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MANAGEMENT DISCUSSION SECTION

Brent Norwood

Investor Relations, John Deere

Hey. Good morning, everybody, and welcome to our virtual CES booth here at Deere headquarters in Moline, Illinois. I'm Brent Norwood with Investor Relations, and I'm very excited to be joined this morning by three panelists from our Production and Precision Ag leadership team. We're at CES, so we're going to be talking about all things precision ag this morning and precision technologies, everything from our strategy to current products we have in the market, as well as a look ahead to the future roadmap.

Now, it's worth noting, this is our third year at CES, and each year, we've highlighted a different step in the production system: with our first year highlighting crop harvesting; our second, crop protection; and this year, we're highlighting the planting step. We've got the new 8RX tractor behind me, as well as our ExactEmerge planter behind.

Now, the format for today is going to be entirely Q&A. I've got a couple of questions that have been pre-submitted in advance to get us going. But I'd encourage everybody to submit questions throughout the duration of the event. We're going to try to get to everybody's questions as we go along. There is a Q&A icon in the upper right-hand corner of your screen, so you can simply click that and submit your questions. Alternatively, you can also email any questions you have to DeereIR@JohnDeere.com and we'll include those in today's events.

Now, before we begin, it is worth noting that today's commentary and discussions may include forward-looking comments concerning the company's plans and projections for the future that are subject to important risks and uncertainties, including those related to the effects of the COVID-19 pandemic. Additional information concerning factors that could cause actual results to differ materially is contained in the company's most recent periodic reports and its 10-Q and 10-K reports filed with the Securities and Exchange Commission. Except as required by law, the company undertakes no obligation to update or revise its forward-looking statements.

This event may include discussion of financial measures that are not in conformance with the accounting principles generally accepted in the United States of America, GAAP. Additional information concerning these measures, including reconciliations to comparable GAAP measures is included in the company's most recent 10-K and posted on our website at johndeere.com/earnings under Quarterly Earnings & Events.

With that out of the way, let's kick things off with a quick introduction from each of our panelists. Please tell us your name and what is your area of responsibility here at Deere.

Jahmy Hindman

Chief Technology Officer, Deere & Co.

Thanks, Brent. My name is Jahmy Hindman, and I'm the Chief Technology Officer.

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

Good morning. My name is Deanna Kovar, and I'm the Vice President of Production and Precision Ag Production Systems.

Julian Sanchez

Director-Emerging Technology, Deere & Co.

Good morning. Julian Sanchez, I'm the Director of Emerging Technology.

QUESTION AND ANSWER SECTION

Brent Norwood

Investor Relations, John Deere

Q

All right. Thanks for the introduction, gentlemen and ladies. Let's go ahead and get started with our first question. Over the summer, we created a new organization, the Chief Technology Organization. Talk a little bit about what was the rationale for forming that, what is the CTO organization tasked with delivering and why now.

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah. It's a great question, Brent. I'd like to answer that question in the context of our technology stacks. If you think about the technology stack that we deploy, deliver to our customers, it really is foundational upon the connectivity solutions that we deploy. We couple that with sensors and software. It's reliant upon a data platform and the applications that we write against that data. And prior to the reorganization that we've gone through, many of those components or steps within the tech stack were done in different parts of the organization. So, it wasn't always seamless. We didn't always have the same focus and priorities across the organization. That allowed for different user experiences frankly within the technology stack.

And so, by centralizing that work and driving towards an organization that has responsibility completely from top to bottom for that technology stack that really enables us to provide I think a more seamless solution to the industry. It also enables an increased level of focus and a very good understanding for what the priorities are for the work that we need to do to deliver within that technology stack. And in the end, I think that makes us a much more efficient, much more effective organization and improves our speed to delivery.

Brent Norwood

Investor Relations, John Deere

Q

Thanks, Jahmy. So, Deere has pursued a bit of a different strategy relative to other industry players with respect to the development of precision technology. Choosing to develop a lot of our own proprietary core technologies versus partnering, and we integrate those core technologies with the underlying equipment. What's the advantage to this strategy and why have we decided to pursue that versus kind of a pure partnering strategy?

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

Yeah. It's a great question, Brent. Thanks for asking it. As we think about the ability for us to deliver at speed and deliver technology that works in the field, one of the greatest opportunities that having it internalized at Deere does is allows us to support customers on that last mile as they implement these technologies onto Deere equipment in the field and as we support them in making sure those technologies work over time.

The other opportunity is as we think about this tech stack that we're building, it's about building on top of the technology stack and thinking about that next piece of technology that we can layer on as an organization. And doing that internally allows us to have that vision and that architecture and make sure that we're driving towards not only what we want to deliver today, but what we're going to deliver in the future. And then, now as we switch our focus from products to production systems, finding ways to leverage that technology across the production steps within a production system or from one production system to another is a great opportunity.

I also think it's important to note that we don't always just do it all by ourselves. We're definitely leveraging the innovation that comes from our supply base and ensuring that we're getting the best technologies that are out there and working together with the industry's best and brightest, and that we're the integrator and pulling all of those pieces together to make sure that they come together, create the economic value for our customers and for Deere, and that when they go to the field, they work.

Brent Norwood

Investor Relations, John Deere

Q

Thanks, Deanna. So, precision advancements have come a long way in the last 20 years. Where are we, what inning are we in kind of with respect to the maturation of precision ag technology, and how much runway is left for future opportunities within precision ag?

Julian Sanchez

Director-Emerging Technology, Deere & Co.

A

If we're thinking about using the metaphor of a baseball game, we might say we're in the seventh inning, but it's the first game of a seven game series. If we think about more international game, it might be the first day of a cricket game which I understand can last several days. And here's why that runway is so long. There's two factors. One, the first one is that from an agronomic standpoint, there's still a significant opportunity to continue to unlock value for customers by helping them with the task of precision and getting each seed, each plant what they need, when they need, right, so tremendous amount of agronomic opportunity still left. Farming is also a very complex logistics operation. And so, anybody that looks at logistics, you know that you're never really done figuring out where you can optimize, continually optimize logistics operations. So, again, there's a tremendous amount of runway opportunity for value creation still left in agriculture.

And then when you step back, one of the interesting things is that, as you look at major technology trends, every time there is a major inflection point in technology, that actually opens up new opportunities. So, just very recently in the last five years, as sort of the AI revolution has swept over the world, it has really opened up opportunities for us in agriculture to use AI and machine learning and look for those places where we can apply it and unlock value for customers. 10 years ago, you had the cloud and the mobile revolution, and again, that also opened up a tremendous amount of opportunities where farmers could then monitor the logistics remotely for their farms and get better at those types of tasks.

So, the runway is both in the inherent aspects of farming, which are both from an agronomy standpoint and a logistics perspective, but as sort of global macro tech trends continue to create those inflection points, we're always ready to capitalize on those trends and figure out where those trends can unlock new opportunities for solutions that help our customers.

Brent Norwood

Investor Relations, John Deere

Q

So, over the course of the summer, we talked about a new strategy that we've rolled out as a company. It included the formation of the CTO organization. It also included restructuring the way we're organized primarily around production systems teams. Now, a question we get quite frequently is, how is the CTO collaborating with the production systems teams to determine what the focus of our technology should be in the future and how are we prioritizing those R&D dollars and projects that we decide to begin?

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

So, it's important to note that we're doing this in really two ways. One, the CTO organization is working and looking for those technologies that might be at that inflection point and thinking about how they might be applied to agriculture. From a production systems standpoint, we're focused on really identifying what are the opportunities to create economic headroom for our farmers, and from an agronomic perspective, from an operational perspective what is it, if we could do it, could create value. And so, we've got small, agile teams that are focused on production systems in specific regions and they're learning and becoming experts and already are experts on both the economics of those farms, the agronomics of each plant, and the jobs that takes to sustainably grow a crop.

And what we're looking to do is take those opportunities to create value and collide them with the experts in the CTO organization to define the best solution to unlock that value for our customers and then accelerate it to market production as fast as we can. And that's really at the heart of our production system focus is really thinking about this from a system level and prioritizing the system value over a historical approach of prioritizing the product value going forward. And this is a huge opportunity for us to think differently about how we prioritize our portfolio. And as we think about the lenses we're using to say what's the next best investment for John Deere to make, it really starts with this economic headroom for the farmer, how can we create new value on the farm.

Our second approach and lens that we look at is product leadership. We know that in order to have this system-level leadership and unlock this value that our underlying products like the tractors and planters you see behind me are required to be differentiated and really have the best productivity, uptime and cost of operation as well. We're also looking, of course, at the business value for John Deere, and then we also look to say how does it align to our strategies going forward. And between the CTO organization and the production system organizations, we're very aligned on our focus to drive precision input placement, to drive more automation to the farm, and help farmers make better data-driven decisions.

And so, all of those lenses are aligned between the production system teams and the CTO organization, and we're focused on economic value and having deep understanding of what technologies might be able to do in agriculture.

Brent Norwood

Investor Relations, John Deere

Q

Thanks, Deanna. So, we talk a lot about some of the core elements of the precision strategy. Let's take a step back. We're at CES, right. We've got a lot of key themes that we've been highlighting with the tech media over the last couple of days. Can you guys talk through what are some of the key questions we're getting from folks in the tech media? What are the themes that we're promoting here? And then, let's also just take a quick minute to talk about what's behind us. We have the 8RX tractor and the ExactEmerge planter. So, what are the key themes, and then what's the technology that's embedded in the setting behind us with the 8RX and the ExactEmerge planter?

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah. Sure. I can start. So, the theme for CES for John Deere this year is from the ground up, and it's really the story of the seed and how important and how critical planting is in the production of crops. And the audience that we're talking to comes, walks in with all sorts of different levels of understanding of that. So, sometimes it's – we're foundationally explaining the process of growing crops and the importance of planting, and in particular, we're focused on the application of technology to that planning process. So, the importance of singulating seed, making sure that you don't have two seeds in one place and no seeds in another and how we use technology, in this case, electrification on the planter in order to do that. And then the importance of making sure that those seeds are spaced correctly, both with respect to one another as well as depth in the soil profile, and how that relates to yield at the end of the growing season for the farmer, and the technology behind us is a great talking point to explaining how we do that.

So, we start talking about the tractor, in this case behind me, we talk about four tracks. This is new to the world machine form behind me. First time that anybody has ever put four tracks on a row crop tractor. And we talk about the impact that has from a sustainability perspective, lower ground pressure, less soil disturbance. It really is a technology that allows growers to have confidence that they can use this machine year-over-year in planting their field without inhibiting plant growth year-over-year, because they're compacting the soil less. And we talk about the technology that exists within the machines from a connectivity perspective. It's probably one of our best kept secrets. I suspect that these machines are really IoT devices. They are in constant communication with the cloud and they're supplying information to John Deere Operations Center that our growers then have the capability of looking at and utilizing to draw insights from in order to make their operations better either through the growing season or perhaps into the next growing season.

Deanna Kovar

*Vice President, Production
& Precision Ag Production
Systems, Deere & Co.*



Maybe I'll talk a little bit about the planter and the technology we're talking to the tech industry about, and really it comes down to the uncertainty and the variability that our farmers deal with and how the robotics of each individual row, we've coined a new term of row-bot that is allowing these farmers to get through the field and get their planting done in a timely fashion. And we talk about the hundreds of sensors and the hundreds of controllers that are on this machine allowing us to individually singulate 100 seeds per second.

And Brent, you asked about what are these technology industry folks most surprised about or interested in, and I think at the end of the day, it's about how all of these technologies that they hear about are being used in agriculture today. They're not futuristic. They're real and are happening, and then just the sheer scale at which we're leveraging them to get over up to 500 acres a day and plant millions of seeds perfectly throughout a field. And I think that scale of how we're leveraging these technologies is really the most surprising part for the technology industry and proud of all the technologists within John Deere that have been able to bring it to market and do it at a scale and a level of uptime that allows farmers to adopt.

Julian Sanchez

Director-Emerging Technology, Deere & Co.

A

Yeah. I'm going to add real quick on the scale question. One of the things that's been interesting talking about this week is this planter, as Deanna just said, puts – each row unit puts out 100 seeds per second, and in our largest planter, there are 48 row units. And so, a lot of times when we have these conversations about how much runway there is left in opportunity, we focus rightfully so on the home runs, right. And so, things like See & Spray, we think we're going to have the sort of step change impact on agriculture. But if you think about what's behind us, that 48 times 100, if you even make a small improvement to each of those row units in the precision and the accuracy with which they can place a seed that immediately scales 48 times 100. And so, again, capturing that runway left is also about, it's not just about the home runs, it's even minor improvement in technology, minor incremental innovations have a significant impact across millions and hundreds of millions of acres.

Brent Norwood

Investor Relations, John Deere

Q

So, when we talk about a lot of our precision technologies, we use this term and concept job automation or maybe we call it machine intelligence. First of all, what is job automation? Why has that been the focus of John Deere's precision journey here recently and how does it relate to or support kind of future endeavors around autonomy?

Julian Sanchez

Director-Emerging Technology, Deere & Co.

A

Job automation simply describes – each machine in agriculture doesn't just drive, it does a job, right. This machine behind us plants. And so, the idea behind job automation is being able to introduce sensors, intelligence, and actuation to help do that job as well as or in some cases better than a human operator or human being would be able to do it manually, right. So, that's sort of the basic definition of job automation. The reason it's so important is because that's where a lot of the economic and agronomic headroom exists in agriculture.

So, in this broader journey toward autonomy, there's really three important components. The first one is knowing where you are and that's something we recognized was going to be a critical part of our tech stack over 20 years ago, so we invested in having our own, bringing in that technology, GPS technology in-house. By the way, now it's a GNSS technology, because our receivers can get data from all the other constellations. The second is having an awareness of unexpected physical objects around you and that's a problem we're working on from within agriculture, but frankly the whole world is working on that, obstacle detection.

And then, the third one again is that job automation and that's we are laser focused on the journey of developing solutions that unlock value for customers with job automation. So, it's an exciting journey for us, because we can continue to strive for full autonomy, Level 5 autonomy. But that journey of unlocking and developing job automation along the way is what unlocks value for farmers, and that's the most exciting part for us in agriculture.

Brent Norwood

Investor Relations, John Deere

Q

Yeah. Go ahead, Deanna.

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

Yeah. And Brent, I think it's important to note, Julian is 100% right, and this machine here has to go plant. But one of the things I think is really important is it does a lot more than just drop a seed right. It has to make sure that we create a trench for the seed to fall into. We have to do it in an accurate way. We apply crop nutrients while we're

doing it. And then we have to close the trench and make sure that there is enough soil on top of the seed but not too much and not too much force. And it's all of those small pieces of the bigger job of planting that our focus is on automating because each one of those steps within the planting process has a significant impact on each one of those seeds' ability to pop out of the ground in an even way and deliver the best yields at the end of the season. And so, job automation we think lets automate planting but it's really about automating each of those smaller steps within the planting process. And to Julian's point, we automated the job of steering the machine through the field 20 years ago. And ever since then and continuing out in front of us we're looking to find ways to automate more and more of those incremental jobs that someday will stack up to the entire job of planting.

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah; and I'd also add it's important I think not to think about automation in the context of just replicating what the human in the loop would do, right. In most cases we are actually performing the tasks that the human would do but we're doing it better. We're improving the outcome. If you take the example of the X9 Combine that was introduced this year and won an award at CES and you think about the adjustments that have to happen within operating a Combine in order to make sure that you have the cleanest quality grain going into the clean grain tank and no grain going out the back of the Combine back onto the field, that's an adjustment that typically would take place manually by an operator, a very skilled operator in a Combine historically. We've automated that function with visual information. So there's high speed cameras that are taking snapshots of the grain as it's flowing through the Combine and we're making those adjustments at a much more rapid pace and with much more detailed information than a human in the loop ever could. And so to that runway that Julian pointed out earlier, part of the reason that runway is so long is because automation enables us to actually significantly improve the performance of the job as well.

Brent Norwood

Investor Relations, John Deere

Q

So, in late 2017, we acquired a company Blue River Technology, and that company came with an initial product focus See & Spray. Additionally they brought core capabilities to Deere with respect to computer vision and machine learning. So the question we're getting a lot from investors is where are we on the initial release of See & Spray, one. And then two, how are we doing with the broader integration of Blue River's capabilities kind of within the enterprise?

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

So Blue River has been a great ad for us, Brent. We're going to see the initial introduction of See & Spray technology this year. Later on this year, you're going to see a more advanced version of that rolling out the following year. And that really sets up I think an interesting conversation around this idea of sense and act in this case See & Spray. But to the runway that Julian mentioned before, we are giving machines the gift of vision in the case of See & Spray and the ability to have intelligence to think through the AI algorithms that are going into those pieces of equipment. And so it quickly opens up this universe of possibility. If you can sense in this case see and you can think in the machine, what else can you do with that technology. And it quickly conjures up all sorts of interesting ideas in and around the ability to identify what that individual plant might need and then act specific to that plant. And that gets you into a whole different level of precision within agriculture that's definitely on the horizon for us, it's part of that runway that Julian pointed out.

I'd also just maybe turn the page a bit and offer up that we're utilizing the skill sets that exist at Blue River and all of the amazing folks that work there into our Construction & Forestry products as well. So they're helping us

understand how to go about obstacle detection, which is critically important in a construction space, utilizing very similar techniques, very similar hardware sets to the See & Spray technology that we're developing for sprayers.

Brent Norwood

Investor Relations, John Deere



So we're starting to get a lot of questions online, so I'd encourage investors to keep submitting questions and we're going to try to get through as many as possible. Quite a few of the questions are concerning data; John Deere has a very robust data platform in the John Deere Operations Center, couple of questions. First, how does the data center and our data platform create value for customers? Second, what's on the horizon for the John Deere Operations Center, what future capabilities are we starting to think about? And lastly, how are customers using data to create better environmental outcomes?

Julian Sanchez

Director-Emerging Technology, Deere & Co.



Our data platform and our digital tools that are in front of the data platform are, I think, the most collaborative in the industry. And I highlight that term collaborative because what the job of that platform, the job of that platform is to help farmers achieve their objectives, help them farm. Right. So why is it so collaborative? Number one, is one of the data platforms that allows – that has the highest degree of seamless connectivity between what is happening in the field and what can be then reviewed later or in real time. So all of our vehicles being connected in real time and transmitting the data to that platform allows farmers to view what's going on in real time from an agronomics perspective, from a machine perspective, and then also allows them to make decisions in the off season. We're at a point in agriculture when you talk to farmers about what is it that you need, what are the opportunities that you're looking at, they say you know I just – I really we have so many great tools right now. I really need all of this to really work together well. And again, for us, that data platform and those digital tools is that intersection point, that intersection tool that allows us to bring all of that together.

The other reason it's one of the more collaborative tools and I would say the most collaborative digital tool in agriculture is we have a number of APIs in that platform and at the moment have well over 180 connected software companies. So these would be other companies in agriculture that are providing some value to an individual farmer and we allow the farmer to import or export data between those other platforms to again accomplish their job in the most seamless fashion.

In terms of the opportunities for sustainability if you think about the emerging opportunities in this space, it starts again with documenting what you're doing in the field. Right. And so I think we're really really uniquely positioned here to help farmers understand what opportunities they might have in sustainability markets like things like carbon sequestration because, again, we have in that data platform enabled them to document all of the passes through their field with hundreds of sensors.

And so if we allow them to use that data and we provide them a way in which they can seamlessly and with a high degree of ease of use understand how the data they've collected, how the practices they've implemented can impact their opportunities in sustainability markets, that's a place where we believe the operations center will have a significant impact.

Brent Norwood

Investor Relations, John Deere



We've got a couple of questions about the role that our dealers play in the adoption of precision ag. So, clearly, we've created a lot of great products. We have a future roadmap of further technology and integrated into our own

machines, but we don't sell and support this to the customer. So do we have any way to track the investments that our dealers have made over the last five years with respect to supporting and selling this precision technology? And what incentives does Deere use to kind of help our dealers make those investments?

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

Yeah. At the heart, every farm is different and every fleet on every farm is unique, and it's critical that our dealers are there to understand how that next technology that a farmer could adopt could increase their yields, lower their costs or reduce their risk. And so it's clear our dealers play a huge part in our ability to get these amazing technologies adopted on as many farms and on as many acres as possible over time.

For the last decade since we started putting connectivity in every one of our large ag pieces of equipment, we've also brought our dealers along on a journey as they think about their capabilities and their abilities to help customers install and use these technologies, support them if something goes wrong and allow them to maximize the value. And so dealers have invested a tremendous amount in both their personnel capabilities as well as their ability to leverage the data themselves through contact centers and data management centers.

And while we don't have a dollar amount to tell you how much dealers have invested, we have continued to put new mile markers out in front of our dealers about the capabilities that we want to make sure that they have and then measure them on their ability to execute on those capabilities. And at the end of the day, it's their ability to sell the complete John Deere value proposition of the amazing equipment we have, the leading-edge technology and their world-class dealer capabilities, that shows up in that measurement.

And today we're continuing to build on how we think about adoption in their measurement and how we measure dealers in their ability to execute on the things we put out in front of them. And today, we not only look at how well they're doing from a market share perspective, but we're also asking and sharing with them how well they're doing of getting customers engaged in our technologies, both equipment technologies as well as the digital technologies that Julian talked about.

Brent Norwood

Investor Relations, John Deere

Q

So we've talked a lot about our precision technologies available on some of our latest equipment like the new 8RX and ExactEmerge. But there is also an enormous part of the installed base that has a retrofit opportunity. So what efforts is Deere undertaking right now to pursue adoption via the retrofit strategy? And specifically for the planting step what types of technologies can we retrofit back into previous generations of equipment.

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

Yeah, so, at the heart of it for 20 years, our precision ag business has been a retrofit business. It started as a ability to put technology on your fleet of equipment and auto track and document, and that's continued forward for 20 years. So no matter where the farmer is at on their technology journey, if in the planting step there is a place for them to either get their machine connected, get GPS technology onboard, or then advance into some of the more machine-based technologies like ExactEmerge, individual row hydraulic downforce, and now ExactRate, which is a new fertilizer system that we have that allows us to make sure we're putting the right amount of fertilizer on at the right time.

And so all of those technologies are capable of being bought on a brand-new planter out of our seeding factory here in Moline or they're capable of being retrofitted on more than a decade's worth of installed base as well.

Brent Norwood

Investor Relations, John Deere

Q

Awesome. How does Deere measure the impact that our precision ag equipment has with respect to the environment? Is there a way that we can quantify or measure the benefits environmentally that a lot of these precision technologies will have? And then, second question, to what extent are customers actually demanding more information and data concerning the environmental benefits of precision technologies?

Julian Sanchez

Director-Emerging Technology, Deere & Co.

A

One of the great things about agriculture is that precision which leads to economic – positive economic outcomes is highly aligned with being able to do more with less. And so, everything from our core technologies around guidance which allow you to not have any overlap where you're wasting either fuel or you're wasting inputs like chemicals to being able to exactly apply nutrients on plants only in the areas that are needed, all of those technologies again both benefit the farmer economically as well as have a positive impact on the environment.

And so where we kind of like to look at it is we always start by helping farmers see the data. I mean, farmers have a show-me culture. Show me how this works, right, and show me the value. And because we have our data platform, our strategy is always, well, let's make sure that they, from day one, can begin to see the impact and compare the impact of different practices or different technologies that allow them to do more with less. They can see the impact on their operation, they can see the impact on yield, and, yeah, I mean, they're all businesspeople, right, so they're analyzing all of this constantly and making those decisions over time.

And so, with that approach then, it allows us to continue to promote and develop technologies. And we are on this path, I mean, all across all of our vehicle platforms we're on this path where we're looking for opportunities to unlock – develop technology that allows them to do more with less. So it's an exciting time because again the two and some – in some other industries the environmental impact of something and the productivity or the convenience are diametrically opposed. In agriculture, they're highly aligned. And so, our precision ag strategy to develop more of these solutions and automate more jobs is already very, very well-aligned with having positive environmental impacts.

Brent Norwood

Investor Relations, John Deere

Q

So when we talk about precision ag adoption, we've measured engagement primarily through this concept of engaged acres. First, can one of you define what an engaged acre means? And then second, will we continue to use that metric going forward or are there other metrics that we might use to gauge kind of customer engagement within our system? And then the last question is what about dealers, how are we measuring their ability to be engaged in precision technology?

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

So I'll take a crack at that, Brent. An engaged acre is an acre in which we've documented a single field pass within the last 12 months. So it means that one of our connected machines has done work across that field, documented it and shared it into our cloud-based system at John Deere Operations Center. So over the last 12 months, we've had over 230 million engaged acres in our system. So those are within the last 12 months actions

been taken and we've documented that. We're also looking at how good is the quality of those engaged acres. How many acres have had multiple passes across them over that same 12 month period and documented them. And so, we're measuring how good and how deep of engagement do we have. We're also measuring digital engagement. How well, how many users are going into our John Deere Operations Center desktop system or the highly used John Deere Operation Center mobile experience to keep track to plan monitor and analyze what's happening on their farm.

As we think forward about how do we measure technology and are we delivering the value to agriculture that we expect to be, we're going to continue to look for more and more utilization metrics. Of course, we want customers to engage and buy our technologies. But for us it's equally if not more important that they're using those technologies and that they're getting the value from them. So we will continue over time to change our measurement from just did they buy it to, are they using it and are they getting value from it across as many acres as possible. So that's a huge opportunity for us to make sure that we're not just talking about it, but that we're delivering on the value.

And then every time we have these measurements at a macro level, we know that if we want to drive even more engagement we need to drive these metrics down to the individual dealer level and allow them to see how their individual customers are leveraging technology. So we're continuing to not only measure it at a global John Deere standpoint, but helping dealers see how their engagement is as well and how their individual customers are engaging. And all of this is done of course with the customer's consent with our data management policies and allows us to help each individual customer think about what's that next opportunity to add more value to their farm.

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah. Maybe I'd add Brent that this audience is probably fairly familiar with the acquisition we made late last fall of Harvest Profit. I think that's a great example of how we're trying to make sure that we connect the technology that the customer purchases and deploys to the value that it creates, right. We have the ability today data to connect it to yield bushels per acre of corn or soy or something like that. Harvest Profit gives us the ability to have that customer see that value and that technology show up and reflected in their balance sheet at the end of the day. And I think that does a nice job of closing the loop on value creation of the technology all the way to the customers' business at the end of the day.

Brent Norwood

Investor Relations, John Deere

Q

Let's switch gears here for a second because we've been getting a lot of obviously we've talked a lot about precision ag but we've also had a number of questions about how are we leveraging a lot of this technology created for precision ag and moving it across the aisle into construction markets whether it would be earthmoving or road building. So I know part of the promise of the CTO organization is that we would create better leverage between one division to the next. So can we talk about a few specific examples of technologies that is being ported from ag to construction and forestry. And what's the timeline on some of these technologies.

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah, it's a great question and a significant part of the reason actually for the organizational changes that have taken place. So a couple of specific examples that I point out the Gen 4 display, the precision ag display that sits in many of our self-propelled large ag pieces of equipment is a display that will be leveraged in the very near term

into the construction application. So that's a great example of being able to take advantage of the scale of the volume that exists in the large ag space for that display as a specific example leveraging it into lower volume but still critically important products within the construction and forestry space.

I think another example that I'd point out we referenced it earlier and it's really a leveraging of technology and resources is this obstacle intelligence problem that we're working on solving in the construction space. That's leveraging stereo cameras, for example, that we're developing for the See & Spray technology. It's also leveraging the advanced algorithms that we're developing for that technology just into a different application. So, the position of the cameras change, and what you're trying to identify within the cameras changes, but the core elements behind it are remarkably similar and I think speak to the power of our ability to leverage technology from agriculture into construction.

Brent Norwood

Investor Relations, John Deere

Q

This next question I think is applicable to both our Ag & Turf division as well as our Construction & Forestry division. With the new operating model rolled out this summer and then the creation of the CTO organization, how is product development changing at Deere versus product cycles in the past that were typically four and five years, technology, product cycles can be maybe more incremental and have faster speed to market. So, maybe, Jahmy, can you talk a little bit about how product development, because you've been on both sides, in our traditional engineering platforms as well as in the technology group, how is that changing with respect to some of the organizational changes we've made over the last year in the new operating model?

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah. I think it's a great question, Brent, and it's part of this ability to leverage technology. So, once we develop technology within a product, in this new model, the intent is and we're executing on this currently the ability to leverage that into more products, right, so that you don't recreate the wheel, so to speak, with another product. And to the extent that we're capable of leveraging that technology, we increase the speed to market. When we can take advantage of the software that's been developed and the hardware that's been developed, for example, in an application on a tractor and leverage it to a sprayer, we increase the velocity of being able to deliver that technology into the marketplace. So I think that's one critical component.

The other aspect is a recognition that the technology development cycle spins at a faster rate than the core product development cycle does. And so, making sure that we have consistent interfaces defined on our products so that we can deploy new technology very quickly to existing products and to the products that are sitting in the field population is a critical element of us being able to scale that technology moving forward. And I think both of those kind of come together in a very interesting way because of the new organizational changes and our intentionality around making sure that that we spin the technology cycle faster than we do the core product cycle.

Brent Norwood

Investor Relations, John Deere

Q

So, in a related question, Jahmy, given the fact that we will see technology developments happen maybe at a faster clip than previous product cycles have happened in the past, how is that impacting customer behavior? Are we seeing any change in the replacement cycle of customers as some of this technology is coming out at a faster pace than previous product cycles?

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Yeah. I think it's tied back to the value the customers see in the technology. So, they certainly want to be able to take advantage of the latest technology when it adds value to their business. And there's an appetite and a draw for that. So, my experience, I'll be interested, maybe Deanna can comment on this one too, that the appetite for technology, once a customer sees the benefit of that technology in their application and showing up at their balance sheet, is immense. And I think that is a draw for us, it's a demand on us to be faster, and that's a good thing. That's a great challenge to put in front of our organization. Our organization is going to respond to that and is responding to that.

And I think that also speaks to the need as we go through product development for us to think about what's next, right, not just about the technology that we're delivering into the market at this point in time, but what will that technology look like three, four, five years down the road, and how do we prepare the machines that we're developing today, the equipment that we're developing today to take advantage of that technology in the future.

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

Yeah. I think part of what's really important to think about is how critical this consistent technology stack is for our farmers. If you think about the core components of a display in a server and a receiver that have literally driven tremendous value over a 20-year period through guidance and section control and now we're turning on the end and we're moving to a new technology called AutoPath that brings in connectivity into that conversation. And this consistent interfaces conversation is really important for farmers to continue to adopt new technologies over time, but not necessarily always have to buy the latest and greatest and have the ability to retrofit and make incremental improvements in their operation.

And even from an equipment standpoint, we talk about long development cycles, we're also focused on figuring out how can we drive incremental value season to season on the underlying equipment as well, how can we bring new technologies to the planting step every season and make sure that not only can new customers get the benefit of that, but we find ways for the existing fleet to get each of those incremental value as fast as possible. As we think about Smart Industrial, it's identify opportunities, create solutions and then accelerate them on as many acres as possible. And that's going to happen fastest if we increment it versus wait for huge, huge bundles of value to come.

Brent Norwood

Investor Relations, John Deere

Q

Thanks, Deanna. We've got a couple of questions come in around this concept of job automation, and we talked a little bit about it earlier in this event. But the questions are really around, we've done a lot of job automation specifically around crop harvesting and with features like Combine Advisor where we've been able to really create a feature that helps self-optimize that machine as it moves through the field. What are other areas within the production system where we expect to see more job automation, more self-optimization in the field?

And then the next question is, tangentially related to that, is with respect to autonomy, are there parts of the production system where we would expect autonomy to take first relative to maybe some of the other steps?

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

I'll take the automation answer because it's an easy one, Brent, it's all of it. It's everywhere, right? Everywhere where we can create value, to Jahmy's point earlier, where the automation can do it as good if not better than what the operator could have done themselves. And we're prioritizing how we go about automating, what we go about automating next by really looking at the value that it can create for the farmer, can we do it better, can we lower their risk, can we decrease their costs, can we increase their yields by automating every piece of the pie. And so that's how we'll look at it and prioritize what comes next. And it's across all of the production steps.

We do talk a lot about Combine Advisor. It's easy to conceptualize, for sure, but we've been working on automating all of the other production steps as well. ExactApply is a great example of automation of the ability to turn compensation and turn on and off nozzles. That's automation that kept the farmer from having to consider driving differently in a field and be more productive as they apply nutrients and crop protection.

Julian Sanchez

Director-Emerging Technology, Deere & Co.

A

And I'm going to build on the job automation discussion here. Even Combine Advisor, which is a very sophisticated system that can make a novice operator perform – put a novice operator in the cab and the combine can still perform as if there was an expert operator in there. So, even that system, right? The runway in the harvesting space is not nearly over, right? So Jahmy alluded to this earlier, there's still then things that that's taken a novice to an expert level. There's been things that the humans can't literally see and has never been able to see and there's places we can put cameras and sensors and build intelligence that is able to achieve things that even an expert operator can't accomplish, right?

So, even in the step of harvesting, continuing to have a good understanding of what grain is being harvested and how that grain is moving through the machine and making tweaks to that machine, making sure that we're holding on to every, every single kernel of grain in that machine, there's still a tremendous amount of runway there as well.

So I agree with Deanna. The opportunities are all the way across the board. And just to give you a view behind the scenes looking through how we brainstormed this, again, it's not just trying to take a novice – the performance of an operator to an expert. There's places where we're brainstorming and we say where could we put a camera and what kind of information or a camera or other sensor, what kind of information could we glean and what kind of intelligence systems and algorithms we can train in order to add a significant or, like I said earlier, even an incremental level of precision or intelligence that when you scale it across millions of acres has a tremendous amount of impact.

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.

A

I think another really important point about automation is that historically we thought about automation within a production step, within the machines you see behind me for planting. But our opportunity, as we step back and really look to prioritize the system-level value that we can create is the value that we'll create from step to step, and the amazing flywheel that we create that allows us to plant with a John Deere system and make the application of crop nutrition and the harvesting steps even better. And that across step opportunity that we have at John Deere and within agriculture is where we believe we'll see a tremendous amount of value in the future.

Jahmy Hindman

Chief Technology Officer, Deere & Co.

A

Brent, maybe I'll just cover a couple things on autonomy. Our view simply is that we're going to continue to increase the levels of automation to the point where eventually autonomy just happens, right. It just feels natural, it's going to happen because things are automated to the point where the step is just not that significant.

But I think if you think about the agricultural process, not all jobs are created equal, right. The planting job represented by the equipment behind us is really, really complicated. The harvesting job is complicated. Not all jobs are as complex as those. And I think the first step into full autonomy into the agricultural space is going to be in those jobs that are simpler for us to do, right, that are simpler to execute and allow for us to leverage what is on-the-edge technology into that space as quickly as possible, but also in a way that sets it up to succeed as much as possible. And then I think, once we do that and that's successful, the appetite is going to be there and it's going to come really fast for us to fully – go to full automation for an increasingly complex job like this planting system that's behind me. I think that's how that unfolds within the industry moving forward and I'm really excited about that because I think that's very much in our near future.

Brent Norwood

Investor Relations, John Deere



So we've got about three more questions and then we'll wrap up. I think this next one's an important one. It's one that we get a lot from investors. As we talk about all of this new technology that's coming down the pipeline, what we've done today with respect to job automation and what's coming ahead, is there an opportunity to change the business model slightly from adding incremental content to having an opportunity to have some reoccurring revenue via subscriptions? As a lot of these machines are getting smarter each season, they have the ability to download updates over the air, how do we think about this technology and the potential implications for our future business models?

Deanna Kovar

Vice President, Production & Precision Ag Production Systems, Deere & Co.



Yeah. We're certainly constantly thinking about how we attribute value and sharing the value that we're creating through these technologies. And we have been working to drive more subscription-based models into our technology. So, our universal display platform, the Generation 4 display that people are leveraging on their older equipment today comes with the ability to do AutoTrac in base. But then if customers want to go further than that, they want to leverage section control or some of our automation technologies, those are per annual subscriptions that they're paying to get access to those technologies and allows them to try new technologies at a lower investment by just paying a subscription for a year.

And then we have to continue to make those technologies and those applications even better so that they continue to come back and buy them. And we see great renewal rates on those universal displays. And you'll see us continue to think about ways with our core precision ag that we can help farmers get into precision ag at a lower cost and then get more value over time.

Secondarily, we've got a lot of amazing technologies in the pipeline, and some of those technologies are going to change and mature at a faster rate than the underlying equipment. So, we are definitely looking at these new technologies and how do we bring them to market in a way that allows again to drive adoption and then for customers to get incremental new value over time. And we definitely believe more subscription-based systems will come to that. And then, of course, there's the big picture pilot of how do we monetize the whole system. And we're early in our thought process on maybe new ways across the system that we could give customers choice to think about how they might get into the John Deere equipment and technology that we offer.

Brent Norwood

Investor Relations, John Deere



Thanks, Deanna. We've got two more questions, ESG-oriented, I want to throw out to the panel here and then we'll offer a few closing thoughts. But before we get there, first, with respect to kind of future regulations, do we see at some point in the future where we might have requirements for zero emission equipment for Deere and what are we doing to potentially prepare for that in the future?

Jahmy Hindman

Chief Technology Officer, Deere & Co.



So, yeah, the answer is yes and it's already happening in niche markets in particular in the construction industry. We're seeing that happen and enforced locally, municipalities being the primary place where that's happening. And just from a technical perspective, there's different technologies that we're investigating in order to participate in that space, battery electric being one that many people are familiar with, there are other alternatives out there. We're actively exploring those at the moment and recognizing that there is a need today and a growing need in the future for us to be able to put powertrain systems into equipment that get as close to or at zero emissions like battery electric technology.

Brent Norwood

Investor Relations, John Deere



And how do we think about sustainable farm practices particularly with respect to things like agroforestry or regenerative agriculture, what are we doing on those fronts?

Julian Sanchez

Director-Emerging Technology, Deere & Co.



I'll go back to the conversation around data and what we can do with our data platform. So, the key thing in this space is being able to highlight the opportunities for a farmer and giving them the tools to be able to compare and contrast how different agronomic practices are going to impact their profitability and the way in which they're able to farm sustainably, right.

So, if you think about something like cover crops, it's giving them the ability to analyze, if I do this with my fields, if I execute new agronomic practices, this will be the impact – the potential impact on yield of my current practices. But then as things like carbon markets continue to emerge, also having the tools to highlight those opportunities within that platform will also be a very important part of it. So, those are all the things that, again, as we look at the development and the evolution of our digital tools, we're looking at bringing all of that in one place where they can seamlessly evaluate the impact of making those tradeoffs all across the board.

Brent Norwood

Investor Relations, John Deere



Thanks, Julian. So we've covered a lot of ground here in the last hour and I'm going to see which one of you wants to volunteer to kind of succinctly wrap this all up. I mean, the basic question we get is we understand where John Deere has been on precision development, a leader in the industry. But what's next? And I know we've thrown a lot of concepts at folks over the last hour, but how would one of you want to neatly wrap that up and describe what to expect from John Deere in the coming years with respect to precision ag development?

Jahmy Hindman

Chief Technology Officer, Deere & Co.



Yeah. Maybe I'll start and anybody can contribute. I think about the journey that we're on as one where we're giving machines intelligence and increasing intelligence over time. That journey, Julian mentioned it, we're at the very beginning of that. We're giving them senses. In this case, the vision with See & Spray as an example and we're on the beginning of that journey. And you can sort of let your mind run wild when you think about the opportunity space that's in front of us, when you have machines, equipment that have the ability to sense and to think and then to act precisely, right, in this space of agriculture. And that has a tremendous impact on the industry. It has a tremendous impact on sustainability, we've talked about that. It has a tremendous impact on the profitability of a grower. And I'm super excited that we're on the very frontend of that and we've got some significant technology influences that are coming together in the moment that we live in today that are going to be with us for a very long time and create a very, very, very bright future for agriculture.

Brent Norwood

Investor Relations, John Deere

Thanks, Jahmy. And thank you all, our panelists, Jahmy, Deanna, and Julian, I hope our investors found this very helpful. Thank you all for attending. I know we got through many of your questions, we might not have gotten to all of them, but as always please feel free to follow up with us, shoot us a note at DeereIR@JohnDeere.com and we'll certainly get back to you. Thanks again to our panelists. And have a good day, everybody.

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