

Clemson University

The Adaptive Construction Industry

AGC Allhands Essay

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## **Abstract**

The construction industry is an industry that always unites to find ways to solve problems. It is very complex and requires considerable organization, hard work, specific skills, and a whole lot of determination. In this paper, I will discuss three ways that the industry is making strides to make construction better and more efficient: (a) increased use of modular construction and prefabrication, (b) use of drones, and (c) Building Information Modeling (BIM) use. With the construction process becoming more and more complex, improving efficiency and safety has gained more attraction, especially when coping with fundamental issues such as labor shortage, resource limitations, and quality/safety assurance.

## The Adaptative Construction Industry

We all know there is a shortage of skilled labor in the market right now. The average age of skilled laborers is approximately 41 years old (DataUSA). How are we to keep up with efficiency and quality when there are less people to employ? That is a problem our industry is facing right now.

This shortage of young labor is due to a combination of many things, but I will mention a few that I have seen. Those include college being pushed on all young adults during high school, while opportunities of apprenticeships and things of the like are being discouraged. The uncertainty of location and long and unpredictable working hours are also making it hard for the younger generation to take on the challenges of construction jobs. As the shortage of labor has led to efficiency and safety being harder to obtain, the industry has found certain ways to adapt and improvise.

Personally, I have seen evidence of this labor shortage in my experiences with the industry. One evening at dinner in a conversation focused around faith in construction, I was talking with a gentleman in the home building industry. He told me that the average age of their carpenters was 65 and that they were always looking for more experienced carpenters. During my last internship with Baker Concrete, I saw a shortage of skilled finishing concrete workers. Baker did not have many in-house finishers, so the finishers were stretched thin when we had small and miscellaneous pours. The shortage is evident everywhere you look in the construction industry, and improvements in the efficiency and safety of construction processes would certainly help.

## Modular/Prefabrication Construction

One method used for combating the need for greater efficiency and safety in construction is greater use of modular construction and prefabrication. According to an article by The Modular Institute that was published in 2018, only 3% of all new buildings in America were using modular construction. In Japan, a modular home factory can have four employees build one home in a month. Consider that: four employees in a constant, safe, stable environment using the latest technology and having predictable hours and job location (Modular institute). These jobs still require skilled workers who know how to operate the machinery and know the process, but the process would be much easier to learn and master in a constant location and environment.

During my first internship with Miller Electric, I witnessed prefabrication on a large scale. At Miller, they had their apprentices, along with one or two experienced electricians, working in their shop to prefabricate conduit runs for mechanical rooms and for underground runs. What I saw was a mechanical room with the walls, conduit, panel boxes, and everything else prefabricated and made ready to be shipped to the jobsite to be put in. This way of doing work would save the company money and time, and make the job much safer by being performed in a controlled environment. One experienced electrician could teach four or five apprentices how to do the job. Prefabrication and modular construction can take people with no knowledge and teach them how to do something by doing it over and over again, becoming efficient in the process. In a controlled environment, the work will not change. Workers will be able to have a routine that rarely changes, and this is a unique opportunity to maximize safety and efficiency.

Prefabrication and modular construction is a way to make the construction industry appeal more to the next generation and improve efficiency and safety in construction despite a lack of labor. However, there are also some challenges to modular construction. One of the challenges is that a component built in a shop may not fit exactly right when it is delivered to the job site. Another challenge is the assumption among people that a modular-built component is of less quality. Also, with modular and prefabrication, more things will become automated, therefore some jobs will be lost. How will AGC help prevent people from losing jobs? I think they could ensure that even if some tasks become automated, there is still a need for human aid in the process. For example, machines will need human input to control the outputs, so people will still be needed. There may be a decrease in the amount of work done by a person, but the person will always need to be present and working. If managed correctly, modular and prefabrication will not lead to job losses, but will change the nature of the job from an onsite job to a job in a controlled environment.

I think AGC and other organizations can make modular and prefabricated construction more popular and accepted by backing programs and companies that use modular and prefabrication construction. With modular construction, AGC may have to expand its boundaries since modular and prefabrication fall under the umbrella of manufacturing and are not directly related to general contracting. If AGC helped make modular and prefabrication construction more popular, it could really aid in the efficiency and safety of the construction process. I personally think that modular and prefabrication construction could become more popular by having models built that are studied and put through certain conditions to see if the modular and prefabrication components would stand the test of time and the environment.

## Drones

The most important goal of construction is safety. Everyone in the construction industry wants employees to go home safely to their loved ones at the end of a job. Safety has improved greatly in the construction industry, but there is always room to improve.

One new technology that is helping address safety in construction, while making the process more efficient, is Unmanned Aerial Vehicles (UAVs) or drones. According to Drone Deploy, drones can improve safety by eliminating the need for a person to go walk a job site for inspection, safety checks, or punch list preparation. Also, eliminating the need for a person to walk on site can give a construction professional more time to get more things done, ultimately making him or her more efficient.

Drones can also help make preconstruction professionals more efficient. According to David Pratt, a manager in preconstruction with Robins and Morton, drones can be used to make estimating much easier, especially with grading. In a presentation to my Emerging Technologies class, Mr. Pratt stated that they can use the information from a drone fly-over on a site to measure how much earth will need to be removed or added for the building. This tool can make these professionals much more efficient with their time and improve the quality of their work.

Inspections for industry professionals can also be made more efficient and safer with drones. A drone can collect thermal information that can be used to see where or if the building has leaks. This process normally takes days to do, but with drones, an inspector can decipher and analyze the building quickly and much more efficiently. Also, a manager on-

site can use drones to check on the status of construction and can use the drones to effectively and efficiently find problems with the building that need to be addressed.

There are some challenges with drones. One challenge is the possibility for an accident when a drone is flying a site. If a drone fails and falls out of the sky, it could potentially hit and harm someone. Drones may not be able to be flown in windy conditions, therefore making the drone useless on a windy day. Also, there is some risk when using drones about the privacy of neighboring sites and homes. I predict that these challenges will play out and become less relevant as this new technology progresses and more and more people begin to use it.

AGC and other organizations can mitigate risks by providing employee training to teach industry professionals how to use drones in a correct and proper way. With the correct training, widespread drone use can become more common both to people already in the industry and to people who are entering into the industry. I personally have not used drones in my short time in the construction industry, but as they gain more and more popularity, I am certain I will use them at some point in the future.

## Building Information Modeling

The last technology I will cover that will help improve construction efficiency is BIM. BIM is a way for collaboration and coordination to take place in an efficient way. While BIM is a known software, I do not believe it is used to its full potential in the construction industry yet. This could be due to industry resistance, lack of ability for everyone to collaborate early on jobs, and the lack of training on how to use it.

According to Lead Innovation Management's article "4 ways BIM can boost the productivity of your construction business", communication and teamwork are keys to a successful project. With that said, communication and teamwork can be enhanced through BIM platforms like Navisworks, which can greatly improve efficiency on a jobsite. The article also says, "The main culprit in construction delays and mistakes is a lack of proper communication on the work site." So, if we are able to eliminate delays due to someone not getting information or having to wait on someone to provide information, then we can greatly improve efficiency with the amount of labor we have available.

BIM technology makes everything near-real-time. If there is a change to the drawings, the architect can make the change and everyone can see the change almost instantly. This means the professional in the field can see the change and notify coworkers so that they realize the change has been made. Also, an advantage of having 3D technology in the hands of field professionals is that they can visualize and catch problems well before the problems arise.

I have seen BIM technology used, but at a minimum. I have seen where clash detection is used, and it was seen that a sidewalk was drawn to run into the side of our building. This was a quick and easy catch, but if we wouldn't have had the BIM technology, the problem would not have been fixed as fast. I think the overall advantage of BIM use is the decrease in delays, which will in turn make workers and the process more efficient.

As with everything, there are some challenges that restrict the use of BIM. One of these problems is that Design-Bid-Build contracts are still prevalent in the industry today. With a Design-Bid-Build contract there is a limited opportunity for BIM to be used because there is limited true collaboration between the construction manager and the architect and

engineers. Without this collaboration, the construction manager cannot catch problems prior to the drawings being submitted. This way of doing work leads to unnecessary change orders and delays, which makes the industry less efficient.

Another problem is the lack of willingness to adopt these new technologies. As stated earlier, the average age of a construction worker is 42 years old, and chances are that this generation does not use technology frequently. If these experienced workers do not embrace the technology, then the knowledge will not be transferred down to the next generation.

I think one way to solve the challenges associated with this technology is to pay bonuses for utilizing technology. We know the extraordinary advantages of using BIM technology, and I think the best way to get the construction industry to buy into and use the technology is providing some kind of incentive for making use of the technology.

I believe AGC and similar organizations, should organize conferences and meetings to discuss the advantages of BIM technology use. These organizations should try to help companies that may be otherwise reluctant to invest in BIM technology explore the impacts it can have on the efficiency of our construction industry. AGC can also help promote more innovative executive/contractual platforms (e.g., design-build or CM- at- risk) that help with the use of BIM to its full capability.

In conclusion, the labor shortage and the cultural/generational change in our industry are serious, but we will adapt and come up with ways to keep on producing quality buildings. In this paper, I have discussed how modular construction or prefabrication can help improve efficiency to combat the labor shortage. I emphasized how drones can help with safety, inspections, preconstruction, and site progress updates. Lastly, I spoke about how BIM

technology can improve efficiency in the industry. I hope that all of these tools will be used to make the construction industry better.

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