Is Manufacturing Ready for XR Technologies?

Consider how cell phones and the Internet redefined communication, education and entertainment, not to mention manufacturing. XR technologies, comprising virtual reality (VR), augmented reality (AR) and mixed reality (MR) processes and equipment, are making those same fundamental shifts. All three are complementary technologies; all have different use cases.

This article is a synopsis of a webinar Tooling U-SME delivered to help manufacturers better understand these trends. Titled "Virtual, Augmented and Mixed Reality in Manufacturing Training Solutions," the webinar was hosted by Vijayanandraj Vaiyapuri Ramalingam, Ph.D, SiFy Technologies North America Corp.; Dmitry Kopytin, BMW; and Chad Schron, Tooling U-SME.

What Do We Mean?

Before we dive into use cases, let us clarify some terms. Virtual reality means full immersion in a VR environment. Goggles/headsets can be tethered and untethered. Tethered means connection to a higher-end PC supplying higher resolutions and processing speeds compared to untethered, which typically come at a lower cost point. Devices include HTC-VIVE, Oculus RIFT/Quest and Samsung Gear, to name a few.

With augmented reality, you're overlaying digital content, such as images, video, or other data, on the real world. Think Polemon Go. Augmented reality can take place on a device you might already have, such as a phone or tablet. Smart glasses and different headsets are available. Many different applications exist.

Similar to AR, mixed reality involves layering different digital elements over the real world. The difference is you can interact with those digital elements. Think virtual work instructions, or overlaying tools on diverse types of processes.

XR in Training

XR technologies have existed in training for a long time, but the only areas that could afford them were the military and healthcare. Economies of scale are now coming down, making XR technologies a pillar of smart manufacturing strategy. XR technologies are showing up in manufacturing production, as well in training. A persuasive reason for XR-assisted training is retention. Research shows that using XR technologies, virtual reality in particular, results in a far greater degree of content retention.

It's also very attractive to that upcoming generation of manufacturers. Digital natives growing up with the Internet and immersive gaming are enthused about XR technologies in a blended learning solution. In summary, lower costs, faster comprehension, increased productivity, and saving money are recommending XR technologies in manufacturing operations.

When people speak of Industry 4.0, automation is usually the topic. Another powerful point is augmentation, or when humans work with technology to make tasks more productive. XR does exactly that. Up to 30 percent of the work time in manufacturing can be augmented through extended reality. How are decision makers responding?

According to a September 2020 survey from the World Economic Forum, more than half of manufacturing respondents worldwide (54 percent) reported being likely to adopt and develop XR strategies by 2025. Asked how XR adoption could help respond to the COVID crisis, the top response cited by 80 percent of the manufacturing respondents was providing more opportunities to work remotely. Others were accelerating the digitalization of work processes (77 percent), accelerate task automation (54.3 percent) and reskilling/upskilling the workforce (40 percent).

In a nutshell, people, processes, and product form the three pillars of XR adoption in manufacturing. XR is all about empowering manufacturing to work more efficiently, safely, and accurately.

VR is already showing a major advantage in training, particularly in complex operations. A core training area XR enhances is basic safety behavior and culture. OSHA safety principles, ladder safety, or maybe helping people navigate confined spaces could be where immersive realism shines. With XR, you will be able to remotely train as well. For instance, if the operator is on the shop floor, he or she can live-relay what they are seeing to offsite trainees.

VR haptics are still evolving, but the potential of tactile feedback in training is high. Hands-on machining methods, tactile assembling, and maintenance support are operational areas that could benefit.

Best Practices in XR

In setting XR strategies for a manufacturing organization, first comes vision. Always keep in mind where you are investing, whether it's people, product or process. IT policies will change and evolve as well. From an XR perspective, what is it that you

want to do, what kind of data and how much are you going to collect? Portability, privacy and cybersecurity all must be addressed. From a technology standpoint, there are a lot of devices and technologies in the market. Business requirements must be well-defined to align the most effective XR choices.

There are cases that work for VR, and there are use cases more suited to AR. In evaluating the adoption risk, you need to be very clear on the desired outcome and risk factors involved. Age could be one such factor; sharing devices could be another.

A frank assessment of workplace readiness is another requirement. Is your workplace infrastructure ready for XR-based solutions? Can you dedicate enough physical space? Are your people on board? Any first-generation technology will have teething issues. Educating your people is essential for them to be prepared. Starting small and going from a proof of concept to scale often is the best way. Leverage all in-house resources, such as 3D programming and modeling, and you'll find developing VR and AR technologies becomes easier and friendlier.

Think holistically about how an XR solution integrates with your other systems, such as ERP, quality reporting or your learning management system. Having a vision, establishing metrics and calculating return on investment will take your XR implementation strategy to the next level.

Immersing XR at BMW

When it comes to XR in manufacturing and training, even the world's pre-eminent manufacturers deal with the same issues as smaller operations. BMW's facility in Greer, S.C., was facing increasing training costs and needed to incorporate new content that would attract young manufacturing associates.

Around three years ago, the company built a project development team and decided to experience the VR world with two 360-degree videos. Familiar in the real estate industry, 360 videos allow users to immerse themselves in a space. While not being able to manipulate objects, users can observe and learn from the environment.

After a little over a year, BMW reported what it called big results: "It really clicks," Kopytin said. "We see associates actually participating and going through the modules, identifying things a lot quicker."

Coming back and redoing training on subsequent modules, BMW saw continued progression that people captured what was delivered to them in XR.

From embedding 360 videos, BMW started expanding into what it called the next phase of VR: designing and utilizing virtual spaces. It became a beta tester for Tooling U-SME's virtual manufacturing labs development effort.

According to Kopytin: "If you can imagine an associate trying to do a connector test or fit test, you would have to have multiple machines and a huge training center for large classes. But if you utilize a virtual space, you can have a classroom of trainees with several of them in a virtual reality experience doing the same activity."

According to World Economic Forum survey, more than half of manufacturing respondents worldwide (54 percent) are likely to adopt XR strategies by 2025.

Next comes overlaying into AR and combining with mixed reality. BMW explored how it could do work instructions and make jobs easier.

"We want to be able to interact with associates and interact with the trainees, because the ultimate goal is to deliver qualified future associates, to allow them to embed themselves into training and fully comprehend the topic, in whichever form it is presented," Kopytin concluded.

For more information on Tool U-SME and access to this webinar in particular, go to www.toolingu.com/resources/Watch-and-Listen and look for Virtual, Augmented And Mixed Reality In Manufacturing Training Solutions.