Market Hunt S02 Episode 10 / Spotlight on Aquaculture / Rich Moccia

[Begin intro music]

Thierry Harris: Aquaculture has been around for thousands of years. But the days of throwing some aquatic organisms in a hole in the ground to watch them grow and then harvest them are long gone. The last 30 years have seen some dramatic technological improvements to the aquaculture industry including the use of Artificial intelligence to monitor everything from feed, to water quality and even fish behavior to make sure they are doing OK.

On this episode special two-part Aquaculture series of Market Hunt, we bring you into the world of aquaculture and the cutting edge of the science and innovation taking place in this field. We'll interview a university professor to provide us some context on the aquaculture ecosystem. And then we'll feature a company attempting to bring the first genetically modified protein to market for human consumption in the world.

Are you ready? Let's go.

[begin theme song music]

Nick Quain: Entrepreneurship is hard, you need to have support there.
Andrew Casey: We fundamentally have to learn how to live our lives differently. We can't keep going the way we have.
Handol Kim: It's not like Google can come and move in and take the entire market. Not yet, right?
Thierry Harris: It's a real balancing act which requires a bit of insanity frankly. But I mean some people are into that stuff I guess.
Handol Kim: You know the size of the market, that's really all you've got.
Thierry Harris: We're coming up with some pretty interesting ideas here.
Andrew Casey: We've solved everything,
Thierry Harris: [chuckles] We've solved it all.

[End theme song music]
[Begin promo music]

Narration: *And now a message from our sponsor, IE-KnowledgeHub.*
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international entrepreneurship. Watch Video Case Studies, listen to podcasts and much more!

If you are an education professional looking for course content, an academic researcher seeking research material , or someone interested in business innovation check out Ie-KnowledgeHub.

Ie-KnowledgeHub focuses on innovation ecosystems and firms who commercialize their technologies in international markets.

Let's listen in to a Video Case Study featuring Magex Technologies.

Catherine Lamontagne: *When we arrived in the United States for the first time, they told us that Magex is too small, it's a small company, we don't want to do business with you for the moment because you didn't prove yourself. You didn't prove that you could work with international companies. We had to demonstrate that our company was not this small SME that they perceived we were.*

Narration : *That's Catherine Lamontagne, General Manager of Magex Technologies, Magex commercializes real estate software aimed at two markets, Real estate investors, and property managers. Magex saw the potential for their products to be sold on international markets. But with a small team of under 10 people, they had to overcome a lot of challenges.*

Catherine Lamontagne: *One of the main challenges we faced was the hard competition of United States software. Because in Quebec the advantage is the language. in french we can sell only to french people. but outside of Quebec our software needed to be bilingual. We had to develop support. English support. We had to have employees able to speak fluently in english.*

Narration: *The Magex case is typical of many small Quebec companies facing language barriers to enter English speaking markets. With a limited team and resources, Magex had to consider market opportunities carefully.*

Catherine Lamontagne: *When we decide to penetrate a new market, we really take time to analyze our competitors. And we won't penetrate this market if we are not able to offer a product, a higher level of efficiency, of user friendliness, of affordability. So we consider ourselves as market disruptors.*

Narration: *What other challenges did Magex face going to international markets? Find out more at the end of the program. You can also checkout the Magex video case study by visiting IE hyphen Knowledgehub.ca. And now, back to the show.*

[end promo music]
[begin intro music]

Thierry Harris: Hi folks, Thierry Harris here.

On this special two part Market Hunt Aquaculture series, we are diving into the world of aquaculture farming and genetic engineering. We'll learn about the journey of a Canadian innovation which began in a lab at Memorial University and went through a 25 year regulatory approvals process to become the first genetically modified protein approved for human consumption in the world.

This case is as much about consumer education as it is about how products are perceived and how that perception can impact the very survival of a product in a market.

We'll chat with Sylvia Wulf, President & CEO of Aquabounty. Wulf will discuss Aquabounty's journey of commercializing their genetically modified AquAdvantage Salmon fish.

But first we speak with University of Guelph professor and aquaculture industry veteran Rich Moccia. Moccia will provide us with more context on Aquabounty's history, their early challenges getting their product approved in both the U.S and Canada, and help us understand the Aquaculture ecosystem. We will explore some of the tremendous innovations occurring in this field.

Moccia has had a long history in aquaculture in Canada and around the world. You can check out his impressive Bio on our episode show page. He holds an undergraduate degree in Marine Biology and graduate degree in aquatic pathology. Let's get to know him a bit better in his own words:

[end intro music]

Rich Moccia: I first came into contact with fish farmers when I was a graduate student, actually helping them solve some problems at the farms. Cause I knew a little bit about fish and water, and that began my longterm journey involved with the industry. I was self-employed for eight years in the private sector and did two small startup companies in aquatic farming technologies. And then I moved back into academia in 1987 when I took a job back at the university of Guelph to develop agriculture education and research programs, here in Guelph.

[Music interlude]

Thierry Harris: I asked Moccia to provide us with a bit more context on the aquaculture industry.

Richard Moccia: Aquaculture is the aquatic equivalent of agriculture. So that is the farming of a very wide and diverse group of aquatic species that are produced for a variety of purposes, from human food to food ingredients, to even engineered technologies where we're developing systems to be able to grow human pharmaceuticals, even in, in some species of fish with unique technology.

[Music interlude]

Aquaculture primarily around the world is the farming of fish, shellfish, crustaceans, and aquatic plants in advanced farming based systems that are owned by a company that are basically utilizing human intervention into most aspects of the life cycle of these animals or plants, and are essentially producing biomass then to go into the human food chain in the food marketplace.

So aquaculture has a direct parallel to terrestrial agriculture. Farmers own their fish or shellfish or crustaceans or plants. They breed them, they feed them, they manage disease problems. They grow them up to a market size. They sell them into the processing industry where they're developed into a number of different kinds of consumer products. And then they're marketed out to the consumer, everything from institutional markets, restaurants, and direct to home sales. So that really is aquaculture as it exists today.

It's practiced in virtually every country around the world. We farm a couple of hundred or more different species of fish and plants and crustaceans and mollusks. And, the interesting part is that 30 years ago, aquaculture contributed less than 5% of the world demand of seafood products in the human food market. Today, aquaculture is supplying over 50% of the world demand for seafood, and the other 50% really comes from the wild harvesting of products around the world with, through the commercial fishing industry.

[Music interlude]

So, you know, the important thing to understand about agriculture is that it is moving away from the older technologies of hunting and gathering, which is what the commercial fishing industry does, right. They go out into public waters and

moving, hunting, and gathering to farming based technologies. And, you know, the best example I give my students of that is that we used to supply bison by shooting them on the Prairie's and hunting them. Nowadays, we don't have any more wild bison that we, we hunt anymore on open lands, but we now farm them. Right. So you can still buy bison meat, but it's farmed. And so we're also moving, uh, agriculture technology from hunting and gathering to farming.

Thierry Harris: You mentioned how the technology has innovated over the last 20 years, give us a bit more details about how this technology has evolved and where it's at today.

[Music interlude]

Richard Moccia: Farming systems of course require that the farmer manages reproduction, genetics, life support systems, health, engineering technologies, and virtually every one of those sub-disciplines of aquaculture farms has innovated at an almost exponential rate over the last three decades around the world, and also in Canada.

40 years ago, we used to dig a hole in the ground, throw a few fish in, throw a bit of waste feed in there, and the fish would grow and you'd harvest out a few, send them to market. And that was basically the early generation of what we called fish farming at the time. But in the last 30 years, we have developed very exquisite technologies around feeding and nutrition, for example, trying to understand the very precise nutritional requirements of these animals to grow them successfully and healthily in captivity and produce a product of high quality and high tastes and other texture characteristics for consumers.

[Music interlude]

Richard Moccia: We have had significant advances in genetic selection and genetic engineering technologies. We've also had incredible technologies in animal health and disease management in aquaculture. So development of a better understanding of disease processes in aquatic organisms, how they can be managed from a veterinary care perspective, the development of various pharmaceuticals and therapeutic agents to be able to manage animal health and captivity. Vaccine development, for example, has been a huge one in aquaculture in the last three decades to try to manage health of both fish and other organisms like shrimp in captivity.

Water quality management has been perhaps the single biggest area of innovation in aquaculture to be able to have systems which can manage all the basic life support, water, quality oxygenation, you know, the removal of metabolic wastes from the animals in their systems.

Unlike most terrestrial animals, aquatic organisms, essentially urinate and defecate into the same environment that they live in. Right? So because they're surrounded by water. And so they urinate and defecate into that water. And so fish farms need to be able to manage those aquatic systems to have a high level of both welfare, but a high level of life support systems for the fish.

[Music interlude]

The other areas of innovation have really been in the processing side and the marketplace side. So aquaculture has developed a number of new and innovative products to try to, you know, encourage diversification at the retail level to encourage consumers to consider a farmed product as an alternative to a wild harvested product.
And it's hard to be able to pick just one technology where we've seen the most innovation, but, I would say perhaps in life support systems maybe has been the, the area of greatest development.
So we've now moved from that dug hole in the ground where you threw a few fishing to very sophisticated engineering systems of closed containment, where, you know, we computer monitor all the different life support systems. We have mechanical controls. Artificial intelligence and artificial learning systems, computerized control of feeding. Even we have now very smart, monitoring systems of fish behavior to be able to, determine perhaps when the fish are acting abnormally to require veterinary intervention. So lots and lots of very sophisticated is being innovated in aquaculture.

[Music interlude]

Thierry Harris : And which one, so would you say just a, to put a little Canadian flag on this, uh, which ones would you say Canada is the, um, our, our number one or number two or our in the conversation in terms of the innovation in aquaculture?

Richard Moccia: Yeah. That's a good question. Canada has had research scientists essentially that have added value to virtually every one of those disciplines, but perhaps the ones that we are maybe most noted for around the world would be our nutrition and feed formulation technologies. So we had some of the very early

experts in nutrition and feed development in Canada. We've made great strides in this country in developing very precision feeding strategies and precision feeds for fish.

The other one I would say is some of our development in open ocean systems in that is some of the technologies that we're using for our net pen farming in our salmon industry in both coasts in Canada. We have been very innovative and very creative in trying to find solutions to problems with icing and weather in our Northern climates.

We have incredible engineering challenges to putting these large farms out into ocean environments with everything from, you know, tidal currents to storms, to you know, shipping traffic and everything else. So that's, that's had a lot of innovation in Canada, too.
And then the other one, I would say in Canada has been in the genetic side of things, not just in the genetic engineering technologies like AquaBounty, but in the, the more conventional and classic genetic selection where, you know, you'd pick a fast-growing mother and a past fast-growing father, breed them together and get fast-growing offspring and utilizing a normal genetic selection. Those would be ones that I would highlight Canadian innovation.

[Music interlude]

Thierry Harris: Who are some of the main, you know, this innovation, as you said, it's flourished in the last 40 years, who are some of the main stakeholders in the aquaculture ecosystem that are helping support this innovation?

Richard Moccia: You know, first and foremost, I need to give shout out and credit to our federal government and our department of fisheries and oceans Canada. Because over the last 50 years, they have been a world leader in understanding fisheries systems and developing many of the early research innovations in nutrition, breeding, genetics and life support technologies. And they did it initially as a way to support their own rehabilitation and restocking program. So we have for many decades, uh, attempted to rehabilitate salmon, for example, on both the west coast and the east coast. And so the federal government spent a lot of money in those technologies, which were all exported into aquaculture.

[Music interlude]

Our federal government through Fisheries and oceans Canada, were some of the early leaders in investing in, in research and technology development, um, similar to that, though, of course, we've had our federal research funding agencies, NSERC probably been the biggest one, which has supported all kinds of innovative research and development at universities and in private companies to develop new knowledge and develop technologies that are tailor made for Canada.
Beyond federal levels of investment, we have seen substantial investment by a number of provincial government agencies as well.
In the province of Ontario, for example, our provincial Ministry of Agriculture Food and Rural Affairs has been a long-term supporter of aquaculture research and development. We have one of the world-class facilities, uh, for aquaculture freshwater research in Ontario, that's been supported by the provincial government, and you could kind of replicate that investment across other provinces in Canada. British Columbia. , many of our Maritime provinces, for example have been significant investors in both, classic institutional basic research, but also in research and development and in technology transfer, which is a very important element of that, right?
Once you develop the technology, it needs to be adopted by somebody. So it needs to be transferred to the private sector. And those are of course are very meaningful parts of, you know, training business, students and others these days to understand that innovation pathway from the lab to the marketplace.
[Music interlude]
We've also in Canada had some very entrepreneurial companies, Canadian, born and bred. One that comes to mind is Cook aquaculture, which is a company in Atlantic Canada, which had been involved in the commercial fishing industry in Atlantic Canada and or one of the very early investors in agriculture development at a large scale. They are now a very large international company that grows salmon and a few countries around the world. And they are still a kind of a family owned company that has been a tremendous investor in the industry and, and saw the opportunity to provide food from farms where they had previously supplied that same fish product from the wild harvest fishing industry.

We also in the earlier parts of Canada's development had investment from Norwegian companies that came to Canada to co-invest with, the private sector here. And you know, that course evolved and consolidation happened over long periods of time, over a two or three decades or so. We now have some very, very large companies in Canada, Mowi international, MOWI Mowi international is one of the world's largest salmon farming companies that are invested in Canada. And of course it's like you could provide many other names of companies. Um,

The other, the other interesting piece that I'll say, uh, is that we've also seen substantial, uh, partnership and co-operations with First Nations groups in different parts of the country. They are also involved in aquaculture in many of our coastal farms. And even in Ontario here are partnered with First Nations groups.

And then of course, you know, we now have a number of other companies, like AquaBounty, which probably spent well in excess of a hundred million dollars trying to bring a technology to marketplace in the last couple of decades.

[Music interlude]

Thierry Harris: Let's get into AquaBounty. Could you please tell us what is AquaBounty?

Richard Moccia:
Well, AquaBounty is a publicly traded company which has specialized in bioengineering and genetic engineering technology in aquaculture. They began as a, an idea in a scientific laboratory at Memorial university where a technology was developed to try to enhance growth performance in salmon and the early entrepreneurs in AquaBounty saw the opportunity to take that technology, commercialize it, try to move it into the private sector and essentially create a for-profit company that would produce farm fish for the world using very sophisticated genetic engineering technologies.
They essentially have the technology of both manipulating the genetics and the fish as well as growing and selling fish. So they're both a technology company as well as a fish farming company, uh, that attempts to grow food for human consumption. So they're very interesting and a perfect example of a made in Canada, uh, entrepreneurial outgrowth from a research laboratory into a, essentially a private company now on the stock exchange.

[Music interlude]

Thierry Harris: This research that started was happening. I mean, it took a long time for them to get all the approvals that they had and you're identifying the genetic research for the fish and then the actual aquaculture technology. Perhaps you can break those down and give us a little bit more detail about each.

Richard Moccia : Sure. Well, back in the 1980s, a researcher from Memorial university called Dr. Garth Fletcher was working on a genetics of what's called an antifreeze protein at the time, they were looking for ways to try to make fish more

tolerant of some of the very cold water temperatures that they had in the north Atlantic. And Dr. Fletcher teamed up with another individual Dr. Choy Hew at that time who was at Memorial and then went to the University of Toronto to utilize the same technology of putting unique gene sequences of other fish species into an Atlantic salmon. And they had this idea that if they took a gene from a Chinook salmon and another gene sequence from a fish called an Ocean pout, that was a promoter gene it's called and they could transplant these genes into an Atlantic salmon. They actually could produce a fish that grew more quickly than the non genetically modified fish.
Well, this was really at the time almost a stuff of science fiction, where you could take genes from a Chinook salmon and an ocean pout, put them into an Atlantic salmon. They would incorporate into the normal genetic sequence of the Atlantic salmon. And it would ultimately produce a fish that grew four to five times faster than a non transgenic fish. And additionally, it would also utilize food energy more efficiently than a non transgenic fish. So this technology then could produce a faster growing and more energy efficient fish. Well, that was all in the laboratory at the time Memorial university had encouraged researchers to try to commercialize their technology at the time. And so Dr. Flesher reached out and met a gentleman by the name of Elliot Entis, who essentially took the technology and attempted to commercialize it, uh, and began the very, very long term process of trying to secure approvals for food safety and utilizing that technology in the commercial agriculture industry that began in 1991.
[Music interlude]

Thierry Harris: For more on how Entis spun off Aquabounty Technologies check out the Nature magazine article link in the episode show notes. It's a fascinating story. Back to Moccia.

[Music interlude]
Richard Moccia: Well, it took all the way through until 2015. So from 1991 to 2015 of submitting applications on the technology and food safety and environmental safety to both the U. S. food and drug administration, as well as the Canadian Food Inspection Agency. And it actually took until 2015 where the technology was finally approved and considered to be safe for use in the human food market, that was in the United States. And then one year later, 2016, the technology was approved in Canada by the Canadian government. So a very, very long term undertaking that costs tens of millions of dollars, essentially for that company to try to ultimately bring that scientific discovery to the marketplace.
It was the very first example, in North America and Europe of an animal species that was genetically engineered being approved for human consumption. And we have

had a number of plant based species which are genetically engineered that are already in the food marketplace but there has never been another animal species approved for human consumption.
From 2015 to 2019 AquaBounty, then attempted to both license the technology and also then utilize it themselves, to build production growing facilities for salmon. So they now have a couple of production growing facilities and entered into the actual, farming industry themselves too. So they really are an interesting technology development company that actually moved into farming as well.
And so they are there today attempting to make a profit off of this technology, uh, that essentially was developed 40 years ago back in the research labs of Memorial university. So, it's an incredible story. They have not been successful yet to make profit off of the technology. And they're still, uh, trying though, um, and kind of utilizing now the, uh, stock market and, uh, entrepreneurial and, uh, investors to try to drive it to the next level.

[Music interlude]

Thierry Harris: A couple of mind blowing points here that Professor Moccia just mentioned. No 1 this was the first ever genetically modified animal protein to be approved for human consumption. No 2, it took 25 years from the initial scientific discovery at Newfoundland and Labrador's Memorial University to commercialize the product. Remember folks, we'll have an interview with Aquabounty President & CEO Sylvia Wulf coming up in the next Market Hunt episode of this two part aquaculture series.

In order to approve the technology both United States and Canadian Federal Agencies required Aquabounty to restrict farming of the Salmon to land based farms.
The issue has been a contentious one. Environmental consortiums composed of fishermen's associations, ecology groups and indiginous Nations have sued regulatory agencies in the US and Canada on the potential risk of contaminating wild salmon populations with genetically modified fish. We have more on these cases in the episode show links. With much respect to all sides involved, we are not here to discuss pros and cons of GMOs for human consumption or potential impacts on wild populations, but to understand the challenges and opportunities of aquaculture innovation and how Aquabounty is undertaking the commercialization of this novel protein.
Bottom line is Aquabounty needed to find a way to grow these Salmon in self contained land based farms away from wild salmon populations. Moccia elaborates on the impact of the FDA decisions on Aquabounty.

[Music interlude]

Part of the regulatory approvals of both the US government and Canadian government, were done with the proviso in the restriction that these genetically engineered salmon would only be grown in closed containment facilities on land. And that was very different than how 99% of the salmon around the world are grown because most of the salmon that are grown in virtually every country around the world are farmed in floating net pens out in ocean, environments, right? So they're in public waterways, out in the Atlantic and Pacific ocean in many countries around the world. And one of the challenges of course, of the open ocean net pen farming is that if a fish escapes, for some reason, it has the potential to breed with a native fish or a wild fish, and therefore transfer some of those exotic genes in this case that are in the AquaBounty salmon to wild fish, and that's considered to have a too high environmental risk.
So both governments of the United States and Canada said, you're approved to farm these for human consumption, but they need to be done in virtually closed containment facilities to prevent escapement. So that technology is called recirculating aquaculture systems where essentially you have a large building and inside that building is a whole variety of interconnected technologies to manage water quality to provide all the basic life support systems for the fish. And they're all done within a contained environment so that no fish can escape into the wild.

So AquaBounty now is farming fish in these closed containment aquaculture systems, which in and of itself is an emerging technology in agriculture. It has, it is being developed now on a sort of a very large scale around the world. As some companies are attempting to move their production from these open ocean net pen environments to these closed containment systems. And they do that for a number of reasons, of course, in an open ocean net pen, you're contending with everything from storms diseases that are in wild animals that can transfer to farm fish. You're in public waterways and shipping and navigation. We actually had a Norwegian submarine this past year in the summer of 2020 collided with a salmon farm out in, in ocean waters. And so this presents a fairly high level of risk and, and looking to move the salmon farming onto land onto private property, enclosed containment, AquaBounty themselves are not really developing the closed containment technology. They're utilizing those systems that have been developed over the last 30 years by a number of other companies. For AquaBounty of course, they have no choice if they're going to grow these fish, farm them and sell them for human consumption. They have to be enclosed containment.

So AquaBounty as a company is utilizing really two separate technological innovations in their company. One that they developed, which is the genetically engineered salmon, and the other one is a farming systems technology that have been developed by other companies around the world to be able to grow them in close containment virtually anywhere they want. The important final piece of this puzzle, I guess, is that AquaBounty is looking to be able to farm fish closer to the final marketplace for their product. So then that eliminates obviously longer term shipping and transportation reduces the carbon footprint because you don't have fish being shipped in trucks and airplanes long distances, um, and also allows the potential to deliver a fresher product more quickly to that final marketplace. So it's really an integrated strategy utilizing genetic engineering, utilizing very sophisticated, closed containment, recirculation technologies, and attempting to exploit a marketplace by being closer to the final product demand.

[Music interlude]

At the same time globally around the world, many other salmon companies are exploring investment into close containment, recirculation systems as well. So you see this interesting kind of parallel course of the development of two technologies. And in AquaBounty's case, now one relies on the other exclusively to be able to penetrate and be in the market. AquaBounty fish, is called the AquAdvantage salmon. So that's the trademark name of the genetically engineered fish.

Richard Moccia: So this is really the front of the pack. this is the high risk taking company that has spent tens of millions of dollars to try to bring a brand new novel product through the regulatory system and try to bring it into the food marketplace, and essentially to try to provide solutions to farming salmon that will be able to add profit to the farm and also to be able to farm it more sustainably, longer term.

[Music interlude]

The other important piece of the equation and something that's important for your listeners to understand is that the AquAdvantage salmon basically provides two advantages to farmers. The fish grow more quickly, and they also utilize food energy more quickly. Those are two huge opportunities for farmers. And if we looked at other examples, uh, in terrestrial agriculture, if you could bring a technology to say the swine industry or the beef industry, the poultry industry that could offer much more rapid growth and much more efficient feed utilization, those things would be considered panaceas to solving huge market opportunities for farms, right? These

are tremendous opportunity advantages for farmers, but of course they come at significant challenges as well because of that same technology.

[Music interlude]

Thierry Harris: The typical innovation journey from university labs to commercialize their activities into fully fledged companies. You need to have a market, you need to have some investment. You have described a very mature industry with small and medium sized companies being merged into international conglomerates over here. So there is, uh, an opportunity to find new markets, for the innovations, to justify as the millions and tens of millions. And in some cases, hundreds of millions of dollars of investment.

Rich Moccia:
Here's another take home message though about this innovation from lab to marketplace. Um, one of the things which most often gets overlooked in innovation technologies is the regulatory and policy environment and the social acceptability of bringing that innovation to the marketplace. So the model that we've talked about around AquaBounty is perhaps an excellent example of that, that technology was developed in the 1980s. It was attempted to be commercialized first in the early 1990s. And it essentially took close to three decades to actually get it through the regulatory process, um, to be approved for use by an adopting company. And this is often overlooked by entrepreneurs. You know, they think they develop something new and next year they're going to be making all kinds of money, uh, when they, you know, bring the product to the marketplace. But in fact, this regulatory ecosystem that they have to work through for a lot of new products is something that's really under appreciated.

The other main take home message that I want to leave for the students is the social and cultural fit for the technology and how that might impact adoption and then ultimate success or failure in the marketplace. And again, the AquaBounty salmon is perhaps the best example I can think of for that.

Thierry Harris: Yeah.

Rich Moccia: That technology essentially now is not widely considered to be an appropriate technology in the agriculture marketplace. There has been significant pushback and rejection by the consumer marketplace. Everything from, they don't feel it's safe for human consumption to worrying about the ethics and morality of intervening in the genetic composition of a living organism to produce this animal

for human use only. And the other big part of it, which was really unseen at the time the technology was developed.

And that is that even the agriculture industry itself has not embraced the technology. And here's an interesting thing to consider: if I came to the agriculture industry 20 years ago and said, I can offer you a solution, which will allow you to grow fish four to five times faster and save money on food, energy, I would have been considered to be otherworldly in my ability to solve one of the biggest problems in agriculture. And that's fast growth.

That's exactly the benefit of the AquaBounty salmon, but you can look across virtually every industry association in Europe and in Canada and even the United States. And most of them are not embracing the technology. Why, because it's considered that it's a potential negative impact in the marketplace to the consumers that we now have. We have marketed farmed fish based on their health wellness, based on the fact that they are unadulterated based on the fact that they have, you know, high levels of omega-3 and omega six fatty acids. And there they're good for you to eat. They have very high quality protein, low saturated fats in them. And all of a sudden, now you're going to bring this technology that consumers go well, I don't really want to eat that fish now because you've adulterated the genetic.

So interestingly, it's an incredible solution that has never been embraced by the industry itself, that it's been there to be an advantage to. And that is because of social acceptability has never been realized for that technology yet. In fact, it's probably the single biggest barrier to the technology having been widely implemented.

And these are perhaps the two most important take home messages that I would give entrepreneurs and innovators. And that is understand that it's not just a potentially a long time from innovation to marketplace, but you also have significant potential barriers around regulatory environments and also social acceptability.

it's just incredible to think of where we might've been today, had that technology been approved and adopted 20 years ago, compared to where we are today, where only one company has it. They basically produce only produce a very small quantity of fish. And they're still at the beginning of the adoption pathway, right?

Thierry Harris : Yeah. Yeah. Well, it's going to be a fascinating journey. Another big thing for entrepreneurs is if you don't have any competition out there yet, maybe there's a reason for that.

Richard Moccia : Well perhaps. The competitive environment you talk about is actually bearing down on AquaBounty at a high speed these days, because we have two emerging technologies in what's called the gene editing area and in the CRISPR technology, if you kind of look at that.

Thierry Harris: Yes we do.

Rich Moccia: So those, those approaches actually will have the ability to very rapidly produce genetically engineered animals and fish in particular, in this case, to be able to do a lot of other things other than just grow fast. So you may be able to use gene editing, for example, to have a fast-growing fish, which is resistant to certain disease issues. And that's sort of an interesting one because, uh, the regulatory system for those technologies is not yet well established, and they may be more quickly, approved because of a different perspective on whether they're safe or not, because there's no novel genes put into them. Right?

Thierry Harris: Yeah.

Rich Moccia: So AquaBounty may be the first casualty in the sophisticated genetic technologies being out competed by other ones, which can be more rapidly put through the regulatory process and perhaps not have all the same safety protocols on them that AquaBounty does now.

Thierry Harris: Yeah.

Rich Moccia: I'm not saying my crystal ball is any better than anybody else.

Thierry Harris: No. Yeah.

Rich Moccia: But it's interesting one about, about competition from emerging technologies.

Thierry Harris: Yeah, yeah yeah. Labeling was another huge issue that they had because nobody was clear on how to label this type of fish. And that took them

years to just get the eggs across the border, into the United States so that they were able to go ahead and commercialize this there. So...

Rich Moccia: Well, the labeling one also, I mean, incredibly interesting story for a student to chew into. Because, you know, we require labeling on regulations where it relates to either safety issues or nutrition issues, right? So then you have certain labeling requirements, but there really isn't a good justification to label a genetically engineered fish because it's considered to be safe. And from a nutritional point of view, it's exactly the same as an non-genetically engineered fish.

Thierry Harris: Right.

Rich Moccia: But consumers were the ones who said, we want to know if we're buying a genetically engineered fish or not, so that we can make the decision to buy it or not buy it. Right. So now you've got this interesting paradigm shift between a labeling system, which was predicated on safety and nutrition to now a labeling demand because of consumer expectations about what they want to see on the label.

And of course you can see that, you know, it might be an advantage or disadvantage because in some cases, if you label the fish as being genetically engineered, it might not impact the marketplace at all. But in other places like in Canada, we've had people that said, we're going to pick at, the grocery stores that have genetically engineered salmon on them. And they would know that if it had a label on it, right?

Thierry Harris: Definitely.

Rich Moccia: And so the grocery store might say, wow, we're not going to carry those because if we have to label them, then we're going to have all kinds of controversy in front of our store because of it. So, labeling is another whole incredible discipline to talk about it.

Thierry Harris: Yeah, definitely. Okay some of the big misconceptions that are out there about aquaculture in general, you've listed a few of them, already.

Richard Moccia: Yeah. There's, there's a few general and common misconceptions about aquaculture, and from fish in particular, one is that they're not safe for human consumption. There've been a number of stories over the years about, you know, unregulated use of pharmaceutical products in aquaculture and you know, various

chemical contaminants getting into the fish, that sort of thing. But that's a misconception. They're very safe for human consumption, but commonly many people think I'm not going to buy farm fish because they're not safe.
Another big misconception is that all fish farms are highly polluting to the environment and that they're an ecological disaster, right? So if you just Google aquaculture, some of the first links that will come up are from the antagonists who talk about the environmental negative impacts of aquaculture. Again, a very wide misconception. Most of our farms are very environmentally sustainable, uh, and are improving all the time.

One of the other big misconceptions is the one that consumers and many chefs have, for example, and that is farmed products are inferior to the wild caught ones, right? So we have many chefs, for example, that said, “I don't want to purchase a farm salmon. I want only wild one. That's a wild caught salmon,” because for some reason they think the quality is better and that's a misconception. In fact, it's changing pretty rapidly. We have now a number of professional chefs who are leading in trying to show the high quality and some of the different hedonistic, traits and qualities of farm fish over, over wild ones. Right?

And of course the other big thing is that one of the advantages of aquaculture is that it is reducing the pressure on wild populations. And, you know, we know globally that we're wiping out and overharvesting, many of the world's wild population of animals, and farming provides a solution to that.

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Thierry Harris: If you had a chance. Okay. If we, if you had a chance to get, uh, some students, uh, some business students are entrepreneurs studying aquaculture, what kinds of things do you think that they should be studying?

Richard Moccia: I love this question. They need to drill in to understanding food economics. Okay. So, economic students, you know, and business students kind of understand broadly about things, but the food economics is a very different ecosystem than understanding, say, economics in the automobile industry or whatever. So the food economics is one the impact of trade and trade policies on our food systems, and that includes things like supply management, for example, right? So, you know, some of our products we can import and export freely in Canada. Other ones, we have geographical restriction on them, because of supply management. And so for business students to understand the complexities of trade, and that's both import and export and, um, uh, programs around supply

management, which we have in some parts of our terrestrial agriculture industry. So our dairy industry is supply managed. Our poultry industry is supply managed, you know, and how these things impact trade. So those are very important business students.

The other piece that I find most economics and business people don't understand and where they need additional exposure is to the regulatory and policy environment that all new products have to succeed in. Right?

So, and, you know, I think we talked about an incredible example of that in AquaBounty, but you could make the same case if you developed a new technology around, um, you know, a car technology, for example, uh, that we'll have to go through all kinds of regulatory and approvals, right? So most, most business and economic students did. They don't understand that environment. And that's a great one to get extra training.

Thierry Harris: That's all for today's episode. We've had the pleasure of listening to Rich Moccia, Professor in the Department of Animal Biosciences, at the University of Guelph. Stay tuned for our next episode featuring Sylvia Wulf, President & CEO of Aquabounty, the company at the tip of the spear bringing genetically modified Salmon to the market. Remember to check out the case study questions on the episode show page. So much to discuss You can always send us your questions and suggestions at solutions at ie hyphen knowledgehub.ca

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Narration: And now a final word from our sponsor, the IE-KnowledgeHub. IE-Knowledge Hub is a website dedicated to promoting learning and exchanges on international entrepreneurship.

If you are an education professional looking for course content, an academic researcher seeking research material , or someone interested in business innovation check out IE-Knowledge Hub.

Let's pickup where we left off for Magex Technologies, a small Real Estate management software company founded in 2003.

Catherine Lamontagne: The company was founded in 2003, but recently it was sold to a bigger group in France of many IT companies. So if we lack competencies internally I can ask to the group to, to, to borrow a resource or just to have access to their knowledge. For example we outsource programming, and we also have access to a larger network.

Narration: An issue many small companies face when being bought up by larger ones is that internal efficiency controls are put in place to make sure the operation is running smoothly.

Catherine Lamontagne: The change in ownership brought Magex to review all its structure, internal structure because before it wasn't structured. The main change is that now we have to plan, execute, control our activities to be able to give reports to the stakeholders. To be able to justify all that we want. Before we didn't measure our results, we were doing it, and, did it work? "Oh yeah, I think it worked. Ok we will do it again. No this time it didn't work." We didn't know why, so now we are looking for the why.

Narration: The added structure has helped Magex build more robust strategies when pursuing international markets. Much of these are based on partnerships with software distributors. Julien Gagnon, Magex's Business Development Director elaborates:

Julien Gagnon: We got the attention of a few actors in the industry in california. and from there we built a partnership. We established that we should communicate on a daily basis and share our sales activities on both sides of the borders and make sure the success that we were having on one side we wanted to duplicate it on the other side.

Narration: You've been listening to segments of the magex technologies video case study. Learn more about software product adaptation, international marketing and branding as well as building a positive team culture by watching their full case available for free at IE hyphen Knowledge hub dot ca.

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Petraki, Seratone Studio and Lisa Querido, Pop up Podcasting. Show consultant JP Davidson. Artwork by Melissa Gendron. Voiceover: **Katie Harrington**. You can check out the IE-Knowledge Hub case studies at Ie hyphen knowledge Hub dot ca. For Market Hunt, I'm Thierry Harris, thanks for listening.

[End Credits Music]

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