People Power! Helping Manufacturers Leverage Their Valuable Resources

Manufacturing personnel are developing an increasing focus on automating visual inspection, enhancing equipment maintenance, and improving business intelligence. Watch CLA's digital team in this on-demand webinar as they share how they've helped clients automate, accelerate, and enhance processes.

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Here is a transcription of this session:

Noel Hopkins:	Hello, everyone. And welcome to today's CLA webinar. Thank you all very much for joining us. We very much appreciate your time. We recognize this is a very busy time of year for many of you, and we very much appreciate you taking some time to join us on this webinar.
	We're very excited to share with you today some of the experience and some of the information we've gathered from our manufacturing clients and trends that we're seeing more broadly in the industry. And we're going to talk about some of the ways that CLA has been helping our clients leverage technology to make the most out of the valuable resources, the valuable people that you have helping drive your business forward. We're going to be taking a moment to share some real-world examples.
	And I'm excited today to be joined by my colleague, Liam McGoldrick, who's a data scientist here at CLA. And Liam has a rich history in data science, specifically around computer vision and predictive analytics. And so I'm excited to introduce Liam to you today.
	My name's Noel Hopkins. I'm a digital growth director here at CLA, and I help clients identify opportunities where we might be able to help them with technology and help deliver those solutions. Liam, would you mind giving us a quick introduction about yourself too?
Liam McGoldrick:	Hello. Hi. Like he said, my name's Liam McGoldrick. I work here at CLA on the data science team, specifically focused on machine learning. So really, I spend a lot of my time making sure to keep up with trends in the industry and seeing how we might be able to leverage new developments in that field to assist our clients.
Noel Hopkins:	Thank you very much, Liam.

Now, many of you will know CLA because of our accounting, our auditing, and our consulting practices. But today CLA is much more than even all of those services. We offer a digital service line to our clients, and we have been working with clients across many industries for two years now. We pride ourselves in taking a very collaborative approach to digital transformation and digital initiatives, and we serve our customers in three areas. I just want to take a moment to share with you what makes up our digital service line.

So we have a data team that leverages data technology to provide insights and data visualization to our clients. We have partnerships with leading software platforms where we can leverage off-the-shelf solutions to deliver value quickly and robustly. And we have an automation specialty team which looks at automating processes, removing manual steps and labor burden.

And today we're actually going to touch all three of those, those teams within CLA, within the digital service line, which commonly work together to provide solutions to our clients. Happy to provide more information about our digital service line during this call, or if you would like more information subsequently, more than happy to connect with you individually.

So the thing we want to talk about today is how we're using these digital teams to serve our manufacturing clients. And today it's a very difficult, challenging time to be in manufacturing. And this article from the National Association of Manufacturers outlines some of the macro-level challenges that many of you are possibly facing today; supply chain issues, workforce labor shortages, and rising costs due to inflation and compounded by those supply chain issues.

When we've talked to our manufacturing clients over the last several months, out of these three issues, the one that's been the most problematic is the growing workforce need, the labor shortages. So today we'd like to focus our time and attention explaining how we're finding successful ways to leverage digital technology to alleviate, or in some cases eliminate the pain caused by labor shortages. And we'll do so by sharing some real-world examples and capturing your feedback.

At this point, I'd like to throw up a poll question. You should see a question pop up on your screen here shortly. I'd appreciate your feedback. How many of your businesses today see labor shortages as a critical business challenge? Interested to hear from the folks on the call today whether that is indeed a key business challenge that you are all facing. So if you wouldn't mind taking a moment to give us a yes or no on that question. And as you do so, I'd like to also ask a second question, a follow-on question, which is do you anticipate those labor shortage challenges also occurring next year in 2023? So first question is do you see labor shortages as a major challenge today? Second question is do you see those challenges continue into next year?

Thank you very much for providing the answers to that question. And as we now dive into the presentation, providing examples of how we're helping businesses

with critical labor shortages and challenges, please feel free if you have any questions as we walk through this presentation, please use the Q and A to type in any questions you may have. At the end of our presentation, we'll take some time to review those questions and provide answers, and there'll also be an opportunity to verbalize any questions and for us to have a discussion. And we fully anticipate the presentation and the questions all being done well within the hour. So we're aiming to finish about 15 minutes before the top of the hour and give you all some time, valuable time back.

Okay, so let's dive in. Let's talk a little bit about how technology is starting to alleviate some of these critical labor challenges. I reference this Forbes article from August because I think it really captures a trend that we are seeing and our clients are telling us is a very important thing for us to identify, which is that labor is significantly challenging the ability for many manufacturers to produce product, to respond to demand from their customers, and that using technology, such as machine learning and AI, can alleviate that challenge. We're able to deploy technology to, in some cases, replace very manual monotonous tasks that are challenging to resource for and challenging to maintain folks within those positions. These tend to be positions of high attrition and low value in terms of utilizing the crucial resources that you have available.

So by deploying systems in place of those labor solutions, businesses are able to redeploy those valuable resources onto higher-value activities, freeing up the resources to do things that are more critical to their business. And the data solutions that are deployed are able to capture key data metrics that allow businesses in manufacturing to do things like improve productivity, reduce scrap rates, and improve overall efficiency. And I'd like to talk about how we go about this holistically before we talk about some specific examples.

So when we think about process automation, how we might eliminate or alleviate the amount of manual processing required, we think about this simple digital automation model. In any manufacturing environment, there are hundreds, if not thousands of processes taking place continuously and simultaneously. And many of those processes have steps which can be automated.

And so we take a very consultative approach to understanding our clients processes, what data and what inputs are available today or could be made available. And those could be data inputs from visual inspections, from camera, still images or video, could be from equipment control units and other equipment parameters, or it could be from sensor readings, providing valuable inputs that then we can then use digital capability such as data analytics, machine learning, and AI to process and provide valuable business outputs. Those may be actionable insights that allow people to take more decisive, timely action on. They might be outputs that integrate with the equipment on the shop floor and actually update parameters real time and they can drive major business improvements. And we'll share some of the return on investment that we're seeing from clients today.

So this process automation model can be applied to many different processes and you leveraging many different types of digital technology. Liam and I would like to start with one example, which is the use of computer vision. At this point, I'm going to hand over to Liam to tell you a little bit more about how we develop computer vision and show you some examples of how we're doing this in manufacturing environments today. Liam.

Liam McGoldrick: Yeah. Thank you. Yeah. So as you can see here, we have an example we like to use with these tennis balls that we have created. This is a model we trained over the course of a few days with relatively little data and it's able to achieve a pretty impressive accuracy.

And the reason we like to show this as a demonstration is because I think it really primes people to understand really the breadth of possibility here. So these kind of models can be used to, obviously here, look at tennis balls, but for any sort of manufacturing process that has visual inspection involved. So if there's defect detection that's happening by an employee currently, that can be done typically with a computer vision model with some benefits, such as consistency. The model's going to always be using the same criteria to determine what's good and what's bad, what it rejects. And there's also just the reliability aspect. So the model's always paying attention as long as the camera's on.

Yeah. So the other aspect of this that I think is critical to be understood is that in this field there have been huge advancements in the last few years. Typically, I think the perception of these kind of things is that they're to be done by the most advanced companies with the most budget for R&D and only those companies. That has changed significantly in the last few years with the advent of what's called pre-trained models, which we can talk about a little more at a later slide.

But the crux of that is that the pre-trained models allow us to leverage a lot of data that is outside of the specific problem that you're solving. So if you're trying to train on tennis balls, you don't need a billion pictures of tennis balls. You can use a billion pictures that someone else has already trained on and use maybe just a few. In this case, I think we labeled 30 or so pictures with these tennis balls and were able to get this result. So it's very low relative to previous machine learning data demands.

So yeah, like we talked about, the ROI here, a big part of the ROI comes down to what is the cost of running these models. So once the models are trained, the cost is relatively low to run them compared to labor. And the added benefit here is that the yield/scrap rate will typically improve because the consistency of the model, the highly tuneable nature of the model allows you to kind of tune it in. And once it's working well, it'll continue to work well. It's kind of as if you could train your employee one time and he will never quit and he remembers everything perfectly.

Noel Hopkins:	Yeah. Thank you, Liam. I love this visual because it really illustrates two very important messages. The first is that operating a computer vision model on a shop floor in itself costs less than the labor associated with those manual inspections. But the really big win is the information and insights that you can gather from that computer vision system.

The drivers of scrap, the causes of low yield can be identified very rapidly and either physical action taken or an automatic feedback looped to the equipment initiated to reduce the yield issues or scrap rate issues that you see. So that's the really exciting thing here, that automation for releasing the labor to go do more valuable things is only part of this solution. The second part is the enormous value you get out of yield and scrap rate improvements. |
| Liam McGoldrick: | Yeah. So here we have a bit of a case study. So with this particular case study, what we had done was go through and found a bunch of pictures and labeled the individuals in the pictures. And if they were wearing hard hats, we labeled the hard hats. We were able to do this with 30 or so samples. That's kind of the magic number we found with these more modern models, that you need at least 30, which is not much.

What we found that was... The training for these was significantly more stable, meaning that it previously, even if you had thousands of images, you might train and just get to a bad result. Whereas with these newer models, we were able to train and every time we would get a high accuracy model out.

We also get confidence intervals out of the models we're using. As you can see here, it says person 91%, so it's 91% confident that's a person. And that's really critical in a lot of manufacturing context because you may not want to trust it when it's 90%. If it's highly critical, if it's important weld that you need to inspect and make sure it's perfect, you're going to want 99% at that point. So being able to know when the model's unsure is a huge safety feature that really makes these models a lot more useful in practice.

But ultimately, what this allows is for us to take the human from what we like to say is from doer to reviewer. So whereas a human previously would be walking around the job site maybe to make sure that everyone's wearing their hard hats, now one person can get all the data and be notified if there's someone where there's a low-confidence interval that they have their hard hat on and maybe go out there and tell them to put his hat on. |
| Noel Hopkins: | That's great. Thank you, Liam, for that example, and it really illustrates the technology really well.

So computer vision is certainly an area that we're seeing enormous benefit from. And I love the point that Liam makes, which is that the level of effort required to deploy a computer vision system is significantly lower than it was just three or four years ago. The training and the supported infrastructure |

means that this is now technology that can and should be available to any business looking to reduce the manual labor associated with visual inspections and visual management.

Moving on now to another example. Similarly, using data to drive down operating costs and free up labor resources. We see an enormous amount of equipment downtime and equipment maintenance that is caused when unscheduled maintenance events occur. And actually, a study has shown that over 80% of companies experience some level of downtime and many companies deal with this on a regular basis.

By having to deal with unscheduled maintenance and plants that run to fail where maintenance occurs when a failure occurs on the shop floor, the cost of maintenance increases and the downtime associated with that maintenance can be extremely expensive and costly. We're working with businesses today to help them identify the causes of downtime and help them address them at a more convenient time and location, effectually moving unscheduled maintenance to scheduled routine times.

This has a twofold effect. First of all, it allows for labor to be used more effectively, in a more timely and structured way. Secondly, it improves productivity, improves output, and equipment uptime. To do this, we use the same high-level process that we illustrated at the beginning of this presentation by looking at inputs, the automation we can deploy, and the valuable outputs the client would like to capture. And so I'll let Liam walk through some of the methodology here and how we go about this in a little bit more detail.

Liam McGoldrick: Yeah, thank you. Yeah. So like Noel said, it's very similar to the previous examples in that we're going to be looking at what are our data inputs that we can use, and what is it that we're trying to predict?

Now, if there's a specific piece in the production process, say a certain machine that we want to predict when the bearings on it will wear out so we can make sure to replace those ahead of time, we can do that by looking at, okay, what kind of outputs does the machine have? Is there sensors that we can integrate into? Are there certain data sources we can use? Maybe there's even a camera involved. Sometimes you can visually see that there's wear on the machine that might lead to downtime.

But typically, there's also going to be a bit of tuning there as well because you're going to want to have very little downtime with more critical equipment and you may be less worried about cost than downtime if it's the center of the production process. Whereas if there's something that's more auxiliary, that you can tolerate a little more downtime, you might not want to replace the part way more often than you need to. So the model might be a little more conservative. But it's all about kind of tuning it. It's a very task-specific thing that needs to be tuned, and that's what we're here to help you guys do.

Yeah. So really what this predictive maintenance is doing is it's going to be looking at that sensor data and it's going to be saying, okay, when is this outside of a normal range? So one example that's typically used is a vibrational sensor, which basically will look what's the strength of the vibrations I'm seeing? If bolts get loose, the vibrations increase, the strength increases, and now it says, okay, this is outside a normal range, flags it, the technician can go take a look.

That's a easy example I think of how this would play out in practice. So it'll allow earlier intervention. It'll allow maintenance folks to be more targeted and not necessarily just kind of doing a full sweep and checking everything, but they can have a better idea where they should be looking. And like I said, the models can be tuned to get the desired level of paranoia, I like to say, into them.

Noel Hopkins: Thank you, Liam. And I think it's important to mention that many manufacturers are not sure whether they have the necessary data inputs in order to train an effective model and take these predictive actions.

And what I would say is that often there is data available. It may be in siloed systems. It may not be being utilized today. But many times we're able to identify parameter equipment data, sensor data, or use visual cameras to capture data that can be enormously valuable.

So I would encourage any manufacturer who's interested in computer vision, predictive analytics, or just more broadly in how to use data to drive efficiency. Don't be discouraged if you're not sure whether you have that data available today. Every business would like more data and more clean data, but many businesses today have data that can be used to make significant improvements. And we're more than happy to connect with you and your business leaders to better understand what data you have available, what business challenges you'd like to solve, and help you go through that discovery ideation phase in order to understand whether there is opportunity to leverage some of this key technology.

I think the predictive maintenance is a broad topic, but certainly any time that we're able to predict component, equipment, downtime and failures, we see enormous value to maximizing operational uptime, optimizing maintenance schedules, and of course, aligning supply with demand, which is incredibly important today and only compounded by the supply chain complexity, labor shortages, and rising operating costs. So we do see enormous demand for this type of technology.

I can't stress enough just how much success medium, small, and large businesses are seeing with this technology. And everybody we talk to, every manufacturing business we work with and engage with today is on a digital journey, a digital transformation. And it's our commitment to meet you and your business where you are on that journey. Whether you're making huge advances and you're already leveraging much of the technology and data that

you have available, or perhaps you're at the beginning of this journey, it's our commitment to meet you where you are.

And often we start our conversation just as we are today by sharing examples and concepts that we're finding successful elsewhere. And we can then sit down with you and your business leaders, often heads of manufacturing or VPs of quality and production, to help understand what challenges they are seeing today, particularly associated with those labor shortages. And then we can do a digital readiness meeting to assess what data you have available, how we might solve some of those business challenges.

And as we move forward through the steps of our process, which include discovery, if necessary proof of concept, proof of value steps before fully integrated production solutions, we're always conscious of working with you and alongside you to make sure that we meet you where you are and that we advance the technology at the correct pace.

Many times these initiatives start with a very specific targeted business case. We very rarely transform a business overnight and try and solve every issue. But by starting incrementally with high-value, low-effort solutions, we're finding great ways to help our manufacturing businesses and would love to share more examples that are more specific to individuals businesses and how you're thinking about these challenges.

We very much appreciate you all spending this time with us today. We committed to try and keep the time as short and effective as possible. We know that we can't cover everything in a webinar and we know that many people have very business-specific questions or require information that is more pertinent to their specific business and production.

Please feel free to reach out to CLA if you do have any questions. You can reach out to your customer lead, your consultant, or you can reach out directly to myself. My contact information is on the screen here and you can use the QR code to download that. We're always more than happy to share our experience and to learn more about your business. That's a commitment that CLA makes to all clients and we're thrilled to be working with many in the digital space.

At this point, I'd be very interested to hear if you have any questions that you'd like to ask Liam or I during this time. And I'd also welcome any questions either in the Q and A or verbally. So please, if you have any questions, we're opening it up to everyone who's joined the webinar today and very interested to hear if you have any questions for Liam or I.

Something that I found validating here, Liam, was that from the survey that we sent out at the beginning of the call, almost everybody said that labor shortages is a key significant business challenge today. And that's certainly what we're hearing from our clients as we work with them individually. And I think many of

you also believe that that trend will continue into 2023, that this is not a very near-term issue. This is going to be something that persists into 2023.

So these type of technology solutions, leveraging technology to solve them are really critical. So very interested in how we might be able to help more businesses in this way and think about how your business might be able to leverage technology.

Many of the upfront discovery sessions we do and certainly the readiness assessments, the readiness meetings I described, happy to do those with clients. And those are not a commitment or a fee-based engagement. That's just a meeting to see whether there's anything we can do to help and to get to know your business better and understand your business challenges.

I see we've got one question in the Q and A about computer vision, whether this is only for large enterprise manufacturing and distribution businesses. And I really want to stress this point, that just three or four years ago that would've been the case, that to deploy computer vision would've been a significant investment. And therefore, it was very much limited to large-scale manufacturing businesses or businesses manufacturing very high-value items.

Today, we see computer vision applications across all manufacturing industries of all sizes. There are lots of visual inspections that take place either during the manufacturing process or indeed at the end for final QC, QA. And both can be very applicable to using computer vision to automate some of those inspections and to deliver data back to the business that can be used to reduce scrap and improve yields.

Liam McGoldrick: Yeah. Yeah. And I would say even two years ago that might have been the case. It's definitely a very recent development in the field. And at CLA, we've been putting together kind of a library of pre-trained models that has really accelerated our ability to tackle these kind of problems.

The way I like to describe pre-trained models, it's kind of the difference between trying to explain, train say, I don't know, an infant how to do something. It's going to take a long time, many, many examples. Versus the pre-trained model, now you have an 18-year-old high school graduate you're trying to train. Now, they're no genius either, but they're a lot better than trying to get an infant to recognize a defect. Maybe that's not the best example, but I think it gets across the point that the pre-trained model already has a significant amount of contextual understanding of what images look like, what objects and images look like, what the foreground, the background is and how to understand that. And that's something also that certainly would qualify for R&D credits. Yes.

Noel Hopkins: Yeah. We have an R&D credit team here at CLA who are working with a number of clients who are also leveraging digital technology and are able to identify

ways of offsetting some of that R&D investment with R&D tax credits. So it's a good point.

Very much appreciate everyone's time today. Thank you for joining us at this busy time of year. I hope you all have found this informative and helpful. We look forward to connecting with many of you in the future. Thank you again for joining us. I hope you all have a successful and enjoyable December and enjoy the holidays. And we very much appreciate you joining us today for today's webinar. Thank you very much, Liam, and thank you all for joining us.

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