TECHNOLOGY IN CONSTRUCTION CLAIMS MANAGEMENT

INTRODUCTION

Due to the COVID-19 pandemic, the way we work—whether in an office or out in the field—has changed significantly, and in an extremely short amount of time—even overnight in some cases. Without available technology, this unprecedented shift would have been impossible. The abrupt, industry-wide transition to virtual working has led to a new understanding of the practicality and possibilities inherent in many new technologies. As construction sites throughout the U.S. begin reopening after shutdowns or ramping up after slowdowns or suspensions, these technologies may play an even larger role in a project's success.

The mere fact that a construction project finishes on schedule, does not mean that productivity was at its peak. Most likely, downtime was incurred, whether it was due to waiting for materials, having to perform rework, working around other trades, or having to perform work that is inefficient in nature. With the new safety and social distancing policies being implemented, these inefficiencies are sure to increase.

Implementing new technologies such as tablets, drones, or even big data to automate certain processes can improve productivity. Such technologies have become increasingly easy to access and use; all that is needed is a willingness to experiment with them and a commitment to fully explore their inherent advantages.

Along with discussing the technologies themselves, in this article we also discuss some of the practical considerations related to implementing them, as well as potential legal liabilities and ways to mitigate these liabilities. Through this article, we hope to provide a well-rounded view of these technologies to help make informed decisions when choosing to implement them.

TABLETS

When Android released the first modern tablet computer in 2009, it paved the way for revolutionary changes in the way we use technology. Apple further spurred this change with the debut of the iPad in 2010. For the first time ever, consumers could enjoy computer-like functionality married with the mobility of a cellphone and the visual convenience of a laptop screen. With most major tech companies now offering their own versions of tablets, these portable devices are permeating our personal lives. Similarly, they are also permeating our workplaces and construction sites.

Without a doubt, the biggest advantage of tablet use is convenience. We see this convenience in the construction industry, as tablets can replace many items typically used in the field. Instead of fumbling through a full set of drawings and plans, or lugging around a laptop while walking a site, one can simply use a tablet. Similarly, a tablet can perform the same functions as a camera, a watch, a notebook, a GPS, a calculator—and myriad others—all in one device.

Tablets also offer the benefit of real-time information-sharing. As long as internet or mobile data connectivity is available, data can be easily transmitted from one person to another, regardless of location. Software companies are supporting this use by making their products accessible on portable devices through mobile applications, or "apps." For example, some of the most common office productivity software, such as Microsoft Office and Adobe Acrobat, are available for mobile use. Even construction-specific software such as BlueBeam, PlanGrid and ProCore have accompanying "apps" that can be utilized while on-site.

An individual working in the field can now live-stream site walk-throughs to stakeholders or other office-based project parties. Inspectors can share photographs, notes and drawing mark-ups. Drawing revisions can be compared to installed work, and documents can be e-signed in the field. Imagine how more productive progress meetings could be if discussions were accompanied by real-time site footage.

While internet and mobile data connectivity fuel tablet use, they also create a potential downfall. When working on sites with poor or nonexistent connectivity, tablet use can be limited. If connectivity is an issue for your site, ensure that all necessary documents have been stored locally on the tablet device. Similarly, ensure that all modified documents are uploaded back to your company server upon return to internet connection.

One must also consider the cost of providing these devices. Companies may be hesitant to invest in a tablet supply, considering that they've already purchased the typical office-based technology such as computers, printers, copiers, etc.

When implementing use of mobile devices, such as tablets, on a construction project, the party using the device (whether it be an owner's representative, a designer or a contractor) must understand that the information stored on the device will likely be discoverable material. Any photograph, video, communication or document captured or stored on the tablet will become part of the "project file", which, in the event of a claim or legal action arising from the project, will typically need to be produced.

The convenience of using tablets can result in the size of a project file growing exponentially, as more and more files are generated. If a claim does arise, then the project file must be reviewed, redacted, and produced. The time and cost associated with this process grows as the number of files increases. For this reason, it is recommended that efficient document organization be made a priority while a project is still ongoing. Do not wait until a claim arises. Having properly organized documentation readily available can significantly boost one's odds of obtaining a favorable outcome in the event of a claim. After all, it is essential that all project parties and their expert witnesses have contemporaneous evidence to support their positions.

Another area of consideration must be data privacy. A project file will consist of typical construction documents such as drawings, photographs, and emails, some of which may be of interest to nefarious individuals depending on the nature of the project (for example, government facilities or industrial complexes featuring patented systems). The project file will also contain confidential information such as tax identification numbers, as well as personal employee information. It is not uncommon to see a "hacker" breach a company's digital security and steal this highly sensitive information. Every tablet that is used on a construction site, is another chink in the digital armor protecting this valuable information. Companies should strengthen their data security measures accordingly. Tablets should be properly guarded, just as any other company-owned computer would be.

Despite these minor downfalls, tablets still have proven to be a useful tool in the construction industry. At their most basic level, tablets are another source of project documentation, which is always helpful if a claim arises. In addition, use of tablets in the construction industry can allow for improved record-keeping, interactive dialogue between the office and the field, and more efficient problem-solving.

DRONES

Unmanned aerial vehicles, commonly known as "drones," are becoming increasingly common in the construction industry. Drones were originally designed for military use. Over time, however, their presence expanded to the commercial and hobbyist markets. With a wide variety of models available, drones are now being utilized for all kinds of applications, including filmmaking, oil exploration, surveillance, hobby-flying and emergency response deliveries, among many others.

For construction, the most obvious drone functions are in-field aerial photography, surveying and site inspections. Site photography can prove useful when tracking work advancement. Images taken throughout the project life cycle can then be compared to show the progress of work or validate schedule information, both of which are the subject of construction claims.

Unmanned aerial vehicles allow humans to visualize areas that are typically off limits otherwise, whether for practical or safety reasons. For example, a drone can be used to inspect the exterior of a skyscraper, a confined space, or a suspension bridge. While alternatives such as photography from the ground, from a crane or from a helicopter are available, drones provide a birds-eye view that is safer and more affordable. They also limit the effects of human error and increase the accuracy of such observations.

Drones also can be used on site for less-conventional applications, such as surveillance, deliveries and staging. Worker productivity and material shrinkage are common problems that can be addressed by technology. By operating a drone equipped with a camera, a foreman or supervisor can keep an eye on his or her crew (which can be especially helpful in the COVID-19 climate, where "social distancing" is encouraged), as well as materials stored on-site. In addition to monitoring worker activity and storage areas, drone surveillance can act as an around-the-clock deterrent to theft or vandalism—thus maintaining site security as a whole.

Aviation companies are currently working to make "heavy-lifting drones" more readily available. The models being developed can reportedly lift up to 400 to 500 pounds (or 181 to 227 kilograms) and have a flight time of up to 45 minutes. High-capacity drones such as these could be useful for local material deliveries or staging on-site, which would, in turn reduce labor costs.

Expectedly, drones with advanced capabilities, longer flight times and higher carrying capacities come with a large price tag. These premium models can easily cost tens of thousands of dollars. For this reason, one must consider cost when implementing a drone program on-site. In order to remain cost-efficient and avoid overspending, it is recommended that project parties carefully compare model specifications to realistic project needs when selecting the appropriate model for purchase.

As with tablets, the use of drones on a construction site will call for consideration of potential discovery, data security and privacy impacts. Again, anything captured by the drone while performing services related to the project will be added to the project file, and therefore will be discoverable in the event of a claim or legal action.

Additionally, there are added privacy concerns with the operation of drones. On-site work and workers are typically "fair game" to be photographed throughout the duration of the project. However, where that photograph ends up may be problematic, if proper precautions are not taken. For example, if a photograph is taken by a design professional for use on the company's website that captures the face of an electrician, the design professional should obtain the electrician's consent before using the photograph in order to avoid any potential legal action.

Furthermore, the privacy concerns associated with drones extend past the physical construction site. The "birds-eye view" capabilities of a drone often extends past the boundary of the project, where people may have a "reasonable expectation of privacy". The intricacies of constitutional law are outside the scope of this article, but needless to say, steps should be taken to protect oneself from this potential liability. Depending on the nature of your drone usage, additional planning and legal consultation may be necessary before implementing drone photography on your next project.

Most importantly, the potential risk of injury to workers, bystanders and the property below must be considered. While the commercial use of drones may not require insurance, a drone hovering above an active construction site, especially one used for transporting materials, should be insured. In order to protect oneself against this potential liability, the cost of insuring a drone for use on a construction project, which can vary depending on the location and specified use, should be included in project budgets.

It is also important to be mindful of the legal restrictions that have been put in place. For example, the U.S. Federal Aviation Administration (FAA) requires that all non-recreational drones be registered with the government agency and flown by a certified remote pilot (or flown under the direct supervision of a certified remote pilot). Restrictions also have been placed on such variables as device weight, operation timing, weather visibility, velocity, and flight altitude.

An alternative to developing an in-house drone operation is the use of a subcontractor. Some parties may find it helpful to rely on the services of a professional consultant who specializes in drone operation and can be retained on a case-by-case basis.

SMART CONTRACTS

Unquestionably, the contract is one of the most important documents—if not the most important—that will be generated on a project. After all, the contract serves as the primary standard for a project's procedures and defines each party's responsibilities.

A “smart contract” can be described as an electronic-based agreement that is self-executing. It is accompanied by a computerized code that is designed to digitally verify and enforce performance of the contract terms.

When this concept is applied to construction, a smart contract can be used to authorize automated payments that are issued once certain conditions are met. Delay notices can be generated automatically when milestones are not timely achieved. Routine material deliveries can be scheduled. If the parties so wish, liquidated damages could even be collected automatically when a project is delayed. The triggering events for smart contract transactions include, but are not limited to, payment application approval, temporary certification of occupancy, substantial completion, final completion, and warranty walk-throughs.

Adoption of smart contracts can reduce the costs associated with the contracting process. In some instances, this technology lessens the need for intermediary parties such as banks, notaries, lawyers, etc. It also reduces the time required for completion of these transactions. It should be noted that transparency and quality of documentation are increased, as the smart contract’s algorithm will document the details of each automated transaction. This transaction log can be accessed and reviewed by all signing parties.

As with all technological applications, one must consider the potential problems that can arise from a lack of cybersecurity. What happens if a software “bug” or data breach affects the smart contract? When dealing with legal documents and the movement of money, a situation can easily go awry in the event of a glitch or coding error.

Also, due to the nature of the coding process, modifying a smart contract is not as simple as editing a standard Word document. Additional coding would be necessary. This level of complexity poses a disadvantage to the construction industry, where contract terms can change multiple times during the course of a project as a result of design changes, scope changes, time extensions, etc.

There are a number of potential legal pitfalls involved with use of smart contracts, and the allocation of liability will reside in the tedious language of the contract. For example, if a project milestone is achieved, triggering a payment obligation, but the payment is delayed—who bears the associated risk? The owner? The software developer?

Numerous contractual obligations require notice to be provided. If the software fails to provide timely notice, who bears that risk? Contractual contingencies typically require prior approval before proceeding with the work, will that approval be automatic based on an algorithm? What happens if an accidental key stroke approves a contingency—will this error be able to be corrected immediately or will a resolution require time (which is a scant commodity in the construction industry)?

While smart contracts may be able to identify specific milestones or events more efficiently, the determination of an outcome based on those events will not necessarily be resolved any more efficiently. Typically, if there is a claim for liquidated damages, delay analysis experts review project schedules to determine the critical path and identify the responsible party. If a smart contract automatically enforces the liquidated damages and a contractor claims the enforcement was in error (which is not a stretch of the imagination), the same analysis process would need to be performed.

In the end, the quality of the informational input will govern the resulting output. Thus, the allocation of liability and the contract terms related thereto will be the subject of painstaking review and negotiation. It is always recommended that contractual language be thoroughly scrutinized, reviewed again and then scrutinized some more! Smart contracts are no exception to this rule. Mitigate your risk by carefully crafting contract language under the advisement of one’s legal counsel.

VIRTUAL AND AUGMENTED REALITY

Virtual Reality (VR) is a digitally simulated environment that immerses people in an experience. Users are not just viewing a screen in front of them. Virtual reality allows them to be a part of the environment and interact with it. Augmented Reality (AR) works much the same way as Virtual Reality but stops short of allowing the user to participate in a completely immersive virtual setting. AR is a mix of a virtual and real-world environments, in which what is real is augmented or overlaid with digital images. Of the two technologies, VR is more advanced, and is used more frequently. In fact, VR and its attendant software has now reached a point at which it is “out-of-the-box-ready.” All that is needed is a VR headset or a cardboard/lens setup that utilizes your phone, paired with the specific software being used and then you are ready to go.

This technology may seem like a novel concept, especially when applied to a construction project. But VR can offer valuable alternative methods for collaboration among various

project team members, no matter where they are located. VR also provides an alternative way to view project designs and any errors or schedule clashes. In fact, many users have said that spotting errors and inconsistencies is easier when utilizing VR with BIM as opposed to just BIM or drawings on their own[1].

The biggest benefit of VR is that it puts people "into" the space being constructed. Designers and builders can be "in" the space before it is built, and this unique opportunity can be extended to owners and end-users as well. VR users can see how the space will flow and if the design meets both overall goals and specific end-uses. If a part of the design—or all of it—does not work, redesign is easily accomplished, and can be done in far less time and less expensively than with traditional methods. In addition, VR can provide subcontractors and suppliers with a valuable glimpse into the project and the spaces and conditions in which they will be working, allowing them to submit more accurate schedules and estimates.

Jobsite safety is one of the biggest concerns on a construction project, especially now with the COVID-19 pandemic. Identifying safety risks and making sure proper safety protocols are being followed requires continuous and careful attention throughout the project life cycle. VR can help ensure that all workers are properly prepared for the work and made aware of the potential safety risks. Before ground is even broken, workers can use VR to "walk" the project site, and identify high-risk areas, laydown, spacing or stacking challenges, and other potential problems. As a result, the technology allows them to properly prepare for work and any problems well in advance.

Aside from project-specific safety preparation, there are also Occupational Safety and Health Administration (OSHA) compliant VR trainings being developed[2]. This training can be particularly useful for new workers, helping to better prepare them for the myriad safety risks inherent in a construction project. Better overall preparation can lead to fewer accidents and injuries on construction sites and, ultimately, make the industry safer as a whole.

With VR, impacts can also be visually explained to judges, juries, or arbitrators, step by step, fostering a deeper understanding of the issues in question. While testifying experts may have a firm grasp on the issues related to a project and their impacts, not everyone will have that same understanding. Much can be lost in translation, making complicated concepts even murkier. That lack of understanding can sink even the most carefully documented claim. Utilizing VR in this manner can help reduce that risk and maybe even make it more interesting.

Again, the possible exposure created by the use and reliance upon VR and/or AR should be addressed in the terms of the contract. For example, if an accident does occur on a project that utilized OSHA VR compliant training, a claim can be filed alleging that the OSHA training was either a cause for the accident or that it did not prepare them properly for the potential risks on the jobsite. It is highly likely that both the VR and/or AR developer and organizations, such as OSHA, would disclaim liability or seek indemnification for any such claim. There are an almost infinite number of potential risks on a construction site and it is unreasonable to believe that the VR and/or AR training would contemplate them all. Thus, the risk of workplace injuries still rests with the owner of the site and the respective trades performing services on-site.

Another potential liability with VR and AR is its utility as an aid in litigation. Due to the relatively high cost of VR and/or AR, there may need to be agreement by all parties on its use. If a party has the technical capabilities, it may decide to unilaterally use the VR or AR during the presentation of its case. However, the VR or AR program may be categorized as "demonstrative evidence," which the opposing party(ies) have the right to see in advance of its use before a judge, arbitrator or jury. If an opposing party does not have the VR or AR capabilities, who will bear the cost of providing such services to the other party(ies)? The introduction of VR or AR would consequently lead to expanded time-frames for production, review, and preparation of a rebuttal. Moreover, the VR or AR evidence would not replace experts, it would merely supplement them with the hope of enhancing its viewers' understanding, but with increased cost and time commitments.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

When talking about Artificial Intelligence, or AI, people often scoff at the idea of a machine doing a better job than a human—especially a human with decades of experience under his or her belt. Reticence regarding this new technology may be understandable but is largely unwarranted. AI has tangible benefits in some applications, including construction. Think about what happens on a typical project, whether it is in

1 risVR Webinar: https://blog.irisvr.com/vr-webinar-2020
2 https://www.youtube.com/watch?v=3Eksbi2H4fY&list=PLWp0ZgCxQ42Ep2821JW1a5BfRXEt2VcmQ

real time out in the field or after the fact during a claim or dispute resolution. In both instances, data is being continuously collected and analyzed to provide the best possible outcome.

While experts in collecting and analyzing data are good at this task, AI may, for various reasons, have an edge. Firstly, there is no bias. While we strive to be as objective as possible when doing our jobs, our human nature is rife with both conscious and unconscious biases. Because it is not human, AI has no bias. It is designed and built solely to process data and "learn" the way human neural networks do, but without innate biases. Secondly, AI has unlimited capacity. While a person can work on only so many projects, at only a certain pace and for only so many years, AI has the ability to digest unlimited amounts of project data—and do it faster and more efficiently than a human ever could. Lastly, AI has the ability to not just digest volumes of data more quickly than a human ever could, but also to detect patterns in the data that humans faced with reams of data may miss.

Whereas VR is a simulation of an environment, AI is a simulation of intelligent behavior. "Whenever a machine completes tasks based on a set of stipulated rules that solve problems (algorithms), such an 'intelligent' behavior is what is called artificial intelligence."[3] One application of AI is Machine Learning. Machine Learning is based upon the premise that machines can "learn for themselves" if given access to the appropriate amount of data. Essentially, with Machine Learning, a system can process seemingly endless amounts of data and accurately detect patterns that humans either cannot recognize or otherwise miss.

AI and Machine Learning are technologies that can be extremely useful in the construction industry, given the large amounts of data produced. There are plenty of data-related tasks that we, as construction claims professionals, perform for each project that could be automated for the sake of efficiency, freeing people up to focus on other aspects of a project. A review of daily reports is a good example. In order to automate a task such as this, past project information can be fed into AI so that it can "learn" what information is typically most useful and pulled from daily reports. Once AI "learns" that, project documents can then be loaded into a database and processed by AI to return the precise data needed in a fraction of the time.

The expedient review of daily reports is just one example of many construction industry tasks that can benefit from the application of AI. Prudent firms are recognizing this and are taking action. nPlan's[4] AI application focuses on project schedules. This software "learns" how past projects performed in order to predict the outcomes of future projects. It provides a completely objective view that focuses solely on the data and the patterns found within it. SmartPM[5]'s software works in much the same fashion and can analyze whether a laid-out plan is achievable, given the logic and duration of activities. Then, there is software like SmartVid.io[6] which focuses on another important project performance area: safety. SmartVid.io's construction-tuned AI, named "Vinnie," uses information collected from a variety of sources, such as photos and videos, to identify signs of potential risk.

In addition to automating processes and identifying risks, Machine Learning also can produce vital "Digital Twins." "A digital twin is a virtual replica of a structure that incorporates not only the building's physical elements but also external data such as changes in climate, or tenant and visitor traffic, to better understand how the building will function during its entire lifecycle."[7] For construction, test-runs can be conducted to identify areas of potential risk well before shovels break ground. In addition, after a project is completed, or during any claims or dispute processes, digital twins can be used to clearly illustrate the difference between as-built work and as-planned work. Within the construction and construction claims industries, the application and the knowledge it imparts could be a true game-changer.

AI or Machine Learning is another example of technology that, if used, must be addressed in the terms of the contract. Similar to the previous discussion about smart contracts, AI or Machine Learning is only as good as the data input it receives. If the data relied upon by the AI software is inaccurate, the liability will likely rest with the party that

3 https://towardsdatascience.com/clearing-the-confusion-ai-vs-machine-learning-vs-deep-learning-differences-fce69b21d5eb
4 https://www.nplan.io/
5 https://smartpmtech.com/white-paper/
6 https://www.smartvid.io/safety-monitoring?hsCtaTracking=43eee4a0-1265-4f55-82f0-395e90e69d2d%7C8c352624-7c3d-41e6-a780-95ab62c15588
7 https://www.constructiondive.com/news/digital-twins-to-play-a-bigger-role-in-post-pandemic-construction/578102/

input the data. If the data relied upon by the AI software is accurate and an incorrect result is created by the AI, then liability may fall to the software developer. It all depends on the express terms in the agreement between the AI software developer and the user.

Because AI software provides merely the probability of events, reliance on it should be considered carefully. Every project presents a multitude of variables, and those variables likely change for each project. Location, weather, contractors, materials, design changes, modifications, etc., all will have an effect on the outcome of a project. So, while AI can provide a user with the highest probable outcome, it cannot guarantee that outcome.

Take for example a project where AI software processes tens of thousands of data points and predicts with a 97-percent probability that the project will be completed on schedule. The project actually completed over eight months after the planned substantial completion. Is AI to blame for the project performance falling within the outlying 3 percent of possible outcomes? What if the AI provided a 99.5-percent probability and the project finished three years behind schedule? Furthermore, to what end had a party relied on the AI software's output? What if an Owner limited the potential liquidated damages because of the AI's 99.5-percent "prediction"? The careful drafting and negotiation of contract terms is of paramount importance in addressing these concerns.

BIG DATA

'Big data refers to the dynamic, large and disparate volumes of data being created by people, tools, and machines. It requires new, innovative and scalable technology to collect, host, and analytically process the vast amount of data gathered in order to derive real- time business insights that relate to consumers, risk, profit, productivity management, and enhanced shareholder data."[8]

This definition of Big Data is fitting, and not only because it is simple and concise. Those who work with construction claims routinely deal with "large and disparate volumes of data" on nearly every project. And that amount of data will drastically increase as the use of technology continues rising.

While there is much overlap among Big Data, AI, and Machine Learning, everything begins first with Big Data. Without the disparate volumes of data being produced, there would not be any information to feed into AI or Machine Learning models, and nothing for them to "learn" or automate processes from. There is incredible value in raw data. Within the construction claims industry, the performance of a "sentiment analysis" is a good example of this.

On a typical construction claims project, there could be hundreds of project drawings and thousands of drawing comments that need to be reviewed in order to find either "second-bite" comments or comments related to a specific issue. A task such as this often requires multiple people and is incredibly time-consuming, and the manpower and time expenditures are not always plausible for every project. However, a sentiment analysis allows this task to be performed in a fraction of the time.

With a sentiment analysis, comments are loaded into a database. Notably, the comments would not require formatting or cleanup, as they often do when using Excel spreadsheets. To create the algorithm, the user then identifies key words as "positive," "negative," or "neutral." As an example, assume that "change," "redo," or any similar word related to a claim are labeled as "negative." The sentiment analysis algorithm would then run and identify all of those "negative" comments. In a matter of seconds, the number of comments needing review could drop from 10,000 to 500, greatly reducing the amount of review time needed. That time saved then can be focused elsewhere on the project.

Performing a sentiment analysis of project data is just one example of its benefits. The construction industry is still considered the "Wild West" when it comes to handling big data. Some companies do not see big data's benefits or do not know how to apply it. Others are actively experimenting with it to see just how far those benefits extend.

Once more, the input governs the output. While the efficiency of drastically reducing the volume of documents is an enticing carrot, the potential risk of sole reliance on Big Data, such as a sentiment analysis, can be a painful stick. The use of a sentiment analysis, as described above, should be considered prospectively because it relies on a consistent use of key terms. If the key words identified for the sentiment analysis were not used uniformly, certain comments or documents may not be properly identified. This potential problem is only exacerbated when comments are made by more than one person.

8 (Pg 4): https://www.ey.com/Publication/vwLUAssets/EY_-_Big_data:_changing_the_way_businesses_operate/$FILE/EY-Insights-on-GRC-Big-data.pdf

BEST PRACTICES FOR IMPLEMENTING NEW TECHNOLOGIES

Data is data. What will set companies apart is how they choose to use the data they have at their disposal. If companies opt to do nothing, any resultant insights the data could have provided will be wasted and potential opportunities missed. In addition, other companies will undoubtedly take advantage of the innovations, leaving those who shunned the technology at a distinct disadvantage.

Companies that do not wish to be left behind need to be willing to experiment with and proactively implement these new technologies. The best way to achieve successful implementation is to lay out a plan that identifies who will use and be trained in this technology, the type of training needed, and the details of how and when it will be implemented.

Identifying employees who have an interest in or aptitude for the technology will provide the best chance of success, as they will likely be more driven to learn and, ultimately, discover what works and what does not. Most engineers coming out of college are already being trained in these technologies - structural and civil engineers in BIM, electrical and mechanical engineers in programming, etc. After the users are identified, appropriate training offered by the manufacturer, software developer or other reputable companies should be offered. There are many reputable sources of training, including Udemy, Coursera and Codecademy, which are inexpensive, web-based, and can be scheduled at a user's convenience.

Once employees are trained, they can begin to explore how the technology best meets current and future needs, but actually implementing the technology on projects and tracking its effectiveness is crucial to its success. Targeted projects should be identified to help expedite implementation. Then, as the technology is rolled out, patience is key. The game-changing attributes of the technology may not be immediately evident. It is also necessary to allow for an ample learning curve, as that will provide the best possible chance for success. It is also helpful to monitor the process, and provide feedback to the manufacturer along the way, which will yield improvements for future users and help make the product the best it can be.

CONCLUSIONS

It is often stated that construction is one of the oldest professions in the world and the least technologically advanced. This article identifies and discusses some of the practical technologies as well as the more radical technologies available. Construction claims and project management are like the "Wild West" when it comes to more advanced technology. Up to this point, the construction industry has been slow to utilize technology to its fullest capacity or to develop a standardized set of "best practices" to follow. This article gives just a few examples of the many possible applications available. There is plenty of room to experiment and figure out what works best for your situation.

It is not enough to just discuss the possibilities that these technologies hold. You must also consider the legal perspectives and how to implement these technologies. In order to make the most well-rounded decision, it is best to know all sides, including legal implications. Whether you are a project manager or a construction claims professional, once a claim or dispute arises, you are now treading into legal territory, so it is important to know how these technologies can impact legal liabilities.

As with all the relatively novel concepts and technologies discussed throughout this article, acceptance by the final decision maker, whether it be a judge, arbitrator, or jury, is still an unknown. Unfortunately, there is no crystal ball to understand how the use of these technologies will be perceived by their respective audiences. Thus, implementing these technologies should be carefully considered and if used, meticulously contemplated by the terms of the contractual agreements.

These legal considerations should not be seen as a roadblock, however, just knowledge to keep in your back pocket. Once it is decided to implement any of these technologies, it is critical to have a plan to do so. You do not want to buy what is needed, only to have it sit on a shelf to collect dust. There has to be a plan for implementation, and this article lays out some of the best ways to do so. Again, it is the "Wild West" out there, so it is up to every company to come up with its own set of best practices and to innovate along the way. Through the use of technology, and not just the ones discussed here, there will be new industry leaders that emerge.

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