WHITE PAPER

THE PATH TO LEAN CONSTRUCTION:

Using Wearables and IoT to Reduce Waste and Maximize Efficiencies



Introduction

The construction industry is in the midst of significant transformation. Despite improvements driven by the adoption of new technologies and the use of Big Data, construction firms continue to struggle with stagnant productivity, limited visibility across jobsites and on-going safety challenges. Whereas other industries have seen surges in labor productivity – for example, manufacturing experiences 3.6 percent annual growth and the overall economy grows at just under 3 percent – global construction labor productivity continues to idle at just 1 percent annual gains.ⁱ

To improve productivity and maximize project quality, construction contractors are increasingly turning to lean construction practices. This innovative,

collaborative approach to operating and executing projects is focused on continuous improvement by reducing waste and building with maximum efficiency. It has been shown not only to increase productivity but to give construction firms a strong competitive advantage. However, despite being accepted into the mainstream, many firms find lean construction methodologies challenging to implement.

Some firms experience lack of support at the senior management level; others experience budget barriers, since lean construction may require the adoption of new tools and processes; and others have to contend with challenges such as change management and a resistant work culture. In a recent survey by KPMG on technology in the construction industry, executives said their organizations were "held back by manual processes and multiple systems," and most executives said they lack the resources and skills to get the most benefit from their data."

One path to accelerating the implementation of lean construction practices is technology. The advancement of construction technology in recent years has prompted many firms to adopt Internet of Things (IoT) solutions, such as wearables and sensors placed around the jobsite, to measure and eliminate waste and enable a leaner jobsite.

This white paper explores the background of lean construction, the rise of innovative technology and real-time data, and where the two intersect.

61% of projects are delivered late, and 49% are completed over budget ⁱ

Lean Construction: a focus on continuous improvement

Lean practices were born on the Japanese Toyota production line. Toyota committed to years of continuously measuring and improving their assembly line processes in order to deliver the most quality cars to customers as possible. To achieve this, Toyota relied on two fundamental practices.

The first, referred to as "jidoka", was the act of stopping defective parts or products from being produced in real-time. The second practice, referred to as "Just in Time," was focused on producing only what was absolutely required to maintain a continuous workflow - nothing more and nothing less.

To stop defective parts and products from entering the market, Toyota adhered to the practice of stopping production entirely should an error be discovered. Everything would halt until the root cause of the defect was found and resolved. Toyota believed this was critical to making the "Just in Time" part of the process work; The company sought to produce perfect products – but only products that were needed, in the quantities that were needed – and achieving this meant eliminating inconsistencies and wasted time. ^{III}

It was not until the early 1990s that the term "lean" was applied to the construction industry. While construction is quite different from the manufacturing environment in that each project is unique and the jobsite is an unpredictable, ever-changing environment, similar to manufacturing, lean construction promotes the reduction of waste and enhancement in productivity and quality.

Lean construction strives for higher quality work overall and can be applied to all aspects of a construction project, from scheduling and talent to defects and communication, and relies on continuous process improvements with respect to time, budget and quality.

Waste - and why it matters

Waste in construction has been documented extensively, and although the numbers vary by report, the bottom line remains the same: there is substantial opportunity to eliminate waste and boost productivity at the jobsite.



Lean construction seeks to uncovered wasted resources - whether that's wasted time, wasted movement, or wasted human potential. In reality, waste on a construction project can apply to nearly every aspect of the business from over-production of material, time wasted waiting for the next step in a process, or people wasting time on site tracking down materials, people or information.

As a simple way to consider the key sources of waste, construction industry professionals often use the **"DOWNTIME"** acronym: ^w

DEFECTS:

Defects include anything not done the right way, the first time. For example, if windows for a building were ordered and produced in the wrong size; if the wrong color paint was applied; or if time was not built into a schedule for permitting.

OVERPRODUCTION:

Overproduction often refers to doing something before it needs to be done. While this may seem like a good idea at the time (tackling a task before its due), doing so without the full information or set of circumstances can lead to future rework and lost time down the road.

WAITING:

In this situation, workers may be ready to work but unable to start their job because they are waiting for a previous step to be finished, waiting for materials or tools to arrive, or are waiting for proper instructions.

NOT UTILIZING TALENT:

Construction professionals possess a wide range of skillsets, and not enabling them to work to their fullest potential - or not matching the right professional with the right job – results in subpar workforce performance that contributes to waste on site.

TRANSPORT:

Inefficiencies build up across jobsites when materials must be unnecessarily transferred back and forth or moved within a jobsite. "Transport" can also refer to data or information being shared unnecessarily or erroneously.

INVENTORY:

Wasted inventory refers to anything that is not needed immediately on a jobsite and can be raw materials or finished products. Having too much inventory on site results in wasted space, wasted time (to order the products, accept delivery, etc) and wasted dollars.

MOTION:

Jobsites are vast, physically evolving work zones that are rampant with unnecessary motion. Workers regularly lose valuable production time walking the site to find their tools, equipment or track down the people and information they need.

EXTRA PROCESSING:

This refers to features that are added (as well as time spent adding those features) that offers no real value to the end client and can include extra detailing on finished products, documents that were not requested and so on.

The benefits of Lean Construction

As projects become increasingly complex, and client expectations only grow, lean construction offers a way for firms to optimize resources, recover valuable production time, ensure quality, and remain competitive.

Construction firms that adopt lean construction principles benefit from:



Increased productivity: McKinsey & Company estimated that there may be a 50 to 60 percent productivity gain by leveraging multiple lean construction strategies simultaneously. ^v Lean construction emphasizes adjustments along the way to optimize time and resources, minimize downtime, and keep projects moving.



Improved jobsite safety: Lean construction practices are meant to simplify processes and to allow for more time and effort on preparation before ground break. With extra time to plan – ensuring the right safety tools, equipment and level of training before the project picks up – workers on site are set up for success and can focus on the task at hand. When things run efficiently, they also run smoothly and vice versa. In the literal sense, a lean, clean construction site also minimizes jobsite hazards or unsafe conditions that can lead to incidents.



Reduced costs: Producing only what one needs and reducing costs are central tenets of lean construction. With increased transparency into resource utilization and interaction, construction firms can unlock new efficiencies and save in all areas – from decreased equipment maintenance costs to fewer wasted supplies and recovered man hours.



Higher quality work: Lean construction calls for project teams to operate as a unit and rely on each other to complete a project successfully. In this model, every worker feels empowered to do their best and not only understands their role but has the necessary tools to complete the job. This also supports improved decision-making; when project leaders and teams are on the same page and working together, they can make timely, better decisions that help keep a project moving in the right direction.



Increased client satisfaction: In one lean construction simulation, build time was reduced by a factor of three to five using lean techniques. ^{vi} Simply put, lean projects are completed on time and within budget, which means increased client satisfaction.

Getting started with Lean Construction

The benefits of lean construction are clear, so why haven't more firms adopted the methods? While the concept has become mainstream in theory, many construction firms struggle to implement them in practice. Construction firms are up against budget and resource restraints and must secure both executive and worker buy-in. And while firms may understand the benefits of lean construction, many are unsure of the practical aspects of how to transition from existing, legacy practices to a lean model.

Construction firms looking to adopt lean construction methodologies should ask themselves the following questions before starting their lean journey:



Technology is one way to streamline the adoption and application of lean construction practices. The explosion of construction-specific solutions, spurred in part by record outside investment in construction technology start-ups, has resulted in the spread of Internet of Things (IoT) devices that help power lean construction practices and modernize the jobsite.

Technology as a driver of Lean Construction

The right digital tools can increase communication and collaboration on a jobsite, eliminate manual processes, minimize resource under- or over-utilization, and give workers hours back in their days.

Wearable devices and other sensor-based technologies automatically collect data from people, equipment, tools, materials, and the environment and send it to the Cloud where it is combined with intelligent software and advanced analytics for easy access, analysis and insights.

With a more complete, data-driven picture of site operations, worker movements, equipment utilization and overall safety, project leaders can make better, faster decisions and effectively communicate across project sites. Together, these tools are connecting the jobsite and different stakeholders, helping to enable a smarter, leaner ecosystem.



Recent reports state that the industry is more confident than ever in technology's transformative power. In the 2017 KPMG Construction Survey, **95%** of respondents said they believe technology will *"significantly change their business."* ^{Vii}

Data, Insights, Action: How technology can transform a jobsite

Triax, which develops and delivers IoT solutions for construction, connects the jobsite to enable smarter and safer projects. Its Spot-r platform uses a proprietary network, compact hardware and a Cloud-based dashboard to identify which workers and equipment are active on site, where they're located as well as any safety incidents that have occurred. With increased visibility and transparency into workers, safety and equipment across project sites, Spot-r helps:

• Streamline manual processes. Documenting exactly who is on site, when they arrive, and when they leave is critical to ensuring site control, managing labor, and effectively coordinating resources to keep projects moving. Paper timesheets are tedious, error-prone, and trap important information in a non-collaborative format that is difficult to compile, analyze, and report on.

The Spot-r Clip, worn on the waistbelt of every worker on a project, automatically picks up the Spot-r network when workers arrive, checking them into the site 12x faster than paper sign-in sheets. On a 24-month project with an average of 100 workers, Spot-r can recover roughly 5,136 production hours – almost \$225,000 in wages.

 Identify site-specific sources of waste:
Underutilized man hours – and the larger variability of construction workflows – can be reduced with technology that is becoming widespread at the jobsite. Spot-r allows professionals to drill into specific areas of waste, taking a proactive approach to identifying bottlenecks and optimizing operations – versus guessing or relying on physical observations or anecdotes.



For example, on a 12-story construction project, Spot-r identified significant non-tool time – nearly one-fourth of the day. In this example, workers were losing valuable time in transit. Insights revealed by Spot-r allowed the contractor to improve the alignment of material stockpiling closer to the area of work and to further allocate receiving and distribution staffing according to skill sets.

• Increase jobsite safety: Increased visibility across a jobsite can close the gaps on safety. Spot-r automatically detects worker falls, triggering a real-time notification to safety personnel, and allows workers to report hazards or unsafe conditions from anywhere on site. Real-time feedback allows safety leaders to ensure the necessary medical attention and also provides an opportunity to assess and control risk exposures for others on site. Aggregate safety data can identify trends, providing safety leaders with an opportunity to modify behaviors and reinforce proper procedures at the jobsite.

In addition, the Spot-r EvacTag triggers a flashing, blaring evacuation alarm across the jobsite, reducing evacuation drill times by 72% compared to blowing an air horn on each floor.



For construction firms looking for a starting point in lean construction, the right technology tools offer a way to streamline communication and enable fast gains in data-gathering, jobsite visibility and safety. Spot-r by Triax delivers one platform that is capable of achieving many benefits of lean construction.

To learn more about Triax and how Spot-r can help you achieve a lean construction jobsite, visit www.triaxtec.com/lean.

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