

Talks at GS
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Irving Fain: We take the uncontrolled variable of climate and we control it. And it completely opens up an entirely new paradigm of agriculture.

Kim Posnett: Hello, everyone. Welcome to Talks at GS. I'm Kim Posnett. I am global head of investment banking services and co-head of One GS. I'm here with Irving Fain, who is the founder and CEO of Bowery Farming, which is the largest vertical farming company in the US. Bowery Farming's doing a lot of really innovative work around providing quality, healthy, sustainable food at scale. Not easy, as you can imagine. So we're going to talk a lot today about innovation, vertical technology. We'll talk about the food supply chain, the fresh food supply chain. There's challenges in that. How to reinvent farming. And so Irving, welcome.

Irving Fain: Thank you so much for having me.

Kim Posnett: Let's start by giving the audience a bit about your background, Bowery Farming's background, your mission, the produce you grow, what types of produce you grow. Just give us -- let's frame the background here.

Irving Fain: It's interesting. I come from marketing technology, which, when I had first gotten involved, you know, there was activity for certain but nothing like what it looks like today. There was sort of a fraction of the number of companies, and the saturation had exploded. And so I started to take a step back, and the lens for me was personal passion had to be there and real societal cultural impact had to be there.

And so agriculture's the largest consumer of resources globally by a very wide margin. So about 70% of the world's water goes to agriculture every year. We put about a billion pounds of pesticides down annually just in the US. And that number is actually closer to 6 billion pounds globally. So huge, huge chemical intensity to the way we grow food. And we've lost actually 30% of all of our arable farmland over the course of the last 40 years. And that's a system under pressure today that is only going to increase,

right? Population's growing. We need more food.

And what drove me specifically to Bowery was all the while 70-80% of people are going to be living in and around cities. It was very interesting to me that here's this old, oldest industry, largest industry in the world, arguably, and huge opportunity, enormous impact, and yet the number of entrepreneurs certainly from the world I was in working on problems in agriculture was incredibly small. Certainly far less than marketing technology at that point. And I just thought that asymmetry was really interesting, especially given the scale and the scope of the problems.

And there were some companies out there, but actually over the last six or seven years since we started Bowery, it's exploded in a very good way. And so that was what sort of originally attracted me. Like, wow, there's not as many people thinking about -- there's a lot of innovation in agriculture. But from sort of the tech and innovation economy, there wasn't nearly that kind of focus.

Kim Posnett: Let's go back to the founding moment. So you have the idea. You're thinking about it. Tell us about when you founded the business, the mission. How

much has the mission evolved since then?

Irving Fain: What really got me started, I was looking in and around agriculture, and I remember I was sitting on the deck and I was watching YouTube. And this pre-roll pops on and it's Ron Finley, who they call the Gangster Gardener out of South Central LA. And he was featured. And it was this premise of, like, he takes these vacant lots in South Central, and he turns them into flower gardens and vegetable gardens to feed the communities and help educate people about food. And I was, like, wow, it's, like, a really interesting concept, and, like, why is he doing this? And I just sort of started to explore it.

And that sort of moved me down the rabbit hole of, like, this notion of, like, urban agriculture and what does it mean and what does it look like? But what mattered to me always was scalability. Because why I do what I do today is I'm a big believer, if you can create an economic engine that functions on its own and tied to that engine you can drive substantial cultural and societal impact, you can create exponentially more impact than even an NGO or a nonprofit. And so I was really, really focused on scalability from the start.

And to me, that meant can you grow large volumes of crops? Can you grow a large variety of crops at consistent high quality? And ultimately at a price point -- this part was important -- that opens up the largest market opportunity? And you didn't have to get to the best you could be today, but you had to at least see a path there and you had to be competitive to start. And so that was sort of the lens that I took when I started looking at the business.

And when we started, I built a small team with sort of experts in each area that mattered, and we were wide open. We looked at every possible way to approach urban agriculture. And “urban” sort of in quotes. We looked at greenhouses. We looked at hydroponics and aeroponics and container farming. And it was through that exploration that we landed on what we do at Bowery today.

And so what we do is we build smart warehouse-scale indoor growing environments. And we stock our crops from the floor all the way up to the ceiling. We grow under lights that mimic the spectrum of the sun. And we can grow in a totally controlled and contained environment. So

we grow 365 days of the year, independent of weather and independent of seasonality. So it's reliable, consistent supply of high-quality fresh food year round, which, in essence, is a departure of 10,000 years of agriculture.

But what makes it, you know, I think particularly spectacular is we grow completely pesticide-free, completely agrochemical-free food. So as pure and clean produce as you can find. And when you do that outside, first of all, your quality suffers. But secondly, your yield, which is an important metric in agriculture, drops precipitously. We've grown hundreds of varieties of crops. We have a whole agricultural science and team. Our product is as good as what produce is really meant to be. It is the purest expression of produce. It's what came out of your grandmother or her mother's garden. That is what we grow from a quality perspective.

And from a productivity perspective, we grow twice as fast as the field. We get more crop cycles per year in the field. And we get more yield out of every crop cycle. So we end up 100 times plus more product than a square foot of farmland, and we use a small, small fraction of water compared to traditional agriculture.

Kim Posnett: When you launched, how did you think about what produce to start with? And how did that evolve over time? Because it's vastly different today than it was five, six, seven years ago.

Irving Fain: It is. It will be even more different five or six years from today than it is today because a lot of what we've been doing actually has been building the core foundation of our technology itself. And the answer to that question is we started with lettuces and herbs. And we sort of started there for two reasons.

Number one, it just, economically, it was the most accessible place to start. In this business, the question wasn't: Is somebody going to buy really high-quality produce? The question was: Can you produce it in a way that actually is economically viable? And so it sort of completely switched the equation around. And so we, like, the economics of what we did and what we do has been important since before we ever did it. That was a lot of where we spent our time. And so greens and herbs were very accessible from that perspective because there's a large percentage of the salable mass of the crop ultimately

ends up getting actually eaten and consumed.

The other reason that we started there was focus. And I'm just a vicious believer that focus is critically important when you're building a company and as an entrepreneur.

Kim Posnett: So let's zoom out to sort of there's been this explosive growth in vertical farming broadly, not just Bowery farming. I think there's more than 2,000 vertical farms in the US today. The industry went from 80 billion to it's projected to increase down to 55 billion in just four years. What do you think is the reason for that? What do you think are the mistakes that some vertical farms might fall into and that you would avoid as you're building your business?

Irving Fain: So what has driven this change is just the intense imperative around a change that is required in our food system specifically. You know, back to where I said before. Agriculture is an enormous contributor to greenhouse gas emissions. I mean, 30% of all global greenhouse gas emissions actually result from the food and agriculture system overall. I mean, it is an enormous number. In fact, it is larger than energy and

transportation, if you combine those. So it is, again, that's a very wide swath across agriculture. Of course, far from just what we're covering.

But as a system overall, I find it fascinating because it is a huge opportunity. It is a very important point of focus for us. It is an area that gets a lot less attention in conversation necessarily than some other areas. But we have got to change a number of areas of our food system. And so people are realizing this.

And the other piece of it is kind of what I had mentioned earlier that drove me to build Daria is 70-80% of people in the next 30 years are going to live in and around cities. And so we have a supply chain and a system that really originated when we lived in disparate areas all across the country or countries around the world. And that actually isn't how we live today.

And then the last piece of the puzzle, which is really important, is actually technical trend. The problem is the lights cost a lot of money, and the efficiency of the lights was really bad. And so you could grow bad, it was just essentially research and development. It wasn't

economically viable.

About ten years ago, everything changes. 10-15 years ago. The cost of lights dropped by 85%, efficiency doubles. And so that for the first time -- and, hey, thing was all R&D -- actually has a shot at being commercially viable.

What we saw was a lot of people riding the lighting trend, which was here's this opportunity, the lights. Like, if I just build a farm with this lighting trend, like, I can make this work. And what I saw was that lights made indoor farming viable but not scalable, back to that conversation about scalability. And to get to that point of scalability, we needed to leverage more technology. And that's why we use innovation in robotics and automation, innovation around computer vision and artificial intelligence, center and controls, all of those components collectively with the LEDs to rethink what's agriculture going to look like in the next set of hundred years moving forward.

Kim Posnett: You all know and have read about and studied, many of you, the effects of climate changes. We're in middle of this historic multi-year drought that stretches from the Pacific Coast to the Midwest. California's having

its driest year on record. That's cost the agriculture industry more than a billion dollars and 14,000 jobs. And so you've got farmers across the country who are managing water and essentially collecting water in preparation for these extremes. And that's all contributed to extreme inflation in food prices.

There's other elements that are driving that. Geopolitics, we'll talk about that later. But so how can vertical farming help that? And essentially, like, future-proof the agriculture industry?

Irving Fain: It is fairly shocking to see the intensity and the frequency of headlines around climate's disruption of the agriculture system. And this is coming from someone who lives this every single day. Like, it feels as if the pace of this change has meaningfully increased over the course of the last 12 to 24 months, certainly since when we started.

You know, what's happening out west is, I know, it's tragic on a lot of levels. It's also, some people would say, sort of anticipated and not surprising. You know, we've built huge cities and communities and farmland, you know, that are

heavily reliant are on deserts or heavily reliant on aquifers and mountain runoffs that are increasingly unreliable and uncertain.

And talking to folks who are substantial agricultural land owners out west, I mean, there is a lot of conversation that a million acres, give or take, may need to come offline in California in order to rebalance the supply of inputs and the demand of inputs, that equation, because it is just completely out of balance. And that's a lot of land and a lot of crops.

All of these pieces go back to a lack of reliability and certainty in the face of an increasing disruption from climate. And what we do at Bowery is essentially completely hedge against and mitigate that disruption. We take the uncontrolled variable of climate and we control it. And it completely opens up an entirely new paradigm of agriculture because you're taking the equation that we talked about before, you're flipping on its head. Now all of a sudden, it's completely controllable. It's completely replicable.

Kim Posnett: What about the uncontrolled variables

of war in Russia-Ukraine, COVID? Like, there's been major disruptions to the agriculture industry globally beyond climate.

Irving Fain: What's interesting specifically about COVID and what's interesting about the Russian-Ukraine piece is it shined a light for people on the fragility and the interconnectedness of the supply chain itself, right? Who was talking about supply chains? And now you probably can't go a couple days without hearing an article about it or reading an article about it, rather, or listening to a story about it. I mean, it's on everybody's mind. And COVID was the first real kind of wake-up call. Like, wow, we are heavily independent not only on other parts of our own country but on other countries just to get the food we need.

And there's this, particularly in the Western world, there was this sort of just assumption that, oh, yeah, like, I'll go into a store and what I want will be there. Without the understanding of what underpins, infrastructure-wise, the ability to actually provide that.

Russia and Ukraine reinforced that, but there was a bigger piece to it, too, which is food security is national security.

And there is just no question about that. Like, there are very few core components in people's lives that absolutely they must have in order to survive. You know, Maslow's Hierarchy. And food and shelter are obviously two very important pieces to that puzzle. And all of a sudden, again, here comes the global supply chain with an immense amount of interconnectedness and this recognition of, like, we can't get the food we need to the people in our countries. And that is a national security issue, not just a food security issue.

And many, many countries around the world right now are stepping back and looking at their own food systems and thinking about what is my resiliency? Like, what are my plans to ensure the citizens of my country are going to be able to feed themselves and have a level of security moving forward in a world where that security is uncertain?

Kim Posnett: Could you just give an illustrative description of the amount of steps that food has to go through from the farm to the table ultimately? Which is just a way to illustrate the fragility of the food supply chain because the amount of steps is stunning.

Irving Fain: It changes drastically depending on the food, but here's an interesting question. I'll do an audience question.

Kim Posnett: Okay.

Irving Fain: I said I may go off script, I had said. All right. What do you think the average age of an apple is in a grocery store? Someone's got a guess. Four months? Someone else. A week? Eight months? Okay.

It's 10-14 months is the average age of an apple. And people don't believe me, and then they Google it and they're like, "Okay, he's right." Many times they're essentially frozen and they're held in storage, almost ripened but not fully, and then blasted with ethylene gas and delivered. And so when you do that, obviously your product's degrading over time. And so you are eating an apple, but think about what the nutritional quality of said apple probably looks like at that point.

Average age of a carrot? Nine months, give or take. Yeah. And so of course, now, again, there's products you can get that are not that old, but this is generally what you're

talking about on average in a supermarket.

Kim Posnett: The global population's going to be -- I don't know -- 10 billion people in the next 30 years. That will require 70% more food just to service that food demand. How will we do that globally? And how important is vertical farming to that?

Irving Fain: There are a lot of different solutions. I'm just talking about what we're doing at Bowery. First of all -- and I should have said this before -- but our product gets to our consumers a day or so after we harvest it. So that means it's fresher, it lasts longer when you buy it, and it's more nutritious because about 50% of nutrition is lost from the harvesting a product to when it actually gets delivered just in the categories where we are now. So you get a better, higher quality, better tasting, more nutritious product right off the bat. But it's also reliable and it's consistent. And so the ability to strip out the uncertainty and the unreliability from an increasingly challenge climate, geopolitical landscape, supply chain, labor environment, that is going to be critically important.

The other part of it is the existing system today, like, we

don't have that much land to expand into. In fact, we're losing land, not gaining it. And so what we can do is we can produce the equivalent supply from a field in a hundredth the space of land, and that's a huge advantage as well. But opening and allowing food to get closure to where it's moving, create more efficiency in the supply chain, and use that land for something else has an enormous benefit. And that piece of the puzzle overall is going to be really important moving forward.

Kim Posnett: Because I'm a tech banker, I spend a lot of time around vertical technology. I feel like Bowery Farming is at the center of that. You're at the center of agriculture. You're at the center of technology. A huge, I mean, I would argue one of the biggest differentiators of what you're doing is the operating system that you built in and around Bowery Farms. I mean, you use robotics, AI, machine learning, like, all of these different technology components in what you're building. And you measure everything. There's a ton of data that you're collecting that I think the agriculture industry, outside of you, is not able to even collect; therefore, they can't analyze. So could you just talk a bit more about that operating system?

Irving Fain: Yeah. So we at Bowery, we design our own technology. We build our farms with our proprietary technology. We certainly are, you know, a food company in the sense that our product and our end product that you all experience is food. But we are really a technology company arguably more than anything because our focus is using that technology as a competitive advantage but to drive efficiency, product variety, expansion, price opportunity, etc.

So first and foremost, we've at this point automated the entirety of our farms from beginning to end. So from when a seed is planted until when we harvest our product, put it into a package, then put it into a box to be shipped, that entire process now is automated. Now, there's still plenty of opportunities to do even more, but that automation is either completely designed and created by us or we build it in conjunction with partners where we protect IP that we add on.

So we have this whole network of sensor and controls that we developed. We collect millions of data points in real time. And that data impacts of course taste and flavor but also crop health and yield. That data gets mixed with data

from our plant vision system. And we actually take photos of every crop in real time. We run those photos through deep learning algorithms that our team has built. And we can, first of all, just look at a crop and say, "I know what's happening to that crop right now." But what's really powerful is then we can very accurately predict what will happen to that crop in the future.

Kim Posnett: Based on the photos?

Irving Fain: Yeah. Just based on the imagery.

Kim Posnett: Wow.

Irving Fain: And the library of imagery and experience that we've now built up. And so then the system takes all that data, and it puts it through other machine learning algorithms we've built. And we say, based on what we see, what we know, and what we expect, what tweaks and changes to that specific crop do we want to make. And those changes get pushed out and automatically adjusted. No human being's involved. No intuition. No judgment. No decision making. All automatically. And so you're adjusting, testing, adjusting, testing, monitoring over and

over again at a rate that's never been possible outside and certainly with a level of control that's never been possible.

And what the OS also does is it runs all of our farms and the systems inside the farm. It also runs all of the work management. So it tells farmers what to do, when to do it. It handles scheduling, work organization. And that's important because anybody can come be a farmer at Bowery. You don't have to have ever grown a crop. It's accessible to anybody, but it also is important because, if you think about what has essentially hindered agricultural scalability, it's climactic variants and knowledge specialization.

And so now we can build a farm anywhere in the world -- Siberia; St. Paul, Minnesota; St. Petersburg, Florida; it doesn't matter. We can create the exact climate that we want inside of that farm. And that is a lot harder than just putting up four walls around some lights. We put the operating system in. You have the knowledge of every crop we've ever grown, every process we've ever run immediately available to that farm. So we're basically building a distributed network of farms. Every new farm that enters the network has the benefit of the network before it. That

farm contributes data into the network then, and the network itself gets more powerful.

Kim Posnett: So you just talked about all this stuff that the operating system can do. How do you think about the balance between human and computer, you know, 5, 10, 15, 20 years from now?

Irving Fain: There's two P sides to that question. The first is, you know, at Bowery, there's always a place for farmers within the company. And our farmers work alongside automation and work alongside and with our technology. Actually, what's so I think invigorating for me about it and exciting about it is, you know, our software engineers and data scientists and mechanical engineers are sitting down with our farmers and talking about, like, what can we do better? And how can we change this? And how can we make it easier for you? And so we have that loop of learning that's so close to us and so proximate and fast. And so we're designing to make their experiences better and more efficient.

And so what we're trying to figure out is, like, how are the tasks that we don't need someone to do over and over and

over again, that they probably don't want to, how do we take those tasks away and use our farmers to be doing higher level thinking? Thinking about how are we A) making sure our quality and everything's running and making sure our automation itself is running and making sure that we're getting from our farm what we want to get out of it? And that's where we're trying to move our farming jobs in general. I mean, already, we're much, much more efficient of course than a field.

Kim Posnett: So what's next for Bowery Farming over the next many decades? Maybe just also end with lessons learned. You've been an entrepreneur for a long time. Talk about lessons learned and advice you'd give -- because you did start in investment banking -- just for people who may become entrepreneurs one day and what advice would you give them?

Irving Fain: You're going to see ultimately us at Bowery not only in many more cities across the US, but you'll see us in many more cities across the world. And you will see more and more of our products across a wider range inside of the grocery store as time goes on. So it's not only going to be expanding geographically, not just nationally but

internationally. But it equally is going to look like a lot broader set of products that we sell under the Bowery name. And so the ability to go in and say, “Hey, I know what this is, I trust it, I know it's good, I know where it came from,” and to have that across a wider variety, like, having a great, fantastic, incredible strawberry or tomato all year around? Like, that's a great thing. Having ten different varieties of amazing tomatoes to choose from that are good all year round, that's a great thing. And that's just a sliver of what we'll ultimately be able to provide. And so that's where I see us heading.

Entrepreneurship? There's so much you could say here. But I think the first piece I'd say is the questions I get from people a lot of times is, like, “How do I know? How do I do it?” And you can't be foolish and too trigger happy. Meaning, you've got to be thoughtful and spend some time and energy thinking about what it is you want to build and does it make sense and is there a market for it and can you build it? But there is a point of diminishing returns where spending three more months of time and energy and effort to try to figure out if something's going to work or not actually isn't going to tell you much more.

And the point I oftentimes find first time or earlier entrepreneurs is that sort of cliff point. You know, I kind of look at the edge of the stage. It's, like, standing right there and sort of looking to get some piece of marginal information that they hope will give them the confidence to tip over. And at some point, really, the answer is you just have to jump, and you have to believe in yourself. And you have to sort of embrace the uncertainty, embrace the unknown. And it's easier said than done. But that piece of the puzzle is really important.

Kim Posnett: I think that's a perfect place to end. Thank you so much.

Irving Fain: Thank you. Thank you, guys.

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