00:04
Speaker 1
Hello and welcome to the Human and Machine podcast. My name is Jaco Markwat. I'm your co-host, as always, here with Lenny Smith. Lenny and I spoke with Walker Reynolds last week. Absolute industry legend. Talking about his role as an online educator, his role as a leader within industry, and also just about his passion for our industry and some of the driving reasons and passion, I suppose that drives why he does what he does every day. So that was a fascinating podcast last week.

00:35
Speaker 2
Yeah, I really enjoyed Walker's nonsense attitude. I think that's something that stood out for me from his talk was just the notion that people cannot be held hostage for data that they own. Data must be made available. We live in this age where and explain it so well about, you know, a digital work or digital transformation. Transforming your workspace is like having the cell phone or the personal phone for yourself with all of the information that you need available right there on your fingertips. And in this day and age, you cannot have a supplier or a vendor having your data held hostage in whatever system it is. And I think he really summed that up brilliantly for us last week.

01:17
Speaker 1
Yeah, he was brutally honest about his, about his views as well, which I appreciate it. So, if you missed that episode with Walker Reynolds, great guy, lovely chat, very insightful, and just genuinely one of the most passionate people you'll come across in our industry. So, if you haven't listened to the podcast before, we of course, aim to bring you anything relating to the manufacturing, mining and production environments in South Africa. Specifically, we aim to do a small little part to help share stories and news and insights and opinions from people that we enjoy speaking to and people that we find valuable conversations with. And we try and bring you every week. This week specifically, a lot we've spoken. Covid has obviously been a central theme for most of our episodes over the last couple of weeks.

02:13
Speaker 1
We're going to return to that a little bit in this week's episode, chatting about some technologies that perhaps pre Covid and, or as people call it now, BC and AC, before COVID and after Covid were perhaps looked at, investigated, studied, not yet implemented, and how those are set to become quite mainstream and pervasive after Covid. So, this week we're very excited to share with Hermann Scheepers. Our team has known Herman for a couple of years. Herman is a passionate data scientist, engineer, consultant, business developer, and of course, a leader within our industry. We're going to chat with Herman a little bit about all of these things, but we'll let HERMAN do his introduction. Harman, welcome to the Human and Machine podcast.

03:01
Speaker 3
Oh, thank you very much. It's definitely a pleasure to be here. And as an engineer, I'm probably not as good an orator as you guys are, but hopefully I can add some insights in terms of what I say and not necessarily how I say it.

03:21
Speaker 2
No, that's perfect. Casual conversation. I mean, me and JAko always joke about sitting here in our studio, but yeah, thanks a lot for joining us on this Friday afternoon to talk a little bit about, as Jako mentioned, AC and BC, especially around, you know, we've heard buzzwords around the technology, around, you know, AR and VR and machine learning and artificial intelligence as such. I know, you know, as Jacob mentioned before, COVID was still something that a little bit of a hype probably in the hype cycle, but definitely some of these technologies are now actually, and I think accelerated probably because of COVID and the way that we have to do business now. And it's actually now a little bit more tangible and actually implementable in most of the cases.

04:09
Speaker 3
Yeah, I think so. Just do a little bit more about myself. I'm an engineer by trade and qualification. I've been involved interestingly enough, both commercial and industrial it across multiple industries for, I think, longer

than I'd like to admit at this stage. So I've been fortunate enough to see, you know, many trends coming and going and many waves of innovation and technology. So, you know, I think with experience, you learn how to separate the hype from the, you know, from what's real and what's going to make a long term contribution and what's going to really stick in manufacturing and business in general. And if you look at, you know, technologies that have really progressed in the last few years due to, I guess, a lot of research funding going into it.

05:15
Speaker 3
One of them is image processing and machine vision, specifically using deep learning networks and or AI, as a lot of people call it, as opposed to old fashioned or the sort of more traditional rule based machine vision systems. And if you think about the post and pre Covid thing, just general business, I think we all realize now that before disruptions of this kind, people can actually work remotely. It works well, and, you know, office workers can work remotely, and you don't have to have so many people on the actual factory floor. But what about things like quality control? It's a complex part that gets manufactured in a, you know, in a sophisticated plant.

06:11
Speaker 3
You know, I'm thinking things like printed circuit boards, high density electronics, vehicle part manufacturing where people necessarily have to congregate and have to be in one fairly confined space to do that. And the question is really, how could you allow people to do the same job remotely and really augment their expertise using a practical technology that's viable today? Now, there's a few drivers here, sorry.

06:47
Speaker 1
To interrupt you, what you mentioned about practicals. So I think we, you know, maybe the BC and AC views. So obviously, to your point, for many businesses and many, many manufacturing companies for that matter, global crises have always presented moments of revaluation and a new approach. And what I'm referring to there is the kind of innovation new that we see in 2003, for example, with the SARS outbreak that gave birth to companies such as Alibaba and jd.com dot. If you look at the crisis of 2008 and 2009, it was really the time for American Express and Starbucks to pivot to their core business. And so we're expecting that Covid-19 is going to be no different. That will definitely force a lot of companies, and especially manufacturing.

07:42
Speaker 1
And again, to your point, how we use the real or true innovators people, how we use those people within manufacturing, within the plant floor, and how we can maybe pivot where they add value. And I like the stuff that you've mentioned. Now, do you, sorry, I want to get back to everything that you've mentioned, but the point that you mentioned about the practical things. So I would imagine that before COVID manufacturers specifically, they were obviously evaluating where AI can be integrated and the business cases. And to us, it feels like they never quite reached that first step to assess whether it could be utilized and what value it can add. Do you think that's fair? And do you see that?

08:30
Speaker 1
And do you feel that Covid was maybe perhaps the push that they needed in that direction because they were almost forced to do it?

08:38
Speaker 3
Yeah, I think you're right. It was kind of, it was fairly a lot of point solutions. I do have to mention that they are, that one of the AI startups that reached unicorn level is in the engineering, manufacturing and mining space. They are called update AI. And, you know, one of the things that they allow companies to do is to do essentially fault finding and predictive maintenance on especially big in the north American, particularly Canadian mining industry, remotely and with a lot fewer people than they used to. You know, you in Canada, the mining conditions are quite harsh. And it's a, it's often people, it's a fly in, fly out scenario now. And with COVID it was literally impossible for people to go.

09:47

Speaker 3
So with the trend where you see mining all the low hanging fruit and mining has been picked, people are building mines on your plant based on process data. Great. So I think that's one important trend. The other important thing for me is that, you know, people don't really want to just do these things for the sake of it. They want to tie it to metrics, you know, standard, traditional metrics like OEE, you know, which includes things.

10:28
Speaker 1
Concepts of metrics that they understand, that they're familiar with.

10:32
Speaker 3
Yes. Yeah, yeah. Because, I mean, if I'm a plant manager and my KPI is oee based, do I really want to put something in where I don't see immediate payback and where I can't integrate it into my existing infrastructure? And we. I don't have to appoint massive teams of data scientists to. To actually implement the technology. Now companies like uptake are making the process part of it easier. The massive amount of money that companies like Tesla and Google and Facebook is putting into machine vision and image processing research has really caused that field to become extremely sophisticated, where neural nets now are beating any other type of model or technology, for example, when it comes to optical character recognition. And what I think what people have realized is, and another important thing is that high quality digital cameras have been becoming quite accessible.

11:37
Speaker 3
So if I want to put a quality control system now into my plant where I can have very little staff on the floor, I can literally have guys sitting like me now. I mean. I mean, Zoom, you know, talk about companies that, you know, it previously really came to the fore. I think Zoom is one of them.

11:59
Speaker 1
Yeah.

11:59
Speaker 3
Where people are now doing everything digitally. And the same with, you know, quality control and inspections. I can be sitting quite comfortably in my house with my computer, with my high speed connection, and I can be getting. And I can sort of remotely, with robotic assistance on the plant floor or limited staff say, well, the AI says this door is defective. It is defective, you know, please, you know, do whatever is necessary to whatever corrective action my quality management system, you know, mandates under this particular condition. So I think particularly machine vision is one area where it's really making a practical difference today.

12:56
Speaker 3
Another interesting thing is another AI development is you must have seen all these pictures on things like Instagram where you can put ears on somebody's head or all sorts of weird things, but exactly the same technology can be used to create synthetic data. Because one of the big problems with deep learning is that it needs massive data sets for acceptable, out of sample performance. You know, in other words, to, you know, to put it like, in plain English, it takes a long time to learn and it needs a lot of examples, right? So a bit like me when I was young, right? I had lots of. I needed lots of examples to learn something new. And, you know, it's the same with deep learning networks. They're very powerful, but they quite cumbersome to train.

13:51
Speaker 3
So if you look at the common, another technology trend is just the massive amount of money that companies like Nvidia is putting into improving the chips. And, you know, people are learning how to sting these things together into their own supercomputers. So I can now have a very powerful deep learning engine to train networks. I can generate enough data to do it from a few samples. I can generate enough synthetic data by taking a scratch in the door and rotating it. Say, I can have one picture with a scratch and I can rotate it 360 times, and then I've got that same scratch 360 times with different angles to train the neural network with. And this is happening today. That's definitely something that we see that a lot of companies. And it's happening, right?

14:48
Speaker 3
It's happening now as part of this post Covid innovation wave, the companies are actually implementing machine vision systems for quality control.

14:59
Speaker 1
Yeah. And that's exciting. That's really exciting. And to your point, it seems like it's almost a little bit of a nudge that everybody needed to really be forced to investigate and look at the technology and understand the value that it adds. One of the questions that I had for you is, you use the example of you at home on Zoom, like so many other people have been. But obviously, we know that in our world, specifically the manufacturing world, 100% remote operations and maintenance is not always possible in all scenarios. So I think maybe one of the critical things that people are going to ask is, what is this mixture of on site, call it core on site and remote operations? What does that mixture look like while still maintaining, obviously, a safe operating environment for people that are on site?

15:52
Speaker 1
So, in other words, how do we play well together with the tech that's now being implemented?

16:00
Speaker 3
I think that will probably be on a case by case basis. I think probably people would just need to employ common sense or sort of maybe experiment to see what would work for them. But I think there's a few givens, right. You need to have basics in place. That's absolutely critical. Like you have to have. You have to be properly instrumented if you want to do anomaly detection of any kind, whether it's your process data or whether it's on the product that comes out of the process. Good instrumentation is critical. You have to have reliable hardware and software. You have to be, you know, your historian has to be set up correctly. You need to understand or think about how you're going to integrate this with your mes. How are you going to report on it? How are you going to visualize this data?

16:55
Speaker 3
How are you going to, you know, so for me, you can have to have great connectivity. You know, if you're going to have people working remotely and doing something as critical as quality control based on data that gets sent to them over a Internet connection, that's going to be. Have to be pretty reliable and you're going to have to make sure that there's either redundancy in people or redundancy in connectivity. Yeah. So I think there's challenges around that, but I don't think those challenges can't be overcome. And I think the, you know, the way that people have managed to collaborate digitally, you know, have meetings, sell two projects without really ever seeing one another as shown that it's possible, you know, and I agree with you.

17:56
Speaker 3
You know, I know there's a lot of Australian mining companies that work, you know, even doing machine operations remotely.

18:05
Speaker 1
Sure. Incredible.

18:07
Speaker 3
But, you know, that's not for everyone. I think you have to kind of figure out how, you know, what's practical for your plant, what are you trying to achieve and, you know, what are the real business drivers around putting this in place? I guess, like with any, you know, like any other technology investment.

18:25
Speaker 1
Yeah.

18:26
Speaker 3
Good visualization software. You know, the human brain is still the most powerful neural network out there, you know, so you still need to be able to give your operators and your quality control people the tools to do that. And, you know, I think it's also, it's not necessarily restricted to the plant floor. I've got a friend that does image processing on the supply chain side of things. You know, we, the, his AI can basically see whether a truck is full enough, you know, if maybe that it can pick up, you know, things like trucks being over or underloaded from photos. You know, goes to the automated supply chain thing where there's a. There's not necessarily a human being doing inspections anymore or, I mean, we. It could be augmentative, right.

19:28
Speaker 3
Because if you have a large amount of traffic, you know, going in and out of a plant or running around a mine or going in and out of a mine, a person could do a great job, but they could miss things.

19:49
Speaker 1
Yeah.

19:49
Speaker 3
And if you are, and if you've just got like AI assistant that says, you know, Johnny, I think you might have missed something. Yeah, yeah. It just really improves the agility of that person to do the job. You know, whether they on site and they've got a phone as they order, tablet as their device, or whether they at home as a backup for somebody on site. Yeah, I think these are, you know, broadband is so pervasive today that it's becoming quite possible to do this.

20:25
Speaker 1
And the other thing that, you know, a lot of people, the first immediate reaction, you've probably heard this a million times when they hear AI is the rise of the machines. We're going to become obsolete. The rise of the machines, they're taking over. You know, there's obviously that's quite an extreme view of the way things are going, but I think it also presents us, as human workers and empowered human workers, an opportunity to potentially learn some other skills and spend our time in other areas where we can add more value than what we have been doing. That's the other way to look at it as an opportunity.

21:06
Speaker 3
No, I agree. I mean, the history has shown that for every major technology revolution where a lot of jobs were lost, an equal amount of jobs were created in other areas. People are needed to run these things, to train their algorithms. And I think the other thing that we're seeing is that successful implementations don't necessarily cut cost by getting rid of people, but essentially add value by augmenting the capabilities of the people that's already there. You know, I think it's personally having quite a deep understanding, I think, of neural nets and how they work and what they can actually do. I would not trust anything to a neural net without any human supervision or involvement at some level, just not. And that's science fiction. That's saying what coming by, I can.

22:07
Speaker 2
Yeah, I think. I think, Edmond, I think a lot of people think that, you know, AI and machine learning always gives you the correct answer, but there's still a lot of false negatives and false positives even coming out of those networks that I agree 100%. The sanity of the human brain cannot be understated in this. And I don't. I also don't believe that if it's going to be a full on autonomous solution, where this thing is going to.

22:32
Speaker 1
Be 100% all the time, and it does give you what you put in, like anything else.

22:38
Speaker 3

Yep. Yep. There are some, there's some. I mean, there's been a lot of progress in unsupervised learning, you know, where you just sort of give the thing data and it sort of figures out by itself what's normal. But, you know, that's not necessarily the greatest way to train a quality control robot in a plant. Right. 50 50, defective to a client later. It's, you know, it's learned, it knows now that it. What a defect looks like. But you've lost a lot of money in the meantime. Exactly. And I think the. Yeah, I honestly don't think people need to worry about AI and machine learning taking their jobs. I think it's more a case of augmenting people. Obviously, there areas where it can do things that people simply can't do. Yes, but that's different because that's creating new value. It's not replacing people, it's.

23:49
Speaker 3
Yes, doing new things that weren't, for example, micro defects in high density electronics that were extremely hard to detect previously, where you can take a high definition, high quality. And, I mean, those things are coming off the production line at a massive rate. You know, you've got to have a person, you know, so it's things that were not possible before, you know, that can now be done. It's like saying, well, the telephone took away the job of you know who, you know, because, like, you couldn't talk to somebody in real time over a phone before the phone existed. People just don't run that fast.

24:30
Speaker 1
So you mentioned augmenting. Augmenting, I can't remember the term was that you used, but basically augmenting our efforts. Human. So you're talking about augmentative. Augmentative AI that basically learn from us. Am I understanding what that means correctly, technically, that it basically learns from us as humans and not exclusively from data?

24:57
Speaker 3
Yeah, basically. Because if you think about, like, how do you. A very good example is actually where you're doing anomaly detection on a very complex chemical block compressor with 80. With 80 points on the historian. Right. There's no way of making for a machine to make sense of that in an unsupervised way. I studied this quite extensively, and currently, today, as we stand, there's no algorithm that can do that. I know there's been a lot of progress in certain types of neural nets for simpler data where you can do unsupervised anomaly detection, but you're not going to do it for a compressor there. You need a highly qualified engineer that knows hyper compressors to train the machine what data is normal and what's not normal. You're not going to do it without an expert's involvement.

26:00
Speaker 3
So effectively, it's knowledge transfer from the expert into the machine. You know, once you've done it once, it doesn't mean that, you know, the job's over now, because, you know, what goes on in a. In a complex plant like that, sensors can calibrate it. You know, they overall the thing, and now nothing's the same anymore. So, you know, it's a continuous job where somebody that we're subject matter experts have to be closely involved in. In making the technology work for you. And it's. And it's the same with. With, you know, like scratching scratch detection on a door. You still need somebody to manage the process, to integrate it. You know, you still need, like, your more traditional technologies and visualization software to. To make this whole thing work as a coherent system. It's not magic, you know, it's.

26:58
Speaker 3
I mean, I coded my first neural network from scratch in c a very long time ago as part of a demand forecasting algorithm at ester. You know, and it's just like one. It's like one small piece of a very big system with data collection, and it's all process around. That's just one additional tool in the engineers toolkit. And that's how I see it's not, you know, like a transistor is a tool in my toolkit. So it's an evil nick. It's not magic.

27:31
Speaker 2
Now, I fully agree with you, Adam. I'm with you on that, especially on the. You know, there's this example that you took about the compressors. There's certain mechanical properties that goes into the design of those things that by just looking at a point that's been historized, a process variable. There's no way that thing would be able to understand from a mechanical standpoint why certain conditions are in the process parameters that you are.

That they are. If you think about a thrust bearing will run higher than a normal bearing. It's just the nature of the design, and 100% you need to. And that's where that knowledge in the field and that mechanical knowledge from humans now augment the actual data that we're getting from the sensors in the machine.

28:15
Speaker 2
One thing I think that people might have, you know, if they think about augmenting, they probably think about augmented reality. They think about smart glasses and all kinds of HoloLens and virtual reality and stuff that now puts in play. But in essence, it's as simple as. As you said, taking a device and just telling you or making you aware from the result of that AI or that machine learning algorithm. It's not necessarily, you know, that we have to now have all of these fancy devices and almost like minority reports stuff happening on the.

28:49
Speaker 1
Well, that's always the sexy part.

28:50
Speaker 2
That's the sexy part. But I think you're right. It can be just as simple as letting people know by ways of clever visualization, giving him the right KPI and delivering it to him where he is and where he needs to make that decision.

29:08
Speaker 3
Yeah, that's right, because. Very good point. That's the beginning of the process, you know, now everyone agrees that there's a, let's say it's a process versus a manufacturer. Everybody agrees there's a potential problem in the process or the supply chain on a particular complex piece of machinery, but that's the start of the process. And you can also think about it like that. Let's say you've got one great hyper compressor guy in the company and you're simply not going to get another one. And you just want to sort of almost transfer that guy's knowledge into a AI which will then allow, you know, the guy to almost replicate him, clone himself, but never without his continued involvement, you know, so it's kind of like getting more out of what you've got. But still the, you know, all the other stuff has to be in place.

30:06
Speaker 3
You can imagine your senses must be calibrated, your historian must be well managed, your normal visualization, because now you need to drill down. Yes, we think there's something wrong. Now you want to have your regular visualization software because it's the same as, it's effectively like an alarm, right, or an alert. So now the actual experts must come in and say, no, what, you know what, we replaced that sense last week. It's a false law or there's something wrong here, maybe we need to open this thing up, you know, it's that serious. We might have to stop production and have a look. But you're not going to trust those real hardcore decisions. You know, if you've got an order to make, you're not going to trust those real hardcore decisions just to AI.

30:54
Speaker 3
No, you get the actual experts on the job to do a proper on site investigation with, you know, mobile equipment and. But at least now you. And if that turns out to be a, not to a false positive, you saved yourself a lot of grief and money and, you know, potentially lives. If it's in a, if it's in a power plant, it can save lives if it prevents a major incident and, you know, then you're going to be very happy that you did have the, it's kind of like insurance, right? At the process level, on the quality control level, it's simple. You know, it's an extra pair of eyes that works twenty four seven and doesn't have to sleep. In terms of picking up scratches and things. In a dangerous process, it can save lives.

31:47
Speaker 3
And it's a form of insurance because you're protecting yourself against risk things like dangerous chemical, environmental releases or, you know, a turbine flying off its, you know, and killing people. I mean, that does happen. Or boiler exploding. So, so, you know, if you think about the Roi over a long time, if you've got a lot of boilers and you can find some sort of AI that's going to prevent one explosion, the lives, and I mean, to replace a large boiler is not a cheap exercise size, right? It's, yeah, I think it's a cheap kind of insurance if you think about

the fact you're not getting them. You know, there's some uninsurable industrial events that you can help mitigate using AI by preventing major accidents, which I think is a great thing.

32:45
Speaker 3
And it's not taking about taking away anybody's jobs, it's just doing things that weren't possible before. And, you know, post Covid, it means that you can do it remotely. We haven't even talked about other technologies like drones where your image source is a drone, you know, power line inspections, you know, all these fires that get caused in areas like Australia and California by sparks. So you can have a drone going up and down the fire line and sending guys to go cut trees. You're saving lives. You're preventing major damage to property with this technology. So there's the concept of augmentative AI and ethical AI. And there's actually companies that subscribe to that they won't like, engineering consulting companies. I know guy in Canada, they simply don't take on a job if they think the owner wants to cut costs by getting rid of people.

33:53
Speaker 3
And they subscribe to ethical AI and they try and use AI for good things like preventing fires by picking up, finding trees close to power lines that need trimming. And that's a very difficult thing to do with stuff. It doesn't matter how many people you have, you know, when it's rainy season, those things grow quickly. And grass plants, you know, arcing is such a huge, dangerous thing in Australia and California every year. And AI and drones can really help to mitigate that risk.

34:35
Speaker 1
Herman, on the drones, I think the business case for drones, you know, that's fairly well publicized, and there's some, obviously, some incredible examples all over the world. The most or the most obvious one that I can think of is, I think it is in Africa. I can't remember the name of the crowd. They actually use the drones to deliver essential medicines and blood, as well as essential medicines to rural areas in the country. And over and above cases like that, there's an incredible business case for drones in generally speaking, what is. Maybe. Maybe it's an unfair question to ask you, but what, in your opinion, has prevented a lot of those sort of initiatives and projects taking off and becoming a lot more pervasive than what they have been?

35:30
Speaker 3
Well, I think maybe it's also some of it and some of the capabilities have been overhyped. And, you know, there's things like the reliability and these practical things, challenges that I need that I think need to be solved. You know, for example, the drone going down the power line looking for trees, but then, you know, flying into the power line and then causing the flash.

35:58
Speaker 1
That’s not great.

35:59
Speaker 3
So I think that. I think there's definitely risks around it and that need to be resolved. But I think for the right business case, where flying the drone is safe and it's not going to cause a problem in itself, like in agriculture, for example. Interestingly enough, some of the major AI unicorns are in agriculture.

36:29
Speaker 1
Yeah.

36:29
Speaker 3
Where drones can identify, well, a combination of satellite and drone photos, which is then image processed by AI, can really help a farmer, especially if it's a highly automated scenario to pick up dental crop problems and resolve those things a lot faster.

36:57

Speaker 2
And when you hear these stories, Edwin, it actually sounds. It sounds so. How can I say it sounds so. Oh, yeah, of course. I mean, there's this one story of in the agriculture, where all they do is they take a drone, fly it up, they take a picture of the avo trees or whatever, and just by looking at the colour of the green and the tint of the greenhouse of the tree, they can immediately identify. You know, does it need more fertilizer, does it need more nitrogen, etcetera? And when you hear these kind of stories, it's almost like, oh, yeah, it's common sense, right?

37:37
Speaker 3
So, yeah, that's a brilliant example where a combination of a sensor, I mean, a digital camera is just a sensor mounted on the right device, combined with digital image processing, can add massive value. And I know there's a local company that's doing very well with that sort of technology. And there's a, I was actually just going through the list of AI unicorns again, AI and fintech unicorns this morning, and two of them, two of the international list or agriculture, you know, so, and I think that's another important. If you think about modern automated agriculture in the sense it's also manufacturing. You know, if you take the whole supply chain up to the packing store, I don't know what the right English word is the box to it. You know, it's a yemenite, it's kind of like manufacturing.

38:46
Speaker 3
And it's definitely adding a lot of value there. And people are cottoning onto the fact that where it's really happening is image processing due to the fact that it's accessible. There are people that can their skills locally as well. So if you want to do a image processing quality control project in South Africa today, you can do it. There's no real barriers. There are companies that will do it for you that you, there's off the shelf technology that you can just buy and install and it just become, it becomes a normal Si project. And if you look at your Roi and, you know, your business case and you link it to your normal oeeden, no reason why you can't do it today, provided that you've got the rest, you know, the rest in place of your sort of industrial it infrastructure and connectivity.

39:49
Speaker 3
And there's no reason why you can't have people, some of the people involved in that process, you know, sitting at home.

39:59
Speaker 2
Correct.

39:59
Speaker 3
Where you saving office, you're saving office rent, I guess.

40:05
Speaker 2
Correct. Just to highlight that again, if we go back to that image processing, especially in the agriculture, yes, we see the greenery of the trees. But again, a nutritionist, I don't know what they call them. The guys that know what colour green will tell me what chemical fertilizer you need. There's still that interaction between the human that needs to tell the AI. When you get to this tint of green, it means x, y. And I mean, we're never going to get away with that very anytime soon. And one of my colleagues always says that, you know what, there's always someone that needs to be able to fix the robots, right? They won't be able to fix themselves. Well, not yet. So that's great. I think there's opportunities, there's new careers.

40:54
Speaker 2
I don't even remember the new stats of how many new careers are being created every year. But this field is definitely opening up so much other possibilities for generations on possible careers that doesn't even exist anymore at this point.

41:13
Speaker 3

I fully agree. Like you say, it creates new jobs. Those digital cameras have to be maintained. It becomes mission critical. So you need people that look after the IT infrastructure to make sure it's 100% reliable, because now it's so critical to your quality control, to your oEe. And yeah, I fully agree. It's a. I'm personally quite excited about some of the practical aspects of AI that we see now. You know, the post hype and the post Covid, if you want to call it that. And I firmly believe that one of the winners wherever I, if I was a plant manager or owner today that I would seriously look at would be AI enabled image processing for quality control. It's not hype. It's real, off the shelf, buy, integrate, get a Si integrate with the rest of your industrial IT infrastructure.

42:12
Speaker 3
It's a practical thing that you can do today. And on the supply chain side, yes.

42:19
Speaker 2
We've seen some great stories coming out of SI's in America where they use exactly that drone technology with image processing on landfills, where they detect excessive methane leaks in landfills, potentially stopping fires in landfill sites. So there's definitely case studies and real case examples of how this can be definitely implemented. And as you said, Herman, it's not hype, maybe on hype. What do you say?