcycling and recycling items they dispose of regularly.

Entopro will develop the capabilities of collecting and storing recyclable materials for sale as feed stock to downstream local or international manufacturing facilities.

Aquaculture

The first focus is on the 11 small aqua farms in the Toowoomba region. Beyond Toowoomba, Queensland produces a variety of prawns, barramundi, perch, Murray cod, red claw, eels, edible oysters, pearl oysters and hatchery production.

We aim to work with Ridley's Aqua team and their end customers. Ridley are also Australia's largest renderers and therefore have the capacity to roll out a scalable system at their facilities Australia wide.



Organic Livestock and Poultry

Poultry is a much lower cost market. Hence we will start in the organic feed market to access the higher priced feed option. Inglewood Farms in Toowoomba, the largest organic poultry farm, Teys and some other local organic grain feedlot producers have indicated initial interest.

Most sales will firstly be placed by the universities who will undertake feed trials with our product.



INTERNATIONAL TRACTION FOR INSECTS AS FOOD AND FEED

The North American Market

The US

There are over 30 edible insect companies in the US. Notable US investors in the concepts of insects as food and feed are Mark Cuban (billionaire featured on US Shark Tank), Arielle Zuckerberg (Mark Zuckerberg's sister), Tim Ferris (Author, personality and Silicon Valley Investor), Bill and Melinda Gates, Clinton Foundation and notable investment firms. One company, Exo, has raised a total of \$US5.6m from private investors.

The US EPA have funded several projects to develop closed loop systems. If we examine the feed market there are some major players that have since patented and on-sold their technology to emerging players in Europe.

EnviroFlight, based in Ohio, was founded in 2009. EnviroFlight produces feed for pet food, zoos, prawn farming and aquaculture and sells its fertilizer locally and through retail distributors at premium prices.

Aspire Food Group has operations in the US, Canada, Mexico and Africa. It has been acquiring companies organically and integrating its vertical chain by selling in the US and growing and producing in Mexico.

Canada

There are 6 Canadian companies selling in Canada and into the US as well.

Enterra is the largest company in Canada. They culture Black Soldier Fly larvae on food waste feedstock to produce feed ingredients for animals and plants. They were established in 2012 and have received millions in private funding and equity. David Suzuki is a major shareholder and advisor.

Next Millennium Farms or Entomo Farms breed crickets and mealworms for human grade consumption to supply to the North American market. It is Organic Certified.

The South American Market

AgriProtein have established a presence in Chile.

There are two BSF farms in Brazil still in R&D stage.



The EU Market

The European Commission

The European Commission allocated close to €5 million (budgeted €3.88 million) for the PROteINSECT project that “exploits the potential of insects as alternative sources of protein”.

PROteINSECT was a three-year (2013-2016) EU-funded FP7 project enabling the exploitation of insects as a sustainable source of protein for animal feed and human nutrition (PROteINSECT Grant Agreement Number: 312084). PROteINSECT brought together expertise from China, Africa and Europe to encourage and enable the adoption of larval protein in animal feed around the world. The PROteINSECT project consortium has 12 partners from seven countries and is co-ordinated by Fera Science Ltd in the United Kingdom.



Europe seems to be undergoing a big movement when it comes to foods containing insects, with the northern Dutch speaking countries dominating this trend. With an increasing number of people interested in eating insects, governments are starting to see that they should adapt regulations to fit this new reality. Regulations should be geared to enable insect foods to be placed on the market while at the same time securing consumer safety. For the last two years, many revisions of EC legislation have come into effect, with more changes in favour of insect protein on the horizon. The insect sector has pleaded for the revision of EU legislation in order to allow insect proteins for use as feed for aquaculture animals.

The International Symposium for Insects as Food and Feed, which will be held on 12 September 2016 in Magdeburg, Germany, aims to give an overview of the state-of-the-art of insect technology, the prospects and constraints of the use of insects as feed, food and non-food in Europe.

The Netherlands

Kreca is the leading insect farm in Europe with in-house knowledge of breeding and rearing 12+ species of insects. The company is established in 1978 and since then successfully operating through Europe. Kreca is delivering insects for the animal feed industry. They are one of the 3 companies in the Netherlands who are authorized by the nVWA to breed for human consumption.



Jagran B.V. is an engineering company for animal production, which was founded in 1992. Jagran takes, together with its partners, protein and energy from low-grade organic waste back into our food chain. Jagran do this using the larvae of the housefly. The production of the larvae of the housefly takes place in a modern, sustainable and profitable way. A sustainable insect farming industry will provide a substantial contribution to the solution of both the protein world problems as the world waste issue. Species used are: Larvae *Musca Domestica*, annual sales volume (dry weight) 250.000 ton (88% DM) coming years, target group Pets, Fish, Poultry, Pig, main markets, Netherlands, Europe, which products you producing, Maggot meal.

Dutch start-up, Protix, received funding from the Dutch GreenTech Fund BV in 2015 and BOM capital. To date they have raised over €15 million. They have been approved to sell their product to pets and animal feed companies. They have a to scale system in Breda, Netherlands and several projects outside in Europe and Africa.

In 2011 Delibugs started selling edible insects in the web shop. Since 2013 they also started farming and processing all kinds of insects. They want their location in Lelystad to become an international training centre for large scale insect breeding. Insect Europe aims to make edible insects accessible to a wide audience, this is a challenging but worthwhile activity for years to come. They believe that insects will be an excellent addition to the existing food supply chain. From 2014 they are to start, setting up a local insect farm in Malawi around the Kuzungu National Park. In collaboration with “Act to Protect” they are building a better future at a local level, we provide jobs, food and future prospects. Their brands are DeliBugs (human consumption) & BugsforPets (Pet food) and Edubugs.com (education programs for schools).

There are now several Dutch food companies established and major European start-ups are selling into the Dutch market. There has been good traction and a major Dutch supermarket chain began stocking insect products 2015 as the Netherlands liberalised its laws. Smaller supermarkets and markets stock the products too.

Belgium

Belgium became the first EU country to officially approve the sale of 10 species of insect at the end of 2013. Belgium has had the most traction along with the Netherlands because it is legal to sell both animal feed and human food products containing insects in these two countries.

Over 20 companies large and start up have been successful in selling a variety of products into the market from pasta and pasta sauce, breads and baked goods, cookies, snack bars, burger patties and aperitif snacks. Some have even created cocktail bitters.

Of notable mention is Damhert Nutrition (founded 1980s). It was the first company in Europe to launch ready-to-eat food products (burger patties, schnitzels, nuggets) on the basis of insects in 2014 for distribution to the Benelux retailers. In March 2015, they won the INN Award 2015 for the most innovative product of the year.

The Institute for Fisheries and Agriculture in Gent, Belgium, has been funding a project to develop a product based on the mopane caterpillar, native to various countries in Southern Africa. The aim is to develop a product that contains valuable nutritive ingredients. Once the recipe is optimized, the aim is to have it produced in Africa. “Africans feed Africans” implies also that we would aim that the mopane caterpillars be cultivated by the local population in a sustainable way.

The University of Liege – Gembloux Agro-Bio tech, Belgium is leading fundamental research activities to understand the interactions between insects and their environment. Promoting entomophagy for humans by multidisciplinary approaches is a cross disciplinary approach with various departments; food chemistry, research on insect rearing efficiency, nutritional quality analysis, food processing, impact of socio-cultural aspects associated to edible insect tasting assays.



In May 2006, the Walloon Agricultural Research Centre (CRA-W) was nominated as the European Union Reference Laboratory for animal proteins in feeding stuffs (EURL-AP). The mission, in the global framework of the eradication of transmissible spongiform encephalopathy (TSE), focuses on the detection and identification of prohibited animal proteins in feed and the role of insects in feed.

At the Department of Functional and Evolutionary Entomology, University of Liège - Gembloux Agro-Bio, they are working on the insect acceptability in Western civilisation through different types of sensory studies on insect-based burgers or insect-based 3D printed products, and rearing of different insect species like *T. molitor*, *H. illucens* or *A. domesticus*.

Institute for Agriculture and Fisheries Research studies the Black Soldier Fly (BSF) conversion of nutrients from organic waste materials efficiency.

France

Ynsect – Animal feed & Biotech market

There are over 10 edible insect companies in France producing many products from bars, to pasta, etc.



Genopole, France's leading biocluster for biotechnologies and research in genomics and genetics, is built upon the model of American and European campuses and unites innovative high-tech life sciences companies, public and private research and higher education facilities at a single site in Evry/Corbeil-Essonnes, just south of Paris. Genopole is a pioneer in France. It receives funding from a number of different public and private sources. In 2014, Ynsect developed an insect biorefinery pilot at their facilities. Ynsect has implemented major R&D programmes in collaboration with key academic and research institutions in France and Europe (CEA, INRA, CNRS, IFREMER, AgroParisTech, IRSTEA, Wageningen University etc.). The company is supported by Bpi France and the Ile-de-France Region. It is an active member of competitive clusters (Industries Agro Resources, Vitagora, etc.). This year, YNSECT received the 2030 Global Innovation Award and the People's choice Award at Cleantech Open Global Forum in San Francisco. Ynsect raised €1.8m in Series A round and a further €5.5m in Series B round in Feb and December 2014. New Protein Capital, a financial company based in Singapore, Emertec Gestion and Demeter Partners based in France.

NextAlim develops industrial rearing of Black Soldier Fly to process organic wastes and to produce feed and other insect derivatives. Our research deals with rearing automation, growth optimization, insect processing for feed and industrial applications.

AKIOLIS Group is member of Tessengerlo Group, acting in sustainable development, specially in agriculture, food, water and bioresidues fields. AKIOLIS is specialized in by-products and bio-residues valorization (animal and vegetal) from food activities : PAP and fats processing and production, compost production. Akiolis Group processes over 900 KT/yr (wet weight). Their downstream customers are pet food, aquaculture, lipo and oleochemistry companies

IPV Food produces yellow mealworm, crickets and grasshoppers mainly for the pet industry.

Alimentation, Agric-Pêche & Biotechnologie (ACTIA), a partner organisation of the French Ministry of Agriculture Fisheries and Food, has a budget of 78 million euros to coordinate the activity of 42 French centres specialising in applied food research, as well as their relationship with industries, fundamental research. ACTIA facilitates cooperation of these centres with European and International countries through technical assistance and participation in research and technological development programs.

The UMR (unité mixte de recherche in French) “Ecological Anthropology and Ethno biology” is a joint lab partnered with the National Centre for Scientific Research (CNRS), the Muséum national d’Histoire naturelle (MNHN) and the Université Paris 7. Ecological anthropology is a field of research at the juncture between the study of natural systems (ecosystems) and the study of the human species and social systems. The laboratory applies an interdisciplinary approach. Researchers in human sciences and life sciences work together in the following disciplines: 1) Ethology, physiology, ecology, and human population genetics, 2) Anthropology, ethnology, ethnobiology and cultural anthropology.

Switzerland

A Swiss programme of legalisation saw more than ten species given the stamp of approval in 2016. The change in Swiss policy came about after entomophagy advocates put on a bug buffet for politicians in Bern as part of their campaign to shift decision-makers towards embracing edible insects. With the support and on the initiative of the National Councillor Madame Isabelle Chevalley three interpellations to the Federal council have been launched to accelerate the insect industry. Swiss Food Research hosted its second meeting of the Innovation Group Insects for Feed & Food on June 15th with some of the largest European food innovators, researchers and industry players to more fully develop this future food source. In 2015, another insect feed company commercialised its project.



Centre for Agriculture and Biosciences International (CABI) is an international not-for-profit organization that improves people’s lives worldwide by providing information and applying scientific expertise to solve problems in agriculture and the environment. They have been involved in insect as food and feed research.

There are several insect as both feed and food ventures being undertaken.

Finland

TEKES (the Finnish Funding Agency for Technology and Innovation) is part of the Team Finland network. In the Team Finland network, Tekes offers innovation funding and services to internationalising companies, promotes the internationalisation of companies and supports efforts to attract foreign investment in Finland. Tekes provides innovation funding for companies, research organisations, and public sector service providers. Tekes has allocated 100,000€ of funding to a new project to explore consumer-centric business opportunities around edible insects. The ultimate goal is to establish a multidisciplinary Finnish business ecosystem focusing on creating new business opportunities within sustainable food production. Edible insects will be the starting point of the ecosystem. Tekes established the Nordic Insect Economy as credible future business and funded (company’s 100,000€) international growth.



Sweden

The Swedish Government is showing their commitment to green principles and fighting climate change by spending \$AUD440.63 million of tax-payer money on developing climate-smart 'meat' made out of crickets and mealworms. The Department of Animal Nutrition at the Swedish University of Agricultural Sciences runs a PhD project in Cambodia on rearing of crickets for human consumption and have plans for research also during Swedish conditions.



Bug Burger is a start-up making the future hamburger chain where the burgers served are made out of insects instead of red meat. Until this becomes reality Bug Burger is a blog that informs Swedes on the benefits of eating insects.

Norway

AquaFly, funded by the Norwegian Research Council, investigates insects as a possible safe and healthy ingredient in future aqua feeds for Atlantic salmon. Earlier studies at NIFES have demonstrated the great potential of using black soldier fly meal as a protein source in the diet of Atlantic salmon. In AquaFly, we will study the possibility to tailor insect products and optimize its potential for use as an ingredient in a sustainable feed, covering the fish's nutrient requirements and secure production of robust fish. AquaFly will also identify possible risks by using insect raw materials for fish feed by documenting undesirable substances and pathogens in the whole production chain from the food for the insects, insect raw materials, fish feed and Atlantic salmon fillets.



Denmark

The Nordic Food Lab's insect gastronomy 3-year project was funded by the Velux Foundation and the Nordea Foundation. They have published 125 recipes and sensory and academic writings on entomophagy, participating in dozens of documentaries and sharing their work with the world, especially NOMA restaurant, Copenhagen and Sydney.



GREEiNSECT is a government funded project undertaken by the University of Copenhagen. The overall aim of GREEiNSECT is to investigate the use of edible insects as a concrete tool for developing a new, sustainable and inclusive component of the food and feed sector in Kenya, and to contribute to a transition towards a greener economy. Outside the GREEiNSECT programme, the University of Copenhagen have been studying edible insects from both the food and the feed perspective. Our special interest is insect diseases and the control of these diseases in populations of beneficial insects.

The Danish Technological Institute has been interested in edible insects for several years. A recent R&D effort from the team includes 'BioConVal'; a project that assessed feed safety and the potential of mass-rearing fly larvae on chicken manure for application as poultry feed. Current projects focus on bioconversion of organic side-streams from the feed and food industry using mealworms - as well as general efforts promoting the insect industry.

Dr. Joachim Offenberg from the Department of Bioscience, University of Aarhus, has conducted field-work in Thailand, Vietnam, Australia, Senegal, Tanzania and Benin for edible weaver ants (*Oecophylla* sp.) as delicacy and biological control agent.

Iceland

There is currently one edible insect company and one black soldier fly production.

Germany

In Germany, the size of the companies interested in and working with insects as food and feed are on average much larger. There are 5 insect food start-up companies. Of notable mention are Mars PetCare, Mars Germany GmbH, SPS Feed (aquaculture feed and pet food manufacturer) and Saria Bio Industries.

OF the many small to medium sized businesses operating in Germany, Hermetia, based outside of Berlin, is of notable mention too as it has been selling its BSF product locally. After rearing beneficial insects for 30 years, they branched into BSF and have helped start-ups in Europe, Asia and Africa with their know-how. Their growth has been self-funded and debt free. Their expertise and fast ramp-up of production came from a strong underlying knowledge of insect and rearing systems. This is the model we are replicating in Australia with Bugs 4 Bugs. They rear Black Soldier flies and process themselves by hand. Mars has requested 200Mt of insects from them per year. They cannot fill the order with current production.

The Institute for Food Quality and Food Safety, Germany (Department for Milk hygiene and uncommon foodstuffs) has been investigating insects as food and feed since 2006. The initial direction was chemical composition, but the actual focus lies on the microbiological and molecular biological analysis of insects that can be used for food. They examine insects on a regular basis with the goal to establish reliable quality and hygiene parameters in those areas for insects as foodstuff. This goes along analysing the regulatory/legislative issues for this foodstuff in the EU and Germany. A small production research unit for selected insect species has started to operate recently. We offer reliable microbiological, molecular biological, and chemical analysis of food insects.

The Humboldt University of Berlin has been conducting research on entomophagy in Thailand and Laos since 2012.

The Leibniz Institute for Agricultural Engineering Potsdam-Bornim connects 88 independent research institutions that range in focus from the natural, engineering and environmental sciences via economics, spatial and social sciences to the humanities. Research is contributing to food security, animal welfare, the holistic use of biomass, and to protect the climate and environment. They have been publishing articles semi regularly since 2013 on insects as food and feed.



Spain

Bioflytech is a technology based company and a spin-off of the University of Alicante, dedicated to the mass rearing and production of different species of dipterans (flies) that started in 2012 at the heart of the research group 'Bionomics, Systematics and Applied Research in Insects'. The Company has a multidisciplinary team with entomologists and engineers from the academic and research world of the University. Bioflytech is dedicated to research and development of procedures and products related to the artificial rearing of insects that allows their posterior application in a wide range of sectors such as animal feed, agriculture, valorisation of food and agricultural by-products, biodegradation of residues, biotechnology or for use in the sector of biofuels. The company has won over 10 government funded (undisclosed) grants since 2012 to sustain a research team of 10 scientists and engineers.



Entomotech is a research company specializing in the mass rearing of insects for industrial applications. The Entomotech team has more than a decade working in the mass rearing of insects and mites covering more than 130 different species from different orders like Lepidoptera, Coleoptera, Diptera, Neuroptera, Heteroptera, Ortoptera, and Hymenoptera among others. We are currently involved in several projects, from public and private sector, aiming to include insects in feeds for fish, pet, and poultry. In reference to insect application for food and feed, we have been working not only in the nutritional value of insects, but also in other aspects like profitability, disease control, technical solutions, logistics and planning.

Insagri S.L was established in Malaga in 2012 as medium-sized farm focused on producing, investigating and processing edible insects as food and feed. They have built some strong relationships with local cooperatives specialized in organic products certified to develop a suitable biodegradation system feeding insects only with healthy nutritious resources.

Pupa Planet has since 2013 been developing Insect for feed. The project is now focused on Biotech applications from insects, with as main focus insects for Feed (targeting Aquaculture).

MealFood Europe established a mealworm farm dedicated to grow and sell mealworms.

Portugal

SPAROS Lda. is a technology driven company dedicated to the area of fish nutrition. Their expertise ranges from the feed technology (our pilot scale feed mill comprises the latest equipment for manufacturing fish diets, but also for land-based animals) to the in vivo testing facilities with various fish species (assessment of digestibility of new protein sources, its effects on palatability, growth, feed conversion, etc.). SPAROS has a pilot-scale feed mill and up to now has been dedicated mostly to small-scale.



Italy

Italy has multiple NGOs and food development companies. Currently sale in Italy is not possible, hence not a large pull for start-ups.



IDEA2020 is a Spin-off of the Tuscia University that foster an agricultural and rural development based on initiatives in which economic development, environmental responsibility and social inclusion are fundamental and integrated components of a long term sustainable growth. The company has a founding member entomologist that deal with insects for human and animal nutrition. The company is active in developing countries and countries with social emergencies.

Diptera manufacture insect-based animal feed ingredients. They've developed a patent-pending highly automated process that will allow for economical and safe large-scale production of animal feed ingredients.

Malta

The AquaBioTech Group is experienced in fish nutrition, feed formulation, raw material sourcing, and specialist ingredients; feed mill development, specialty products development, fishmeal and fish oil projects. It is now working on the preparation of research proposal under EU HORIZON2020 scheme that will allow them further research in feed formulation and in-vivo testing in aquatic animal feeds used in the aquaculture sector.



ABT Innovia is the aquaculture research entity of the AquaBioTech Group with its own dedicated Research & Development (R&D) facilities based in Malta. The facility is able to provide tailored R&D services to clients from across the aquaculture sector, with needs ranging from the formulation, test-batch production and in-vivo testing of aquatic animal feeds, additives and enrichments, through to vaccine efficacy and safety testing. The facility also undertakes a large number of larval trials for various species, testing live feed enrichments, larval diets and production techniques using new technologies so as to benchmark hatchery and grow out systems.

Austria

There are several start-ups in insect food and some NGOs promoting insects as food.



Hungary

GENOVELO is a novel food distributor, offering unique food and taste experience with its continuously expanding assortment, currently focusing on edible insects. GENOVELO's mission is to collect the unique and novel elements of the international cuisine for enabling the customers to enlarge their gastronomic toolbar.



Greece

Bio-insecta is an insectary specialised on Biological control using macro-organisms (beneficial insects, mites and nematodes). They have started producing *Tenebrio* & *Hermetia* as food for pets in addition to their core beneficial insects business.

**Turkey**

Galenka Animal Health is preparing to invest in an insect breeding facility for animal feed purposes. We are aiming to answer the feed demands of the growing aquaculture industry in Turkey. We are looking for strategic and financial partners to realize this goal in the near future.

**UK and Ireland**

The UK and Ireland have approximately 10 start-ups for insects for food ventures.

The Institute of Aquaculture is a partner in the Protein SECT project – responsible for setting and scaling up insect production systems in Ghana and also carrying out aquaculture feed trials, using insect meal as replacement for fish meal. The University of Stirling has also been an active member of PROTEINSECT with several PhD candidates involved as well as providing consulting support.



IMBT (Immune Macro Biotic Technology) has UK and Australian patents for the production of a medicament (primarily Antimicrobial Peptides, [AMPs]) through the oral pathogenic challenge of an insect. The medicament can be used for the treatment of pathogenic infection in farm animals and humans as a safe, sustainable alternative to antibiotics. Insect AMPs are active against animal and human pathogens.

IMBT has been supported by UKTI in developing its International business, the last UKTI Trade Missions to the USA resulted in IMBT working with a leading USA based, and International animal feed company. Following funding from the company, IMBT working with Dr Tristan Cogan, at the University of Bristol have demonstrated Proof of Principle for the control of a pathogen in an animal model, specifically *Campylobacter* in Chickens. IMBT is in discussions with the company to develop the technology worldwide.