



**HOW INSECTS CAN
HELP REINVENT THE
FOOD CHAIN**

AN INTERVIEW WITH ANTOINE HUBERT



ANTOINE HUBERT
CEO AND CHAIRMAN OF ŸNSECT

Ÿnsect is a rapidly growing agri-food company based in France, set to become one of the global leaders in transforming insects into high-performance natural ingredients for pets, fish, plants, and human beings. Antoine co-founded the company in 2011. In this interview with Arnaud Jouron, Partner at Arthur D. Little, Antoine shares some fascinating insights into the company and the exciting opportunities for the future in the insect-based food industry.

FIRST OF ALL, COULD YOU TELL US HOW THE ORIGINAL BUSINESS IDEA CAME ABOUT?

As long as I can remember, I have always been deeply interested in topics related to agriculture and environment, which motivated me to study agronomical engineering later on. When studying abroad in New Zealand, I had learned how insects were contributing to soil preservation, in addition to other interesting applications in bio-engineering, thanks to their physiological properties.

Back in France, I started to work as an environmental consultant, and alongside this, I started an association to promote the topic of soil preservation with the other future founders of Ÿnsect – Alexis Angot, Jean-Gabriel Levon and Fabrice Berro – who shared the same interest. In particular, we wanted to highlight how worms were contributing to soil preservation and how we could use them to recycle organic waste to close the food cycle, notably in cities.

Quite soon we had transformed a small organization into a think tank, working with large labs to measure the impact of urban agriculture in terms of nitrogen and carbon dioxide. Besides this, we looked into

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what sort of food transformations were possible with insects, highlighting the environmental (e.g., fewer GHG emissions), health (e.g., protein rate, nutrients) and economic benefits of edible insects and their potential impact on food and feed security. Then we decided

we needed to take an active role. Becoming a for-profit organization while retaining a central aim of positive impact seemed to be the best way, which gave birth to Ÿnsect.

The overarching idea of it is essentially that insects have a far greater role to play in our society than just producing honey and silk. They are at the base of all food chains and have an immense amount of biodiversity. They should be further integrated into our food cycle to make what I would call “smart food” more effective.

COULD YOU SAY MORE ABOUT THIS CONCEPT OF SMART FOOD?

Well, let’s do an analogy with the concept of smart grid. In the energy sector, there aren’t any winner-takes-all solutions, but rather, a set of different options that are more or less adapted to certain environments. The diversity of the mix is needed to balance the strengths and weaknesses of each option. The same goes with agriculture – the choice of what to farm will have to vary in terms of its fit to each area, climate conditions and local demand. For food, we could expect that in the future there will be less demand for animal-based protein and more for plants and mushrooms, but also insects. In this context, the aim of Ÿnsect is to help make a diversified “smart food” chain a reality by being the global leader of insect-based products while addressing multiple markets.

WHAT ARE THE ENVIRONMENTAL BENEFITS OF CONSUMING INSECT-BASED PRODUCTS?

The use of insects provides real benefits for our planet’s biodiversity and climate. We have performed end-to-end analyses on our production cycle that support this, and found that there are significant net reductions in GHG emissions as a result of the growth and mortality of animals fed with insect feed. There are also benefits from carbon sequestration through the use of frass (insect droppings) fertilizer.



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In addition, Ÿnsect as a company is working to reduce its own environmental impact. Our current footprint is much lower than that of traditional animal proteins, in terms of both carbon emissions (30 to 50 times less emissions) and water use (20 times less water used than for beef and 50 times less than for pork), while for our energy consumption, we have set ourselves a target of 100 percent green electricity use within three years. Our aim is to go even further thanks to our new farm designs, which will have improved efficiency. It's also important to remind ourselves that environmental improvements are also economic improvements – reducing raw material and energy needs allows us to address clients for which sustainability is becoming increasingly key.

HOW DID THE COMPANY GROW AND DEVELOP?

We started as a deep tech company aiming for scale-up. The overall idea was clear, but we needed to study the potential end markets, define the industrial process, and obviously choose which type of insect would be the most appropriate. In fact, we tested flies, butterflies and beetles, comparing them in terms of physiological properties, scalability and client benefits, before focusing on the *Tenebrio Molitor* mealworm after our first fundraising in 2015. These funds helped us to run several pilots, some in partnership with universities. We then launched an industrial demonstrator and, after just two years, we were reassured of the viability of our concept despite some areas of remaining uncertainty. Launching this first facility was critical in our development. With new Series B and Series

C funding in 2019, we were able to finance our first full-scale farm, located in Amiens. Operations started in the beginning of 2022. The challenge now is to ramp up quickly in order to produce at full capacity.

WHAT MAKES YNSECT DIFFERENT FROM OTHER ACTORS IN THE FIELD?

I see several differentiating factors, but the main ones would be our production process, our local production philosophy and the quality of our products. First of all, our production process comprises two independent steps, allowing us to have one harmonized and optimized platform capable of addressing multiple end markets. The first step

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consists of breeding the larvae using the vertical farming method that we have developed and scaled up. We took the traditional systems used to grow mushrooms and applied the principles of Industry 4.0 to it – the details of this are interesting, but we might come back to that later. Then the larvae are harvested to produce what we call CFL (Clean Fresh Larvae), which is the initial input of all the end products. This CFL is transformed into different finished lines with the appropriate

mix to address each market. Most of our competitors do not have this capacity, as they tend to be specific to only one product in one market. In the end, this means any industrial optimization can be shared across the plants, giving us a tremendous advantage in terms of efficiency.

The second key differentiating factor compared to other alternative proteins (e.g., soy), would be that our products are more local, which is increasingly important both to our clients and to the end customers. The limited surface area required by our farms due to the verticalization concept, the controlled environment in which the larvae are bred, and the fact that our process requires less energy and water than other proteins allow us to be more flexible when choosing the location of our plant. It gives us the possibility to be close to our markets in different geographies and climates. Because we span the entire value chain from biomass supplier to distribution channel, we can, for example, replace chemical fertilizers that come from Russia, palm oil coming from SE Asia, or soy coming from South America.

Finally, there is a point to be made about quality here as well. With our products we have observed lower mortality rates in animals and greater growth in plants, these being major factors that clients take into account when selecting products. This puts us in a good position to place our products in a more premium category.

CAN WE GO BACK TO VERTICAL FARMING AGAIN? YOU MENTIONED THAT YOU WANTED TO GIVE MORE DETAILS ABOUT THE CONCEPT

Yes, that's right. So, as I said, the basic system is quite simple, and has traditionally been used to grow many things, such as mushrooms, insects and plants. The key component that we have added to it is to make it completely automated, with in-built sensors and software that provide us with valuable real-time data. This means better control, process optimization, biosecurity and traceability. We have been constantly exploring and testing different ways of applying technologies from Industry 4.0 to make the most of our data-based approach.

HOW DO YOU SEE THE NEXT 10 YEARS COMPARED TO THE LAST, AND WHAT MARKETS WILL YOU BE PURSUING?

We used the first 10 years to lay the foundations, not only for Insect, but also for the industry, by conceptualizing, building and refining an entire ecosystem surrounding insect farming. The aim for the next 10 years will be to accelerate our expansion to the rest of the world. The ecosystem is still very European at the moment.

This, of course, involves developing new sites internationally in order to produce locally, being close to our raw materials and clients. It also means exploring new applications that we have probably not even envisaged yet, which will allow us to unlock new markets. For example, we have only scratched the surface of the possibilities that insects have in the health market. On this topic, we have conducted pre-clinical trials that indicate that our larvae may have cholesterol-relieving properties. This would definitely help us to accelerate people's acceptance of insect-based products. I think our biggest challenge in the coming years will be to significantly increase the acceptance of mealworm-based products in order to rapidly develop our sales in the animal-feed, human-food and fertilizers markets. The launch of our Amiens farm will be a massive support for this expansion.



Within the animal feed markets, pet food is a top priority, as this is a growing and resilient market that is very well adapted to the quality of our products (e.g., protein contents, palatability), and also provides attractive prices and potentially high margins. To address livestock feed, which is a far deeper market, we need to continue to improve the efficiency and performance of our farms to be more competitive in a market that has large volumes yet lower expected margins. Aquafeed is also a high-priority market, as it has a strong appetite for insect protein given its benefits in terms of accelerated growth and lower mortality.

With regard to human food, we truly believe that this will be the biggest market in the long term. Whether that happens in the next five or 50 years will depend on our ability to deliver on marketing and communications, as well as build up international partnerships to help cross the chasm of popular acceptance – today it's still limited to "early adopters".

Finally, we plan to address the fertilizer market with our "Ynfrass" product, which we would like to use for more than just feeding plants. This is part of an ongoing R&D program to establish the effects on the growth and health of plants that use insect fertilizer, and the results are already quite promising.

DID YOU SEE ANY RELUCTANCE FROM STAKEHOLDERS TO BE CONVINCED THAT INSECT PRODUCTS COULD BE SUCCESSFUL?

I think there are two elements here: one is client acceptance, and the other is regulatory approval. Regarding client acceptance, it is clear that this is evolving for the better. At the time of our last fundraising in 2020, we felt confident that there was a demand for animal and plant feed already thanks to our sales teams, who worked side by side with clients such as pet food companies. Having focused first on quality, we can now focus on improving our technology and processes to become more competitive on price. As for regulatory approval, we have had to put in place an ecosystem that supports the approval of our products, putting regulators in touch with relevant scientists, universities, clients and suppliers. This approach has paid off, with our mealworm products recently gaining approval for human consumption from the European Sanitary Agency.

LOOKING FORWARD, ARE THERE ANY ELEMENTS THAT RISK SLOWING DOWN GROWTH?

Much of our expected growth rests on our ability to execute the planned expansion. For us to be successful, it is critical that we continue to have access to local talent and capital. This is especially demanding, given the fact that our industry does not exist in almost all the countries where we plan to expand, and that some roles are difficult to source, such as the technical ones. Thus, we need to think carefully about our recruitment strategy and how we want to continuously train our new joiners in order to develop the required skills. With regard to funding – be it capital, borrowing or subsidization, we need to acquire a deep understanding of the local ecosystems surrounding our potential suppliers and clients, as well as a perspective on local and national authorities.

HOW WOULD YOU COMPARE THE GROWTH PHASES OF YNSECT IN TERMS OF DIFFICULTY?

We might have the impression that the new phases are more difficult than the previous ones, but they are, in fact, just different. The issues, people involved, knowledge, and available resources are simply not the same. For example, the first funds we had to raise as a young company of 10 people with a narrow focus on innovation were not simpler to get than the large funds we raised afterwards. We were in a cutting-edge field and we had to build a totally new industry. In fact, we had to identify and clearly define the potential markets to understand who the clients were and develop products to address them accordingly. We also had to move fast from principles to a detailed industrial design and our first full-scale operational plant. On top of that, we had to convince the regulatory bodies and investors to support the industry. In reality, the moments where things went wrong allowed us to clarify how we should do things differently. It also forced us to be very flexible and think on our feet, growing and adapting as we went along.

HOW DO YOU SEE THE AGRICULTURE SECTOR EVOLVING IN THE NEXT 10 YEARS, AND WHAT MAJOR INNOVATIONS DO YOU SEE FOR YOUR INDUSTRY?

I think agriculture will be more diverse, driven by consumers who are demanding a wide range of products. This diversification is currently reflected by low-tech systems such as permaculture, local-loop food sourcing, urban farming, and so forth. These are allowing consumers to eat more fresh fruit and vegetables, while reducing the carbon footprint that results from importing these from further afield. However, this is insufficient in the long run. We need to see a step change in the use of technology. Greater use of technology would help to optimize the use of water, fertilizer, feed, etc., and ensure that it is applied exactly when and where it is needed.

Also, I think we will see less monoculture on a massive scale and more diversity even on a regional level. New pairings of livestock and plants will be explored, and will unlock a broader range of products. Rather than seeing farmers raising large vertebrates, we might see hybrid systems playing off the benefits of insects, algae,

mushrooms and plants, taking into account the particularities of the local environment. These are some of the ways to respond to this simultaneous demand for greater diversity and sustainability.

This can also be applied to fishing. Rather than focusing on the two or three popular species that will invariably be overfished and destabilizing the ecosystem, we could fish the 150 species that are available to us while respecting the quotas. The same stands for the use of algae, mushrooms and insects, which have fallen out of use or never been consumed. If people are provided with indications for how to cook these, the demand will eventually follow. This initial spark requires the help of influencers, as I think there is a real audience, especially with the younger generations.

HOW WOULD YOU DESCRIBE THE CULTURE AT YNSECT?

It's difficult to define one culture. Our culture is constantly evolving, and although it is still based on our initial values as founders, it has also been enriched by those that have since joined us. This becomes truer when you consider that more than half of our employees have joined us in the last year and a half. We are always looking for balance,

I THINK AGRICULTURE WILL BE MORE DIVERSE, DRIVEN BY CONSUMERS WHO ARE DEMANDING A WIDE RANGE OF PRODUCTS.

and we favor a culture consensus. We share a deep sense of solidarity as a team, considering that our successes are always collective, and we extend this solidarity to our ecosphere by being committed ecologically, economically, and socially. Adaptability is also part of our DNA since our environments and knowledge are by nature constantly

changing, forcing us to continuously evolve. Another core value would be authenticity, being sincere in everything we do with a strong commitment and belief. We have ensured that we take an active role in conserving these core values by reasserting them at regular events and ensuring that they are effective within our day-to-day operations as a team, as well as with our clients, shareholders, and environment in a broad sense.

LOOKING BACK, WHAT ADVICE WOULD YOU GIVE YOURSELF 10 YEARS AGO, WHEN YOU STARTED YOUR JOURNEY WITH YNSECT?

Firstly, the key is to recruit well and to avoid letting one's ego get in the way of hiring the best talent. We were clear on this from day one. What we could have done better, however, was anticipate where and how soon we would need to recruit in order to keep up the momentum on key projects. This is especially the case with top management roles and the ones requiring a high degree of expertise, as these take six to nine months to recruit – time that is then lost for the company. Secondly, I think we could have made more of an effort in internalizing some core capabilities early on and highlighted its importance from the start to our investors. Indeed, at the beginning, we had to outsource some of our core research and site management, which, in the long run, was not always the most appropriate choice in terms of cost and operability.

AND FINALLY, WHAT DO YOU THINK ARE THE ELEMENTS THAT MAKE UP A GOOD LEADER?

There is not a simple answer here, and the theories on this are numerous. I think that, as a CEO, one must have a holistic vision of the aims and challenges of a company and assess them in their correct context. To do this, you need to ensure that you surround yourself with people who know more than you, and you need to feel safe putting your trust in their hands. It is also important to be able to grasp things quickly, to connect the dots between people and topics and apply one's curiosity to question any subject – even if naively. The leader has the responsibility to ensure that teams are onboarded with energy and enthusiasm. Ultimately, the role of a CEO can be likened to that of an explorer. They must know how to provide a course for the company while remaining flexible in the face of changing circumstances.



Antoine Hubert is the Chairman and CEO of Ÿnsect, the global leader in insect-based protein and fertilizer, which was founded in 2011 and raised nearly \$400M. Ÿnsect is also the only aggrotech company that is part of the French label Next 40.

Besides his role at Ÿnsect, Antoine leads the cooperative insect industry association and the International Platform of Insects for Food and Feed (IPIFF), and is a Board Member of the Protéines France consortium and LFD (La Ferme Digitale). Prior to co-founding Ÿnsect, Antoine worked on scientific projects in environmental risk assessment, biomass and plastics recycling. He is an agronomy engineering graduate from Agrocampus Ouest and AgroParisTech. Together with Alexis Angot, he co-founded NPO Worgamic and the company OrgaNeo.

In 2021, Antoine was recognized as one of the Meaningful Business MB100s, an award celebrating leaders who combine profit and purpose to help achieve the United Nations Global Goals. In the same year, he was named first in the ranking Choiseul 100, and has been selected as part of the French American Foundation's Young Leader promotion.

In February 2022, Antoine published his first book, "For Planet, People & Profit: An Insect Farmer's Manifesto", which highlighted the possibility of combining ecology and economy, while calling for committed entrepreneurship.

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