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Industry Innovations in 3D Printing

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Technology has caught up, and we are in a very fortunate situation where there's pull from the industry, which says it's not just hype. Companies have started adopting it. They believe it's real, they're seeing the benefits, and that's why they are starting to invest in it.

Hanish Patel: Additive Manufacturing, aka the application of 3D Printing, has been around for a while, but now it's finally being adopted for applications of scale. Today, I'm sitting down with Michelle Bockman, global head of 3D Printing, Commercial Development and Expansion at HP Inc. and Vinod Devan, Principal, Deloitte Consulting LLP, to learn how they are helping clients integrate additive manufacturing into product development and supply chains. Michelle, Vinod, welcome to the show.

Vinod Devan: Thank you.

Michelle Bockman: Thank you.

Hanish Patel: All right, excellent to have you on. Now, we've heard for several years that additive manufacturing has arrived, but we've only recently seen it moving beyond lab applications in a meaningful way. What's different now?

Vinod Devan: Yes, I would say it has been around, it hadn't arrived yet so yes, it has been around for over 30 years at this point, and it's been primarily used in prototyping (0:01:00) and some custom applications like

dental implants, as an example, but there are two main drivers of why it has finally taken off and why there are so many applications in the industry. First one, the advancements that were needed in speed and quality and materials hadn't quite been moving at the pace that we would have liked them to. We did not have large companies, we did not have highly capitalized R&D - driven companies playing in this space and now we do, HP being one of them. Second is complementary technologies like IoT and AR and VR and data analytics, all of which are important and necessary, along with a digital thread to make 3D printing successful, were not there, now they are. Together, they're all driving Industry 4.0 with 3D printing at the center of it. So for us it's finally arrived, and hopefully our clients are going to see the benefits of it soon.

Michelle Bockman: To add a little bit more to that, we've seeing companies use 3D printing for tooling jigs and fixtures, and what we've seen is that they've learned (0:02:00) from prototyping and making parts that they can actually put in their factories, and now they're taking those benefits and they're expanding those to production, so we actually see companies that have moved from tooling to jigs and fixtures, to smaller volumes, to mid-volumes, to even very, very high volumes in production, and they're also coming up with new business models that will allow them to disrupt different industries, and it differentiates them.

Hanish Patel: That's fair. So thinking about what you've just said in terms of just how they are moving from tooling and jigs and new business models, I mean, I keep hearing that additive manufacturing will be transforming a $12 trillion manufacturing industry. What are some of the ways that 3D printing is actually truly being used today and how is it evolving, and on top of that, what should companies within tech and media and telecom really be considering when it comes to 3D printing?

Michelle Bockman: Great question. First of all, most people probably know HP for printers and PCs (0:03:00). What they may not know is that HP's 3D printer is a printer that prints itself.

Hanish Patel: Hold on. I want to make sure I understood that. A 3D-printer that prints itself.

Michelle Bockman: Yes.

Hanish Patel: Explain that to me, please?

Michelle Bockman: So a printer that prints itself. So about 50 percent of our custom plastic parts in the 3D printer is printed using our own technology.

Hanish Patel: Wow.

Michelle Bockman: We started working with supply chain, and initially we came up with, I don't know, 10, 15, 20 parts that we thought that we could 3D print. However, I'm working with them a little bit closer, working with designers on designing for additive manufacturing, because if you take your traditional design and you try to 3D-print it then you're not getting the benefits from 3D printing. So we actually worked with the designers, taught them methods on how to design for additive and all the benefits you get from it, and now not only do we use 3D printed parts in the 3D printer, but we use it in other parts of our business, whether it's large format, the business at HP, spare parts (0:04:00), and even some other products. So it's just started small and it's gaining traction, and now we get designers that will hail us in the hallway and they'll say, hey, hey, I've got an idea, I've got an idea on how I can print this part, and what do you think? So it's definitely changed. It's a mind-set change.

Hanish Patel: That's for sure. Vinod, your thoughts in terms of what are tech and media and telecom companies need to be considering on that front?

Vinod Devan: Primarily, there are three sets of companies when it comes to 3D printing—those who've been doing it for a long time and are ready to scale it, those who have succeeded in scaling it and now are trying to figure out, okay, we make things cheaper, better, and we make some custom items, but how do we truly evolve business models to go get new revenue streams and attack different market segments that were

not available to us before. And then there's a third category which has heard about 3D printing, which has played with 3D printing, perhaps in a lab, but has not really deployed it in any meaningful way from a business standpoint in the enterprise.

From a tech media telecom standpoint (0:05:00), we'd really encourage companies to figure out where they fit among those three categories, and depending on where they fit, put some bets in place to go explore it and then go place a big bet in additive, and not just additive by itself, but additive and the complementary technologies around it. The advantages are across the board in engineering, in product development, in operations, and in business models. You just have to figure out who you are today, (0:06:00) where you want to be, and get going, because the rest of your competition is on its way.

Hanish Patel: Got it.

Michelle Bockman: And I'd like to give an example of that. So in one of the past businesses I ran logistics, had about almost $1 billion worth of inventory, and a good portion of that inventory was slow moving. So there was last time buys because suppliers are going to discontinue producing parts, or maybe they go out of business, so you're spending millions of dollars to hold on to this inventory to support a system or a product for 30 years possibly. (0:06:00) So what 3D printing does, it gives you the opportunity to have virtual inventory, virtual warehouses, so you don't - there is no need to hold millions upon millions of dollars of inventory, so when a customer needs a spare part, a service part, then you just print it and a couple of days later they'll get it.

Hanish Patel: Wow, I mean, just the example you cited there and something both of you mentioned and I'd like to anchor in on is business models. And if you think about what you guys have just described there, what do you see in terms of what companies need to do around changing their business model to incorporate these innovative technologies like 3D printing?

Vinod Devan: Yes, Hanish, that's an interesting dynamic. In some ways you have to evolve your business models to be able to accommodate and incorporate and truly take advantage of 3D printing, but then there's the other dimension where 3D printing enables net new business models for you. As an example, if you are a company building medical devices today, (0:07:00) and you have the ability to custom build that device to a patient's exact fit and exact needs and exact outcomes that you need to deliver, now you are able to improve and accelerate the desired outcome for the patient, which means the way you get paid for it changes, the way that the patient recovers changes, the way the hospital treats you changes, the way the doctors treat you changes, and all of those have to be accommodated in order to be successful, which means the entire business model of how money flows through a medical system needs to evolve. So it's not just about making things cheaper or better or more custom, it's about creating entirely new opportunities in the market for yourself and for your ecosystem.

Hanish Patel: And now I want to just carry on in that vein. The fact that there is also 3D printers significantly more available at a consumer level as well. Are consumers going to be further disrupting what you just talked about (0:08:00) within that overall business model, and how that whole in terms of that value chain is going to take place?

Vinod Devan: Yes, but to an extent. So where we focus our attention right now is on the production level 3D printing, and so we expect that consumers will become designers over time, and we expect that they will have their own capabilities as well, but in the short term we really want to focus on how enterprises are able to really weaponize 3D printing for creative designs and crowdsource designs from outside. To the extent that that can be enabled, we believe that there is a strong opportunity and it's in place, we believe that consumers truly (0:10:00) becoming designers of the future is probably a few years down the line because there is a significant difference between the capabilities and 3D printing for consumer printers and production-level printers. But yes, the movement is coming, but it's going to happen in stages, and I think crowdsourcing is likely to become the leading factor rather than each individual becoming a designer on their own.

Hanish Patel: Got it.

Michelle Bockman: (0:09:00) And I would agree with that, and some other examples are, well, first of all, you see this new generation coming, they want everything faster and they want it customized, so 3D printing is the technology that can do that for them. So insoles, imagine if you have your foot scanned and there is a customized 3D printer that can print it on site as you're in the store and you get it. Prosthetics is another example as well, I mean, imagine that you had small, medium, and large for a limb, that has to be uncomfortable for the end patient, so now you can scan a piece of your body and then have it custom-made. And I would say with business models, understanding not only the capability of 3D printing, but what are the needs or what are you solving for in the industry? What are the needs of the end customer? And if you can take that with what Vinod was just talking about business models and you marry those, then you're going to have a product that is a home run every time.

Vinod Devan: So what is important (0:10:00) is that each company decides where they want to be versus where they are and then create a road map to get there. The reason for that being we have seen companies, for example, there's a company that makes hardware devices for the IoT industry that we're working with now, and they have had three runs at 3D printing so far, and most recent one with us, and the thing that they have discovered is every time they were either reacting to engineering, getting excited about something, or they were reacting about an executive who saw something at a trade show and got excited about it and wanted to implement it in their company. The reality is you have to look at the scope of possibilities for 3D printing

and then pick your spots and then go own those spots, learn along the way, get some wins along the way, and then get to the big business model changes. Starting with the business models is a tough play, and that is a big risk, and it's a big ask of any executive team or an engineering team.

Michelle Bockman: And if you can own end-to-end (0:11:00) even better, because you're going to get more of the profits, the end-to-end application.

Vinod Devan: Absolutely, absolutely.

Hanish Patel: So let's stay with the direction we're going here in terms of the advice for companies, and particularly if we're looking at our tech, media, and telecom companies, what advice would you give for them to get started or if they've started to dip their toe into additive manufacturing, and in relation to that, what application areas do you truly see opening up for them?

Michelle Bockman: Sure, so I'll take that one. I'll go back to customer value. What is the customer going to pay for? I think you've got to understand that and what the capabilities are of the technology and how you marry those and what you're solving. So I go back to that. If I were a new customer, we work with new customers all the time, I would start off with an application workshop. Once you understand some of the areas that you want to solve or pain points, start out with an application workshop and you start off with like what are the opportunities? Let's ideate, let's figure out, let's think outside the box, and not just think about what they do today (0:12:00) or the industry that they're in today. What do they want to look like in 10 years? What do they want to look like in five years? Do they want to be the same company that they are today, because I can tell you that looking at megatrends, things are changing all the time.

So, how do you get everybody to start thinking that way, like let's think outside the box, so that's first. And then design thinking, taking them through ways to think differently about the design of some of the products that they're looking at. And once you do that, you come up with some real opportunities, and what we'll do is we'll map it out, like what can we do now, what can we do today, what can we do in the near future, and then what's the far future. And once we map that out then we put a road map together with the customer and we work hand-in-hand, it's a partnership and there's a road map for 3D printing and there is a road map for business models, and maybe investments for the company, whatever that may look like for them, so that's how I would approach it.

Vinod Devan: As (0:13:00) Michelle was pointing out, they want to understand what the customer applications are, and if the customer applications require them to evolve their road map in a certain direction because of where the opportunities are, they are very open to it. So this is truly a co-development and partnering environment in 3D printing, because everybody has to create a market. It's not an existing market that HP is trying to capture or their competitors are trying to capture, it's truly a market that needs to be created as a function of Industry 4.0.

Two primary areas have emerged as the most high potential in the near term that Michelle was referring to earlier. One is digital inventory. Not having the inventory carrying costs, not having the transportation costs, not having the warehousing costs associated with inventory that must be on hold for decades in some cases. That's a big opportunity, it's an immediate impact opportunity, and the way you start that process is by looking at your portfolio of products that you make, the bill of materials of your products and identifying parts that can be printed using technology today and immediately (0:14:00) digitizing them. That's an immediate impact it can have.
The other is around digital development, is designing parts for 3D printing.
They can be lighter, they can be smaller, they can be multiple parts combined into one part because now 3D printing removes the design constraints, and now that opportunity not just allows for innovation, but allows for efficiencies in your product development operations that did not exist before. If you think about a telecom company as an example, a spare part down in the field can result in downtime, which results in lost revenue, which results in customer dissatisfaction. If it's a distributed manufacturing environment, a 3D printed part, you can print it near the cell site, have it delivered quickly, have the site up and running.

Michelle Bockman: And I'll add one point to that. When you look at 3D printing there's definitely areas that 3D printing has an advantage over traditional design and traditional manufacturing, and two of those are ducting, as well as lattice structure. So you're able to 3D print (0:15:00) much more accurately to the actual design in those two areas, and so knowing that, whether you're making sneakers, or you're making ducting for HVAC in a vehicle, whatever that may look like, those are two real applications that there's an advantage. There's many more, but I just wanted to highlight those two.

Hanish Patel: So springboarding off what you talked about with digital innovation, the design thinking and the customer value that this is going to bring. When you think about the business environment as a whole, what impact do you see, be that direct or ancillary, that's really going to be happening through 3D printing?

Vinod Devan: Yes, we talked earlier about what have been the drivers that have brought 3D printing to come off age now, and there is one point that we didn't talk

about, which is the fact that manufacturing jobs are coming back to the US. So, American companies that have been used to the low cost and high quality of manufacturing abroad, especially in Asia, they have to duplicate that (0:16:00) in the US, which is very difficult with the highly paid and expensive US workforce that we have, especially in the manufacturing side. 3D printing can be an excellent solution for it. Michelle, I think there's stuff that HP is pretty involved in on the workforce development for those jobs that are coming back, right?

Michelle Bockman: Yes, as you think about those jobs coming back, we look at the workforce of the future, and what is the impact? What does it mean? We actually have really great opportunity to train people to work in 3D printing. Designers who designed with traditional methods and teaching them how to design with additive manufacturing, and then you also have operators too, and you can train them. And so there's definitely some areas that we have on our radar that we're working on with universities and such, and some of the programs that we're rolling out. It's important, very important to us from a social standpoint that we play a role here.

Vinod Devan: The goal is to be (0:17:00) aware of the workforce of the future, to train the workforce of the future, and the machines are no good if you don't have someone to operate them. The ecosystem is no good if it's not populated with digital natives, and so it's critical for us to do that, and it's not just training new folks, it's also retraining existing workers so that their job security is of paramount importance to the companies as well.

Hanish Patel: I mean, the things that you both have highlighted, the benefits are absolutely clear in terms of what additive manufacturing can do, but given the amount of time you guys are spending in the additive manufacturing space, you must have come across the skeptics, those that have said 3D printing is all hype, it's not delivering on the promise it once said. What have you got to say to those?

Michelle Bockman: So I'll start. I do think that it's real, and I think most of us do in the industry, and it's only because we see it.

Hanish Patel: Right.

Michelle Bockman: And we see customers doing it, at HP we're doing it, eat your own dog food or drink your own champagne, (0:18:00) whatever you want to call it, but we've proved it to ourselves that it's real. So we even have customers who are disrupting their own technology. So think of injection molding or tool and dye, we have some customers who are buying 3D printers and taking their existing technology in designing for 3D printing and it's much faster, so that's where they start sometimes is just disrupting their current technology so they know that it works, and they see the benefits, and they give these benefits to the customer. So a good majority of our customers are using the printers for real production, production of one all the way to millions per year, so we see it. There's no hype there. Maybe early on there was hype, but it's reality now.

Vinod Devan: And I'm an engineer by training and more than a couple of decades ago at this point, I remember seeing 3D printers when I worked in the space industry (0:19:00) and I'm one of those skeptics because over the last couple of decades, there simply hasn't been enough progress, hadn't been enough progress for the reasons that we talked about earlier on the podcast. However, times have changed, technology has caught up, and we are in a real place now, and even from last year to now. We are in a very fortunate situation where there's pull from the industry, across industries, whether it be automotive, high-tech, telecom, oil and gas, industrial sector, manufacturing sectors, you name it, there's pull from them, not a push from us, which to me says it's not just about whether or not we believe it's a hype or whether it's real, it's that the companies have started adopting it, they believe it's real, they're seeing the benefits, and that's why they are starting to invest in it. It's well ahead of the hype curve today, which is what I'm excited about.

Hanish Patel: So let's talk about that hype curve for a second. Do you feel the true (0:20:00) way that it will be absolutely eradicated in terms of hype is when we got consumers that are getting it into the home, because there are phenomenal examples you both cited at an enterprise level, at an industry level, but is it truly the consumer that's finally going to be the one that squashes it and says it's no more hype?

Michelle Bockman: I'm not really sure. I kind of think that it's when we see companies adopting it in the industrial market, which can also be consumer market. When they start, when the consumers start buying their products from an industrial company, and it could be anything from toys to dental liners, so there's definitely a spectrum there and kind of taking a step back, when you think of Industry 4.0 or the industrial Internet of Things, you hear AR, VR, AI. We've been talking about this for a very long time, but the technology has changed over the last few years and now you see it being adopted. And I go back to 20 years, maybe I shouldn't age myself, but I started (0:21:00) out as a kid at a college, 3D printed my first part. I was at Jeep truck engineering, we were doing a tolerance stack and we 3D printed a part to make sure that the tolerance worked underneath the vehicle in the engineering.

Vinod Devan: I think that's well put. I would say it's consumer influenced, not necessarily consumer driven. So the example that Michelle talked about earlier with the sole of the shoes, that's influenced by a consumer who wants customized soles, so the demand is there for a degree of customization, which 3D printing can enable (0:22:00) at a cost and quality that is not possible through traditional manufacturing today. So, eventually we may come to the point down the road where we see what we see in the futuristic movies, where you're 3D printing food and you're 3D printing clothes, and everything is 3D printed on a spaceship going on its way to Mars, right? So maybe we get there, but in the short medium term, I'd say the next five to 10 years, it will be driven by enterprises, it's a B2B application, and then leading to a

B2C application where the consumer benefits from it, the consumer influences what those businesses make, but we don't expect that the consumer is the one who's actually becoming the producer, because I don't think the cost curve gets there, and I also don't think the business model evolve that far at least in the next decade.

Hanish Patel: Got it, now that's fair. So I'm going to ask you a question, or both of you, should I say, on a more personal note, two-part question, right. Firstly, best thing (0:23:00) you've seen 3D printed today. You've been in this industry and additive manufacturing for a long, long time, right, best thing you've seen. Second, what one thing would you want 3D printed?

Michelle Bockman: Oh, wow, those are good questions. The first one, the best thing, the best application. For me, it has to be somewhere in the healthcare field, because I worked in healthcare for about 15 years, and it is very near and dear to my heart, and we used to walk around saying we're saving people's lives. So it's very personal to me, and when we talked about prosthetics or anything that helps an individual, whether it is saving their life or if it's something that just makes them feel comfortable in your own skin, then I think that's really important, and it's my favorite application.

And the second one was what would I like to see 3D printed? Wow, I think that's pretty unique, (0:24:00) but I would say I like to see multi-material parts. So as I said before, when I ran a warehouse, ran logistics, you can make plastic parts and you can make metal parts, but being able to make them together and really disrupt the market, and I think that is the future, I think that's real, but we're not there yet, that's what I'd like to see. Specific parts, it could be anything, but most parts have multiple materials, and I'd like to see that.

Hanish Patel: I'm going to push you further. What would be the item for that multi-material printing?

Michelle Bockman: Let's see, maybe it's something in my house. Maybe it would be something like with physical activity, maybe a pair of rollerblades.

Hanish Patel: Nice.

Michelle Bockman: I'd like to, because then you can use them for, again going back to healthcare, to be healthy, and it would be something that, it's a consumer-based product, so it would be very, something I could use. (0:25:00)

Hanish Patel: Absolutely. Vinod, you're not escaping this either.

Vinod Devan: Yes, you know, I'm going to piggyback off of Michelle on the first one. To me the coolest thing that I've seen so far are the anatomical models in healthcare. it allows the surgeon in the example that's in my head, it allows a surgeon to go away from imagining or simulating on a computer what that surgery might look like, to actually being able to see an anatomical model off that individual's, off that patient's parts that are going to be operated on, and they can actually test what they're doing with specialized surgical kits, custom build for that particular procedure. To me that is extremely cool, it improves outcomes, for sure, but improves confidence more importantly for the surgeon, and as someone who has been through, been under the knife a few times, I appreciate that and I think it's just very cool.

In terms of what I would like to see, and this may be out in the future, but I am a space geek and I would love to see us 3D printing rockets (0:26:00) where it's not just two or three companies that are able to make it to space, but it's becoming more of a consumer activity than just a corporate activity. I'm looking forward to that.

Hanish Patel: Brilliant.

Michelle Bockman: Okay, I want to change mine.

Hanish Patel: Absolutely.

Michelle Bockman: Can I change mine?

Hanish Patel: Yes, absolutely you can, go for it.

Michelle Bockman: So something that I'm really interested in is VTOL, vertical takeoff and landing, and it's basically a helicopter of some sort that can come to your house and pick you up and maybe commute to work, and I would love to see that technology become reality on a mass basis, as well as being 3D printed. So there's my wish, putting it out to whoever can do it.

Vinod Devan: You should have been at CES. They had V-TOC right there on the floor, it was a prototype, but a non-working prototype, but it's becoming real in 2025, so I guess, Michelle, the challenge is to convince them to do it through 3D printing more so than not.

Michelle Bockman: Yes, and just for me.

Hanish Patel: Brilliant, brilliant. (0:27:00)

Hanish Patel: So Michelle, Vinod, first and foremost, thank you ever so much for coming on the pod and sharing your personal desires for a helicopter and sending things into space, so I can't thank you enough for both coming on.

Vinod Devan: Thank you.

Michelle Bockman: Thank you.

Vinod Devan: It's been a pleasure.

Hanish Patel: Additive manufacturing has made significant strides in recent years, and as we learn today, what was once used for small-scale production is now transforming the manufacturing industry and beyond. As companies start to explore the latest capabilities in 3D printing, we should continue to see disruption in the marketplace and further adoption, including applications within tech, media, and telecom. I'm Hanish Patel and until next time, happy listening.

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