

CONSOLIDATION, INNOVATION, AND THE ROAD TO FEEDING 9 BILLION BY 2050

Panel Moderator: *Paul Schickler*

October 19, 2017 - 3:15 p.m.

Introduction

Ambassador Kenneth M. Quinn

President - World Food Prize Foundation

So now I want to invite our next panel up. This is - got everybody going and now follow up with a CEO panel of remarkable diversity, accomplishment and leadership. And let me invite the panel to come to the stage. With Paul Schickler, the past president of DuPont Pioneer, is going to be our moderator of this, and invite Tim Hassinger and R.J. Kirk, Tom Hayes and Jim Blome to come up here for a panel on Consolidation, Innovation and the Road to Feeding 9 Billion by 2050.

I don't think we've ever had an assemblage like this before at the World Food Prize on the stage at the same time. Thank you so much for being here. Paul, over to you.

Panel Members

Paul Schickler	Former President, DuPont Pioneer
Tim Hassinger	President and Chief Executive Officer, Lindsay Corporation
Randal J. Kirk	Chairman and Chief Executive Officer, Intrexon
Tom Hayes	Chief Executive Officer, Tyson Foods
Jim Blome	Chief Executive Officer, Bayer Crop Science

Paul Schickler

Panel Moderator

Okay, and thank you, Ken, and thank you to the World Food Prize for bringing this together. I think as Ken said, it is a pretty remarkable topic but also a remarkable set of panelists that we have to join us to address this topic. And just to remind you, the topic is Consolidation, Innovation and Feeding 9 Billion People by the Year 2050.

I'm not going to introduce individually the panel members. You can read about their bios in the material that is part of the agenda and the World Food Prize material. But we do have Tim Hassinger. Tim is currently CEO of Lindsay Corporation (four days). Prior to that, a long career

with Dow AgroSciences. And then Tom Hayes with Tyson Foods. Jim Blome, Bayer Crop Science, and then R.J. Kirk from Intrexon.

And the reason I'm excited about not only the topic here but also the panel members – when you look at the challenges that we face for nine billion people and the topic of this panel subject, consolidation and innovation, look at the four companies or pieces, sectors of the industry that are represented. You have water – people are concerned about water availability and quality. You have meat, poultry, and a great supplier of protein that the demand is increasing and will only increase as we look to the future. We have seed, technology and crop protection materials that are necessary to lift the productivity from where it is today around the world for the future. And then finally, research and innovation, particularly focused on synthetic biology, key to the future of bringing science to agriculture and food production.

So really a great representation across what I would say not only the most interesting topics that we face but in some cases the most controversial topics that we face. So the format here is I'm going to have each of the four, starting on my left, and we'll just move straight that way, address with comments, about five minutes, the question of – From your experience (we've got great experience here among the panel), what are the trendlines or the most significant developments in your part of the food and agricultural business world, and what do you see are the greatest challenges? Tim.

Tim Well, let me take a shot here. Let me address a few trends that I see and then a few comments around what I think is really critical for us going forward. A topic that's been talked about throughout the entire day is the need to increase food production. And of course a key factor of that is, it's estimated that about 70% of that needed gain is going to come from new innovation. I speak for the industry that I'm representing up here – as we look at irrigation, today 16% of the arable land is irrigated, but that particular land generates 44% of the total agricultural output. So an area of need from innovation is making sure that the efficiency of that irrigation allows, relative to the water supply that we have, that that could continue because of the great need. That's just one example of the need for innovation.

Consolidation is another trend that we're seeing, and obviously that's getting a lot of press related to the industry. And if we look at drivers behind that, we've seen significant farmer consolidation. We've seen especially in the highly regulated areas of agriculture an increase in cost, and in many cases even more importantly an increase in timeline from invention to commercialization. While you couple that with a drive for productivity in what could be described as a difficult ag market, as a result, we're seeing an increase in consolidation.

Consumers is an area I really want to hit, and this is an area that we've seen a significant trend. I can probably best describe this by a study that I saw from the Center of Food Integrity. And if you look at an annual survey that they do – and it's all about what do you see as one of the most pressing needs that you have? It could be unemployment, it could be healthcare, etc. – two of the top four responses were food, around the area of affordability and around the area of health. So it is clearly on consumers' minds about the food and how critical that is in terms of pressing needs from their side. A second question that I thought was concerning that we need to get out on the table is – Do you see the food industry moving in a positive direction or the wrong direction – the right

direction or the wrong direction? And 60% said wrong direction or not sure. So the confidence piece is obviously critical.

Which leads to what I would say is the last trend that I'll highlight here, is – At a time when we're seeing science rapidly evolve and improve and expand, we're seeing the trust in science go down or the credibility of the science decrease. So we've got capability going up but trust coming down.

So, Paul, I would summarize this by saying three things really jump out at me as what can we do. One, the need to connect with the consumer has never been higher, which is really the part of listening and then the second part of that is making sure that we can frame and tell our story and really encouraging all of us as input suppliers in the agribusiness side to really think like a food company in terms of understanding what our end-user, end-consumer is, I think is really critical.

The other one I would say is the need for alliance with, if we could put in quotation, kind of the “unconventional” organizations or partnerships. I think of the Affordable Food Act, which many people in Congress have described as what was probably the most contentious bill to ever go through the U.S. congressional system. That had over 1,100 different organizations supporting that position, of course, with many of them for different reasons, but the need to find alliances and bring that through.

And the last comment I'll leave you with here is, I think it's important that we broaden the term “science.” We've been, as ag, an industry that has focused and really valued technical science. We're now at a time where digital science and social science has now become every bit as important as the technical science side. So those are some areas that I would encourage us to think about in terms of going forward.

Paul Good, Tim. Thanks for that overview. You spoke to a couple of points regarding consolidation and consumers, and we'll probably come back to those later. Tom, please.

Tom Sure. Well, hey, thanks for having us here. To begin with, Tyson Foods is a really proud member of the Iowa community. We have about 10,000 team members that are in Iowa, eight production facilities, and, you know, as Tim said, we do want to talk about the consumer. You're going to find for Tyson, we span from agriculture, so we're part of the agribusiness for sure. We're also all the way to dining culture. We're doing a lot as it relates to our brands. We've got some wonderful billion-dollar brands with Tyson and Jimmy Dean and Hillshire – those are all under the Tyson Foods umbrella if you didn't know.

And to spare you the suspense, for those of you that were at lunch, the issues that we have are obviously feeding the world, but I think Raj – I don't know if he's in here or not – he hit it on the head, I think, brilliantly that we've got to have a combined, sustainable approach to feeding the world for sure, and it's not easy. And so that's sort of the thing that I think is a challenge for us. The opportunity is, for sure, we want to have a nutrient-dense diet for everybody around the world, and it doesn't get done by just one person doing it or one company doing it. We have to be cooperative. We have to do this in a total system effort.

So at Tyson what we're focused on is protein. We're a protein company, and we're real excited about making sure consumers are excited about the protein that we serve. We are in the animal harvesting business, but I would say also we're equally focused on what's the next leg of the journey. We have a company startup called Tyson Ventures, Tyson New Ventures. It's a fund that we're investing in companies that are either in plant protein, could be any sort of new technology on that front, also waste, taking food waste out – a lot of that has been talked about today. And so our focus is on making sure protein is delivered effectively, efficiency – it's got to taste good, you know, if you're going to serve the consumer particularly here in the U.S. – and make sure that we are having a big part of that dialog. You know, we think that big companies need to be a part of this discussion. It's not going to happen alone with backyard farms. Tyson needs to get in the game, and we're really excited about that.

So what I'll say about how we do that and becoming more sustainable is – I've been the CEO of the company since the beginning of January, president for a bit over a year, and we have made the move to actually change what our purpose is as a company. And so our purpose is to raise the expectations of the good that food can do. And that means having a very proactive approach to sustainability versus a defensive approach against sort of NGOs and working more cooperatively with those that take a holistic view to sustainability. We have hired, I have hired a sustainability leader, Justin Whitmore. He's our Chief Sustainability and Strategy Officer, and he is focused on trying to work with the best NGOs that are going to want to be cooperative with us and try to understand that we don't do everything right every day of the week, and we have history where we haven't done things absolutely right. You know, what matters is what we do going forward and how we change the world for the better.

And so for us it's not solving one particular issue, whether it's animal welfare or environment or worker safety. It's doing things all together because we have to have the ability to lift all boats. It's a holistic approach to sustainability.

So then the last thing that I'll just mention is – this is for my purposes the first time I've been to something that is as broad as this as it relates to the agribusiness area, because I'm generally attending consumer conferences, and my background is more consumer. And just sitting here and listening to the dialog today, it's incredible the amount of talent that is not just in this room but is represented by the organizations you're a part of and the companies that you work for. And I think we can do anything. I mean, it certainly is a tall task to be able to drive forward with a sustainable food system for everybody, but I have full confidence that we can do it if we work together. And I'm very proud to be here, and thank you for the opportunity.

Paul Thanks, Tom. Jim, please.

Jim Thank you, Paul. Paul, I want to thank you for the invitation. I'm an Iowa farm boy, a chance to come back to Iowa and be here on a beautiful harvest afternoon. And not far from here the beautiful No. 2 corn is spiraling up that combine and making a spectacular splash into that grain wagon and heading off to feed the world – right? That's what we're here about. And I can almost smell the corn dust, you know – it takes me back. And anybody who's done that knows exactly what I'm talking about.

Appreciate the invitation. Your question, what's our biggest challenge at Bayer. As you know, we're in the middle of our acquisition of Monsanto, doing a lot of things. I got this invitation just a little bit late. Our global CEO needed to go on a different business. If you've seen our press releases the last couple weeks, you know what we're up to and what we've been up to. But as we pursue our quest to feed nine or ten billion people in the next very early stages of this century, and probably with less land and maybe with less water, it's really an important core question for us, what our biggest challenge is.

We have the know-how, we have the resources, so it comes down to that key thing that's your challenge. For us it's the disconnect. It's the disconnect between the industrialized nations who have plenty of food versus the rest of the world who sometimes have a food security issue. Right? And that is in a nutshell our issue on the disconnect.

With industrial nations, we're starting to talk about sustainable farming, and I'm excited by seeing that term. And I see it as an icon to remind us that are associated with agriculture, that a lot of people haven't. When I see that or people bring that up in conversations with me, it reminds me that I need to stop, take time and educate these people on what farmers do. Farmers have been doing a fantastic job of growing over the years. There's just fewer of us. We need to take the time to share that story. And I can't think of a more sustainable farmer than a six-generation farmer working with the seventh generation and making great decisions every day to hand that land off to him.

We also see societal acceptance. Right? So societal acceptance of the farming community is limited, and societal acceptance of new innovation and technology in the food industry is sometimes very low. So we have to address that. I often see the paradox of young people today, and the paradox is that these people will stand... These young people—I love them to death—will stand in line overnight and for blocks, long lines to get the latest iPhone technology, to carry it with them; they'll hold it next to their body. It's fantastic. There are adoption curves in that industry that I'm envious of. Right? But the paradox is, that same young person might actually prefer his food to be grown with a pair of mules. And that's where the story is breaking down. That's where we're not telling our story well enough, and we need to start doing something about it. At Bayer we know that acceptance in our home markets won't help us solve a world hungry. It's really getting that message out and getting that acceptance out to allow us to take advantage of technology to feed the world in the future.

It's all about shared objectives. It's all about educating people on shared objectives. We do it through our industry, through great associations like CropLife or Bio or U.S. farming and ranching alliances and a lot of the commodity groups and a lot of the people I've seen here at this group do a great job of sharing that shared objective of going forward. We also need to do that with academia and also with the consumer groups. And that shared objective is that technology acceptance will feed the world. It's a very simple tool. I spend a lot of time on my boards doing just that—trying to improve consumer acceptance of technology.

So we have the know-how, we have the resources, and I think today's event really underlines the common commitment to the goal of educating the world that we need to accept technology going forward. It is the answer, and it will help us feed the world. Thank you, Paul.

Paul Okay, Jim, thanks. Now we'll conclude the opening remarks with a look to innovation and research. RJ, please.

RJ Thanks, Paul. So first, thanks for having me. I'm lost in thought, based on what each of you has said. So I'd just like to make a couple of observations, the first being – I'm struck by it because you guys are big, incumbent food companies and we're just a tiny innovator company with only a thousand employees. And we have some interesting projects going on in food and some interesting technologies, and I think all of you are aware of them.

But I just want to mention in terms of trendline, right? Clearly, all three of you represent... Well, you represent a genetics business; that's how you became the great, really the great industry. And we were talking about the benefits that Tyson brought to the world through improved efficiency in the broiler. That started out with genetics, right? And then you are in the process of buying... I don't mind telling you this; I've told Robb Fraley this. I sometimes have correct our own people. They'll tell me that we are the leading synthetic biology company on the planet. That's not actually true. The leading and best synthetic biology company on the planet is Monsanto. And thank God they decided to focus exclusively on row crops, or we wouldn't have as much opportunity as we do.

So you are a technology business. You've always been a technology business, Dow, and, Paul, you've been heading a technology business for quite a while. And by that what I mean is biotechnology. So what's frequently lost in this discussion is we talk about the food industry, and it's because you guys are incumbent, so you have to refer to it through the incumbent terminology, nomenclature – right? – food. But it's not really food. At your core and the tools you use and the approaches you use, and it's your biotechnology businesses that really shouldn't be surprising. Because here is, to get back to how we educate the public... I've been doing this. You all do this as well.

What we really need to educate people about is that food is the original biotechnology industry, that civilization was founded 12,000 years ago. What we refer to as civilization was actually founded on a biotechnology – right? – is that we could breed cereal grains initially. We could breed those animals to effect. And the world that the kids you're referring to imagine, they imagine the world of maybe, I don't know, a hundred years? You said mules, right, so a hundred years ago. Right? As being some sort of pristine, natural world that was unaltered by man. That's just craziness. That's not true. Man's footprint on this planet has been enormous. We have radically modified this planet, and we've been at it for 12,000 years.

So the one thing we could do to help the public get educated is, stop buying into this pretense that we now have a decision to make. Like should we be altering nature? Are you kidding me? 12,000 years ago the amount of vertebrate biomass on this planet was about 200 million tons, right? They were called wild animals. Now the homo sapiens' biomass is greater than that. The bovine biomass is a billion; it's a billion tons. So global warming, when you look at core samples from glaciers in the arctic. I mean, we see that that's when it really got going. Of course, that just happens to be right after the last Ice Age, so who knows the cost.

But the point is, we have been busy as genetic engineers for 12,000 years, and agriculture is a part of that. It's not that there's this new technology we're suddenly applying to agriculture. It's just the opposite. I'm thrilled to be here, because this is the origin, this is the mecca, this is the Garden of Eden of man's original technology. And so here's the good news. I'm encouraged by the fact that this worry that we all have, this anxiety that we all have as to whether we can feed nine billion people that will be here in a couple decades... You know, that's been an anxiety of every generation of man since the Reverend Thomas Malthus. And when you look at the prediction that each one of those generations made, including Malthus, they were always 100% correct, based on the assumptions that they were making. But they were historically 100% wrong, and they were historically 100% wrong because technology improved our efficiencies, improved our capabilities.

So what we are talking about... The application of technology to this issue is, as we all know this, and it's not optional. It is absolutely mandatory if we're going to meet this challenge. I'm heartened to think that it is. And just to answer the question, Paul, directly, I see plenty of room for encouragement around the world among regulators, in the media.

I mean, look, there have been people hysterical about vaccines for 200 years, so it's not like we can expect to win everyone over. But in general when I think about, look, our mosquito, the jurisdiction of our mosquito was just transferred from FDA to EPA, which is where it belongs. Our talks with EPA are I think extremely constructive. Our arctic apple, I think tests out as being probably the most consumer-preferred GMO food in all of history, so we're really encouraged about that. I'm not here to make an advertisement, but all I'm saying is I'm encouraged by the things that I see. I'm encouraged by the fact that society is beginning to appreciate the technologies that are central to our lives and our businesses. And I'm very encouraged. I think we're going to see a bright future, and I think we're going to meet this challenge.

Paul Good. RJ, thanks. You said a lot there, and a couple of the points that you made on consumer impact or consumer thoughts and global modification, we're going to come to those. And I'm going to start with Tim and Tom, so give you a little heads up on the consumer issue. RJ, you used the words, I think you said we've got to get real with this, and that means consumers, be open and honest with the consumers. Tim, you mentioned that we need to increase the consumer dialog. And Tom, you've got brands that end up right in front of consumers. So I'd like the two of you to speak to—how do we engage consumers in science that is designed to improve productivity and improve food and help nutrition when there's at least four of us on stage here that are pretty removed from the consumer. Production agriculture is not real close to the end consumer, but on the other hand, Tom is. So, Tim, I'd like you to first respond to that. How do we engage in the consumer, better than we have in the past, when our distance is so far from the consumer but yet these issues are right at the forefront of their interests.

Tim I think the first thing is—over the last few years the level of engagement on this topic has increased a lot. That in itself has been positive. But, Paul, I would say that the emphasis in most sessions that I go to is on how we can be more effective on the “tell,” but I don't hear a lot of comments around how we could be more effective on the “listen.” And we use a lot of terms that, if you're not in this industry, and we've heard

just a couple even this afternoon, whether it's GMO, gene editing, etc. In the absence of knowledge, those are kind of scary thoughts. Those are scary terms, and I think what it leads to is, if listening is critical, then we've got to find forums where we can listen.

And to me that's critical, and I'll just give you one example that I've seen the benefit of. And I'll just use leadership on companies that are in agribusiness, making sure that leadership is in X number of forums where you're talking, presenting, or you're at least in the dialog of a group that doesn't agree with you and your industry, I think is very helpful for us going forward.

Paul So, Tom, what advice would you give to those novices here in production agriculture that don't connect directly to the consumer?

Tom I'm not sure. I'm not sure if I've seen any novice here. Everybody seems like they're experts. What I would say is consumers want transparency, and they want authenticity, and that's what we've certainly seen. There is a difference, I think. Probably older consumers are a little more understanding of what happens on the farm, and probably younger consumers are a bit more removed and so not necessarily understanding what happens day in and day out, how different it is. It puts onus on us as I think manufacturers in the industry to share what we do and be really transparent about it and own it when we have issues. I think that's the first thing.

The second thing is, well, how do you do that? And for us we've done some things like a Facebook live on the farm. We went to a chicken house and showed actually what happens. We've done things that are continuously sort of trying to bring out what are the good things that happen within our whole supply chain. And that's not always easy, so I'd say that's really important. And overall I think people just want to make sure that their food is clean, authentic, healthy. They just want the same thing that everybody else wants. I think it really starts with a level of transparency. And quite frankly, I don't know as an industry that we've really been there. So it's not... I don't know it's necessarily unjustified. I think we can do better.

Paul Thanks, and I'm going to connect this sort of consumer point with the science that is in front of us. And even in the session before we heard Erik Fyrwald talk about gene editing and our opportunity to position it differently than transgenic biotechnology. So now I'm going to look to Jim and RJ to maybe speak to that. We've got an opportunity here with a new science, gene editing, to deliver that science in a different way than maybe what we've done over the last 20 years. So, Jim, how should we go about doing that?

Jim Yup, no. It's an exciting opportunity for us to start on a front foot that says what it is – it's different, we're not adding anything to it, it's editing, and it may have a different regulatory path. The language, the paths, how we address that, could be a wonderful differentiation for a faster adoption curve on that side, and we're excited about that.

Paul RJ, do you want to get real with our message? How do you get real about gene editing?

RJ Yeah, so first of all, I'm one of the... I'm the odd man out in probably biotechnology who is looking at gene editing as distinct from gene engineering – right? I understand why everybody else is excited about it, because it looks like an end around existing

regulatory structure. I'm not in favor of that, generally. I'm just in favor of science-based regulations. I do think that new creations that are brought to market should be subject to regulatory review. I think their safety and utility should be investigated; but once that is done, right, they should be judged on their merits and not based on phobia, technophobia, as I spoke about last year.

So just gene engineering, generally, look, as I mentioned earlier, it's not optional; it's absolutely mandatory. But in terms of connecting that to the consumer, let me give an example. I don't mean to sound too mercenary, but I want to give an example from our portfolio.

So one of our assets – we own the majority of a company called AquaBounty, which after 20 years of effort obtained FDA approval and Health Canada approval of the world's first genetically modified food animal. So this is an Atlantic salmon that comes to market weight in one half the time on about 30% less food. So basically, as we were discussing earlier, basically we domesticated the salmon, and we did it using molecular biology. It has a tiny bit of code that is not native to the salmon. It was actually introduced from other edible fish, other fish that are consumed by man, in order to obtain that better growth trajectory and better feed conversion ratio and so forth.

So how can you engage people on this? Well, I think you can, first of all, educate them about the salmon they're eating today. So the first thing that I would..., and just to show them what the options are, and then it's back to your point, is that, how do you work your asset, right? How do you deploy your asset in the best way and the way that will most logically fit with consumers?

So our idea on this is to realize that this is an environmental benefit. So first of all, if you want to talk about fish, you should immediately recognize that marine extraction is the least sustainable food production technology on the planet. It just can't... We've cut in half the number of fish in the sea over the last quarter of a century. The forecasts are pretty dire. We can't continue to do that. So 95% of the salmon – you want to talk about food security – 95% of the salmon consumed in the United States is imported, chiefly from sea cages in Norway and Chile. So you've got some cages in the sea. You put your smolt in there and you dump food on it. Right? So that means all the indigenous breeding organisms bring every pathogen that they have to your crop. The mortality rates recently in these sea cages have been around 50%. For our scientists to build a library of sea lice, they had to do nothing more than go to the supermarket.

Our idea is to grow these fish on land, so we can grow them here in Des Moines. All right? And we can grow them in Omaha. We can grow them anywhere, right? Grow them on land in controlled environments so they will be antibiotic-free, they will be vaccine-free, they will be pathogen-free, because we will be able to control them – and use this production advantage to confer a consumer advantage. And I think we're going to come to this if I remember rightly. But I think this is what consumers are looking for today, you know, more responsible production, more sustainable food production, and something that aligns more with their interests.

Just going back to agriculture being the original biotechnology, we should remember that the lines between... Actually it was the theme of last year's conference here, if you recall. The lines between food and health and environment, if they exist at all, they're

very porous and very gray. So I think we are all in those businesses, too, and I think if we think about our technologies and the deployment of our assets in this way, we'll find ways of connecting.

Paul It's great to be the panel moderator. I can take a little editorial license here and just make a strong statement that – if we do position gene editing as an end around regulatory systems, it will be the failure of gene editing and the technology. My editorial license.

Again, remembering the topic here, and the topic in the agenda did include consolidation, so I want to shift a little bit and talk about consolidation as it relates to research. You know, one of the fears – yes, you've got anti-competitive issues as it relates to potential consolidation, but one of the fears also is that innovation or research will be diminished. So, Jim, I'd like you to speak to what you see as you go through a consolidation activity, what the opportunities are around for research and whatever the limitations or opportunities there are for research.

Jim Sure. Our excitement around this is to build a company that could be an innovation leader in several areas but at the same time maintain competition within the farm at the farm gate. So you saw us talking about future innovations where we're putting gene trait research right alongside chemical research at the same time, to take advantage or to be an antidote to longer regulatory periods and more expensive regulatory periods. It's been a bit of a difficult time for us.

You also saw us be very diligent about making sure through the regulatory process that works very well in the world, to make sure that we provide the data to the regulatory authorities, explain it to them in detail and make sure that they have complete understanding to make their decisions. As a result, you saw a press release from us last week, creating a new global seed company in BASF, as a result of our actions to try to acquire Monsanto and build a new Bayer Crop Science business. So I think both of them are very important. I think we want to look at transformative innovation in agriculture. There's lots of room to do that. It's going to take a stepped-increase, a different look at research and development. And that's what we're doing at Bayer is to create that kind of a company to do that.

Paul And, Tom, I'm going to ask you the same question, because you're in a little different situation where livestock and poultry have not only consolidated a bit at the industry players' level but also vertically in those sectors as well. So what has consolidation done to your ability to increase innovation in livestock and poultry?

Tom Yeah, I guess I'd start from – I'm a pure capitalist, so I think they know that. Innovation is always going to be there to the extent that companies consolidate and they become too big, and they sort of fall on their own ways. That's an issue, right? So you have companies that will continue to try to get as much scale as they possibly can. And what ends up happening is it becomes bureaucratic – you know, there's a lot of things that get in the way of innovation. But I would say it sort of fixes itself.

What we have done – I'll go back to what I talked about – the Tyson Ventures. It's a private equity, almost part of our business, a separate fund, that seeks out small companies, entrepreneurs that are innovating and doing things that we probably aren't

even thinking of, certainly aren't thinking of, and trying to seed them with investment in order to become bigger.

Consolidation, I think is good in certain areas, certainly not good if it's going to harm the consumer. We understand that fully, and we don't want to do that. But I think in some areas consolidation actually really helps. I mean, if a company can be that much stronger and be a better citizen at the same time, I would fully vote for it. Where I think the rub comes is staying on that innovation curve while becoming big, and that's not always easy. So that would be my two cents on innovation.

Paul And lastly, RJ, if you'd speak to it was well. I mean, you're a leader on the private side. But if you've looked at research over the years, over the last number of decades, public research has declined, private research has increased. There's concern about whether that should or could continue. What's the role of public research in the challenges that we're facing as an industry?

RJ I think that the opportunities are, well, I think the opportunities are so vast that it almost doesn't matter how much public money is spent on research. Because if you look at any general scientific publication, peer review, *Science* or *Nature*, for example, if you look in the employment ads in the back, I think it's about a 100% market share for our fields now. So cellular biology, systems biology, computational biology, molecular biology – these are the people who, companies and academia wants to hire. These are the people most in demand today. Our company, I think, our number one recruitment school is Cal Tech. so I think the amount of intellectual capital flowing into biotechnology... And again I think we're all biotechnologists here. If you get big and successful like you guys you get to say that you're in the food business, but I'll look forward to that someday, hopefully.

So public versus private funding, I don't think that's a big issue. I know in healthcare, you know the NIH is a huge funder in the United States. But around the world I see most innovation is really coming through... Look, put it this way – venture capital flows right now, including into food – right? – but really at an all-time high. So in food technology and biotechnology, general and so forth, at an all-time high, I believe. So I don't think we suffer from funding. And by the way, capital usually... I'm a capitalist, too, so one broad observation I'll make is – it usually flows to wherever it can be productive, public or private. So I don't think this is a great concern.

Paul Okay, we've talked a lot through our comments so far about social issues, whether they be environmental, consumer preference, animal health issues and so on, water. And so, Tim, I'd like you to speak a little bit about some of the social issues in your new role that you're going to be facing about water usage, whatever. Agriculture and food consumes 70% of the world's freshwater. But what you are going to be looking at as you address water issues around the quality usage and preservation of water.

Tim Sure. Well, I go back to the original comment. A very critical, a key driver in this whole industry is the efficiency for irrigation, to what I said earlier, because it plays such a key part to get the ultimate output that we need from agriculture. So there's a lot of different innovations, and I'll just give you one example that I just had an experience already, just first week on the job working at Lindsay Corporation.

Last night we had a group of Lindsay customers in Omaha to talk to them, and it was a forum where - sitting around a table, just dinner. There was no presentation. There was just – what’s on your mind? Let’s talk about that. Now, like I said, I’ve only been in the company one week, but I can say, give a good guess that if that meeting would have happened five years ago, the topics that would have dominated that discussion would have been around the product and the price. And instead, it was all around the digital offering to get ultimately to the most efficient use possible. And this is an area where Lindsay has invested a lot, has a good offering, and a very competitive and actually many cases a leading offer, around the need and the helping farmers on the efficiency of their use of water. Because there’s a tremendous macro need here, and I only see that increasing in importance going forward. So, Paul, it’s on us today, and I think it will only increase going forward.

Paul Tom, animal rights, animal welfare. I think in my recollection, over the next 15 years, 3 billion people will move from lower level income into the middle class. That middle class, that 3 billion people will demand protein. The great protein source is meat, but there are those that question whether the globe can afford to provide that much protein through meat to those 3 billion consumers.

Tom Yeah, sure. So I would say that it’s a tough one, because there’s a lot of focus on – you know, should we be doing this a better way. And my way of thinking is, absolutely, if there’s a better way, we should be doing it. But it has to be affordable, and so right now, I mean, there’s companies out there, Memphis Meats and others that are looking at cultured meats as a way to replicate all the nutritional value that an animal produces in terms of their meat. And I think it’s an interesting technology, and it’s also right now just not affordable. So I think it’s one thing to want to have the food supply. It’s another thing – it’s got to be absolutely affordable.

But that is completely separate from animal welfare issues, in my mind. What we are striving to do is to have the animals have one bad day in their lives, and along that curve, we want to be the right stewards of their lives and to make sure that they are well cared for, and we are a big system. We will get things wrong from time to time. When we do get it wrong, we want to make change for the better and to continue to make sure that we’re doing the best we can with the animals within our care.

But because it is such a massive issue, to your point, as economies become stronger, which we all want globally, certainly protein is the first thing, frankly, that ends up becoming more popular in those economies, because it’s nutritionally dense. So we want to do our part to make sure we’re coming up the curve, looking at new technologies. And we are focused from protein. It doesn’t have to be from animals – we’re focused on protein.

Paul Okay. We’ve got about five minutes left, and also in the agenda, the title was 9 billion people, so I’d like to go right down the line and each of you maybe take a minute or so to just speak to – what have your experiences been in your firms or in your careers about what you’re doing to help agriculture or food development in those countries that need to lift their capable so that they can enjoy food security now and into the future? What have you done at the local level? So first I’m going to start with Jim, then go to RJ.

Jim We have a division that looks specifically at smallholder farming and how we can use automation and other packaging to help them be a profitable farmer so that they not only don't worry about going to bed at night hungry but also that they could create a business that can sustain and be a profitable farming venture. So that's important to us.

RJ Yeah, I think probably the most meaningful thing we're doing in that line is in crop protection. So we've had a lot of interest here at this conference concerning a press release we had out a couple days ago pertaining to our self-limiting insect, which is the fall armyworm. So we've been working on this for a while, and we just got permission from our partner to disclose it, the identity. And the reason we got permission from our partner to disclose it a few days ago is because this is actually wreaking havoc in Africa right now. So unlike the *aedes aegypti* mosquito that invaded the Americas from Africa, this one's done the reverse. So this one's gone from Florida to Africa and is now just decimating the corn crop in Africa. I think the damage now is around 15 billion per year. And a lot of these producers are..., these are family farmers. And so we've seen actually at this conference even today, meetings with government officials and others who have real stakes in the venture. And so we're highly encouraged that we'll be able to help this situation. I think that's the most tangible thing we're doing today.

Paul Tim.

Tim To broaden your question just a little bit—I think one of the first things is... I'll say internal, and then I want to go external. When I look at my own career, a meeting started in the company I was in with what the strategy is. And today meetings start up around this industry around what the purpose is. And I think your question in many ways is—What has brought us as a broader ag industry together towards ultimately a common purpose? I think that's really helped a lot in terms of bringing unity towards a direction and alignment.

And when I think of Lindsay—specifically to answer your question—a project just completed here recently in Africa, which is going to allow that particular community to be able to grow crops that they couldn't grow before and increase production. So for them, a real breakthrough.

Paul Thank you. Tom.

Tom Yes, two things. One is we are predominantly a U.S. company. We do export a lot of food, and we have operations around the world for sure. In the U.S., I'd say it's more of a short-term effort. There is acute need. There's a lot of food deserts, as people have spoken about, and certainly food insecurity is something we're very concerned about. So since the year 2000 we've donated over a hundred million pounds of food to needs that are in the U.S.

And then beyond that globally we are also very active, and there's one initiative that I think is important to know about, which is our One Egg effort. I don't know how many people have heard of that, but it's just starting with one egg. How do you expand poultry production in areas that haven't had it, because chicken is a great way to feed people that need it? It's a nutrient-dense food. And so we have the OneEgg effort that's been up and running in Uganda, Rwanda, Haiti. And that's something that we are

getting behind. And we have a lot of our team members that are extraordinarily excited about what that can do.

Paul Okay, very good. First, I'm going to offer my thanks to each of you for not only being here but also the great contributions you've made to the discussion. Tim, Tom, Jim and RJ, thank you very much. Please share your enthusiasm and appreciation for what they've contributed. Thank you very much.