

# Construction Technology

## Past, Present and Future



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## Abstract

A look into the history of construction technology, from the tools of the past to present day technologies and a prediction on the future state for the industry. Find out how each technology has shaped jobsite, spurred new businesses and laws, the risks and rewards for embracing technologies and what could happen if you stay on the sidelines.

# Executive Brief

The construction industry typically lags when it comes to technology. This can hinder the industry and businesses from capitalizing on the efficiencies and savings (monetary and time) There are front-runners within the construction industry that embrace the benefits that technology brings.

This paper will review previous technologies and their developments, and move into present day technologies, covering how they are creating a competitive edge for the front-runners and what it means for those not implementing or waiting. It will wrap up with prediction of what is to come for the industry from a technology perspective.



# Background

## The Beginning

Construction has been around since the beginning of human existence. It all started with ways to provide shelter from the climate and environment. Over time, shelters became more sophisticated and structures were built for food, religious reasons and more. In early civilizations, most structures did not last long, as perishable materials were used.



Eventually, more durable natural materials were used to improve upon the structure and extend the life of it. As building became more sophisticated for the outside, the interior became a focus and controlling the environment on the inside became part of construction. It is no coincidence that as humans developed, the requirements of buildings evolved as well.

It is not to say that construction has been void of technology. Improvements to materials, like concrete and various synthetic materials for durability and energy efficiencies, have come a long way. Surveying tools and pulley systems have been essential for construction from the beginning of time but have evolved greatly. I give these examples because they highlight that construction once quickly adopted different technologies and materials to improve upon their work and enhance their business. While some companies embrace technology, some are still slow to adopt and acceptance continues to lag.



# The Turning Point: Enter Technology

## Computers, Internet and E-mail

The introduction of personal computers (1981) to society is, in our opinion, the beginning of digital technology in construction specifically, but for all industries as well.

This new technology forged the way for other digital-based construction technology solutions, but with the arrival of internet and email in the 1990s, it was the beginning of moving from paper-driven communications to digital communication. This change impacted many industries, but for construction it was a big change. Permits, drawings and plans could be discussed without having to schedule face-to-face meetings or rely on mail service to send items back and forth. In turn, this improved the speed of projects, at least for the companies that were early to adopt.

These early birds surely had significant upfront costs to get computers, and experienced the frustrations of dial-up internet, but, as time has gone by, the cost of computers has decreased and the performance and capabilities of internet providers and email programs has increased.



# Cell Phones, Smart Phones and Tablets

With the arrival of the internet and email in the 1990s came advancements in cell phones and by the mid-1990s, the arrival of the smart phone. In the early 2000s came improvements to size, features and functionality. The idea behind the cell phone was for talk communication, but, over time, the introduction of texting, email and other benefits grew. In 2007, the reintroduction of tablets came to the field, replacing clunky computers.

While this advancement was revolutionary in the way we communicate, it was also a challenge for the construction industry. Many companies instituted cell phone policies, as they were initially viewed as a safety hazards. Now, they are used to improve safety, coordinate in the field, give weather data, bring communication full-circle, from the office to the jobsite, and more.

Today, apps are making these devices useful for more than just calls—they are rapidly improving project management and providing companies with intelligent communication tools and resources. While many companies still enforce cell phone regulations, having these devices on-site helps fuel technologies in the field, like Bluetooth tracking, inspections, safety, equipment tracking, managing timesheets and payroll, and more.



# Enterprise Resource Planning, Software and SaaS

For the last 25 years or so, enterprise resource planning (ERP) systems have been helping business functions become more organized. Typically, ERPs are viewed as a single platform for accounting, estimating, project management, order management and more.

More software, like building information modeling (BIM) for example, have greatly improved over the last 50 years. From 2D to 5D, significant gains for construction design and build have been seen. 5D technology—viewed by McKinsey as one of the big disrupters of the construction industry—takes BIM to the next level with schedule and costs added to the more common 3D. Computers and smart phones enable these to be even more impactful. Other software options that enhance a construction company's business needs are also available.

The one drawback for a lot of the software available is that users require a computer to employ them, and they may not connect to other systems. In addition, typically these software types require in-house IT expertise or an outside resource for the installation and constant updates.





The solution to the problem of installed software is visible in the industry's shift to software as a service (SaaS). With today's cloud computing environment, SaaS offerings are available for project management, estimating, finance, BIM, asset tracking, time tracking, collaboration, human resources and more. In addition, many vendors are creating open APIs that allow for better connectivity to other software solutions being used.

These digital tools have greatly improved efficiencies, enhanced communication, and provided more visibility across a business.

However, what remains a growing challenge is getting all of these systems to “talk” to each other. Thus, more and more companies are looking for open API integrations to connect everything..



Security—specifically, cybersecurity—is also a focus for many construction companies that do not want their information to fall into the hands of their competitors.

# Equipment

Advancements in construction heavy equipment originally sprang from agricultural equipment advancement in the late 1800s. In the early 1900s and 1920s, the industry saw growing advancements in heavy equipment, but primarily, again, for agriculture.



The 1950s began the start of a growth period for the construction industry and heavy machinery advancements. New laws and the Federal Aid Highway Act of 1956 spurred the interstate highway system. Construction on the project took years to complete, but resulted in the modern-day highway system we know today, which connects people and provides a means for transporting goods, effective evacuation routes and more.

With the Federal Aid Highway Act of 1956 came a “true technology evolution” in the 1960s, and the rise of equipment like dump trucks, scrapers, crawler loaders, crushers, P&H stick clams (the first mini-excavator), wheel loaders, super cranes—the list goes on. Thank you, 1960s! More advancements came over the past 50+ years, and continues today. Modern-day equipment offers intelligent machine control, remote control features and more.





## Automation and Robotics

Automation and robotics are not new developments within construction, but an expansion of automation. A few examples of automation can be seen in prefabrication (dating back to 210 BCE), off-site construction, and modular construction. Why is robotics at the forefront in construction right now? The answer to this is twofold.

### Labor

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Labor shortages (union and non-union) are impacting construction companies everywhere—not just in the United States. Companies have experienced difficulty in attracting and retaining new generations of workers. In addition, skilled labor is becoming a growing issue. In the U.S., 70% of contractors struggle to hire skilled labor. In addition to the current shortage, the Bureau of Labor Statistics shows a 12% increased need for labor by 2026. It isn't just about quantity of workers, it's about quality and experience as well.

### Environment

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There is a great amount of attention (rightfully so) on sustaining the environment. This quote stood out to me and I believe it will to you as well:

“Construction is one of the highest waste industries in the world.”

Even with the rising amount of LEED and green initiatives in construction, somehow the industry is still generating the highest waste.

Let's start with labor. When there are labor shortages, robotics can help fill the gap. A recent Forbes article reported on the construction labor shortage, and went into great detail about how robotics is being used to help contractors not only fill the gap in labor, but also benefit from cost savings.

Many contractors' curiosity is playing a role in implementing robots to help bridge the gap in the existing labor shortage—specifically, excavation, drywall installation, painting and roofing. In a report, Transparency Market Research (TMR) shared that the global market for robotics in construction is expected to reach close to \$500 million by 2026. This report also cited improvements to safety, reduced costs, better accuracy and productivity as the reasons that this would be a positive change for the industry.

## So, how do these two things relate to robotics?

Construction Robotics is one company at the forefront of robotics with its bricklaying technology. While the technology does not replace the need for workers, it does reduce the number of people required and time needed to complete work. This makes robotics (and, I would argue, automation) more efficient and allows companies to potentially take on more work with less demand on labor.

In the same way that robotics cuts down on physical laborers, it also cuts down on waste. Precise measurements and materials mean less waste. This also means less costs for materials and the waste put into the environment.

# Tools, Equipment and Fleet Tracking

Hello paper, Excel and white boards. This trio has been the traditional way that construction companies track their tools, equipment and fleet. This type of tracking has been used by construction companies for a long time. Some have used these methods since they started. Some of the companies still using these methods probably aren't that "into" technology—many of them believe that these methods are enough.

A paid research study, sponsored by Tenna, found that 65% of contractors use a "tracking system" to track their assets. Questions on the accuracy of these systems' reliability and usability raise the eyebrows of many construction companies, especially when assets got "lost" when moving from one jobsite to another or in the yard, when manual updates are missed, or when assets are stolen.



Enter GPS devices in the mid-90s. From this point forward, there have been numerous innovations in GPS technology, which have pushed fleet tracking beyond the standard trio above. Why? Regulations. With GPS and telematics, electronic logging devices (ELD), hours of service (HOS) and others have essentially forced the adoption of construction companies to adopt the technology in order to adhere to the fleet mandates.



Other hardware technologies, like RFID, QR codes, Bluetooth, LoRaWAN, CAT-M and more, have been used to help companies gain insights into location, quantities, and other relevant information for their assets.

Still, today, many companies struggle with moving on from their old ways to the newer ones that clearly showed benefits. With these newer technologies, and updated laws and regulations, more efficiencies will come with more improvements.



## Present Day

Construction continues to grow and evolve to meet human needs and requirements. Likewise, technology continues to develop to enhance and expand our abilities. It's up to construction stakeholders to actively adopt technology before the gap is so wide that catching up will be impossible. Thinking about the costs associated with technology might evoke anxiety or an eye roll from many people. But, if you think back to the companies that once sold ice for ice boxes, they probably never thought they would be put out of business by the refrigerator.

## The Future

Technology in the construction sector is unstoppable. It will continue to expand and grow. Technology companies are being founded with construction needs in mind. Regulations will continue to expand, and new laws will be created. Safety will be at the heart of the need for technology.

Competition will become fiercer, as companies with technology will have more ways to calculate better job costs, give more accurate bids, have more control over labor, keep better data across their organizations and use far more resources to allow them to pivot and react faster than companies without it. The enhancements of equipment are moving toward a robotic hybrid—we will soon see hybrids of robotics and equipment surpassing the current intelligent versions we see today.

# Advice



Perhaps the industry's hesitation to embrace technology is being caused by the integration of these solutions into the complex environment that is a contractor's business. However, with tracking technologies, you will become more efficient and competitive. Just like the software and ERPs above, not all solutions “talk” to each other and the struggle to manage multiple vendors sometimes outweighs the benefit of the solution. Which is another reason we see the future moving to inclusive technologies that allow bird's-eye views of the business from all areas from finance to field. Time spent in different systems should not outweigh the benefit of the system itself.

## When looking to implement technologies ...

I encourage these three key points:

1. Integrations and open APIs
2. Security—specific to cybersecurity
3. Look for a partner, not a price. Chances are that a great price will hold no value when you experience a problem and no one is there for you to call, email or text.



# Conclusion

Construction is not as quick to adapt to new technologies—or as resistant to it as it once was. This seems counterintuitive, given the incredible advancements that construction (building materials, tools, equipment, technology) has undergone to build our modern-day skyscrapers and multibillion-dollar projects.

However, without the adoption of technology, many companies may find themselves unable to compete with savvy technology-focused construction companies that embrace change to solve for labor, tracking, time, and other costs to make their profits and companies grow.



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