Midstream Oil and Gas Construction: Getting the Basics Right

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The U.S. midstream oil and gas construction industry has experienced tremendous growth over the past decade, forcing industry stakeholders from across the nation to work together under extreme environmental conditions, compressed project schedules, persistent labor fluctuations and ongoing cost pressures. Despite collapsing crude oil prices and declining natural gas prices, the midstream oil and gas market is poised for continued strong growth – mainly due to the huge transportation demand for getting oil and gas from the wellheads to end users. Within the pipeline construction sector, planning, designing, and building activities remain historically high and are expected to remain robust for the near future.

Though business remains strong, many oil and gas construction projects continue to be plagued by escalating cost overruns, project delays, mounting risks and declining productivity — particularly on mega-projects. Indeed, what we have is an industry imbalance shaped by volatile market cycles and the resulting decades-long push and pull among owners, engineers and contractors.

"The industry hasn't been able to find a good equilibrium where all stakeholders get what they want," stated a large global engineering firm's director of construction.

In FMI's discussions and project work with industry leaders in the midstream oil and gas construction space, we have found that many construction firms operate in a highly chaotic business environment and don't understand the basic "blocking and tackling" of construction. In this paper, we will explore the basic preparations needed to get a company on track to tackle the next large oil and gas boom and provide straightforward tips for achieving this goal.

Finally, a case study on JV Driver (a Canadian industrial construction company) and one of its preferred suppliers, Intelliwave Technologies Inc., highlights how a creative partnership has resulted in the development of innovative tools to improve site logistics and reduce rework through effective equipment and material tracking in the oil and gas sector.

The Perpetual Productivity Challenge: An Old Story

The U.S. construction industry isn't readily associated with words like "cutting edge" and "innovation," particularly when compared to high-tech industries like aerospace or biotechnology. In fact, the construction industry in the U.S. has posted a lengthy history of productivity decline, according to numerous industry research studies.

Matt Stevens, president and management advisor at Stevens Construction Institute, Inc., calculated the U.S. construction industry's labor productivity from 1993 to 2013. He stated, "Generally, the negative changes over the last three decades have outpaced the positive changes. Lack of consistent engagement by construction project stakeholders to each other has made

project information flow unevenly, causing chaos. The contracts continue to be draconian, so each party acts with as much legal insulation as possible."[1]

Though one could debate the many reasons for ongoing productivity decline, it is important to keep in mind the true meaning of productivity. At its most basic level, productivity describes a relationship between physical inputs and outputs. The formula is disarmingly simple:

Productivity = Units of output/Units of inputs

A productivity index highlights the ways in which a company can extract an increasing number of units of output per labor hour, per pound of materials or per machine. Traditionally, productivity in the oil and gas construction industry has mainly focused on direct labor. Given the continuing productivity decline, however, industry leaders are starting to question some of the fundamental business practices that the industry has taken for granted for decades.

"We need to move away from Einstein's definition of insanity: doing the same thing over and over again and expecting different results. We just have to try something completely different," stated one supply chain manager of a large Canadian oil sands operator.

In his recent article, Bob Prieto, senior vice president at Fluor Corporation, confirmed this opinion, "The persistent performance challenge drives me to question whether the theoretical foundations of project management theory – as it is widely practiced today – are sufficient to meet the challenges of large projects…. Perhaps large projects, and especially large multi-project programs, require a different theoretical foundation than the traditional theories that underpin our management practices…"[2]

The productivity formula raises the question of whether the construction industry as a whole needs to fundamentally rethink the "units of input" by exploring new and groundbreaking business practices. For example, FMI has started to see progressive midstream oil and gas construction firms invest heavily in building project management capacity by innovating in areas such as prefabrication, technology, knowledge management, and communication, to name a few. In the coming years, oil and gas owners will likely focus on construction companies that can limit rework orders; optimize labor, equipment and materials scheduling and use a modular approach to project management. These tactics will help improve productivity and manage costs in a tight labor market – two key concerns for owners in this sector.
Don Thorn, president at Welded Construction, stated, "We're seeing some advancement of processes and equipment through the use of technology. The long, large-diameter pipes will probably be done with mechanized welding in the future, and that will certainly help with the craft shortages to some extent. As a result, we will need people with experience utilizing mechanized welding equipment and increased training activity from our labor forces."

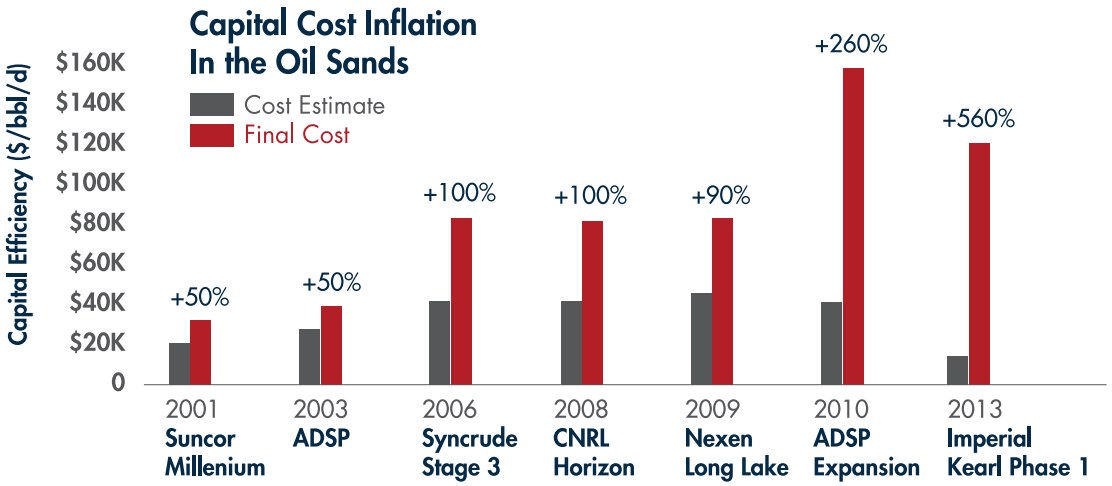
In Canada, oil and gas companies and oil sands operators are overcoming productivity issues by investing more heavily in innovative technologies. In a recent FMI research study focused on the Alberta oil and gas and oil sands industries, conversations with owners, EPC (Engineering, Procurement, Construction) firms, and energy infrastructure construction companies revealed some widespread dysfunctions among project stakeholders, which have resulted in significant project cost overruns and low project performance on numerous high-profile projects (Exhibit 1).

In light of these industry challenges, forward-thinking companies are looking at new ways to collaborate

[1] Construction Productivity in Decline. National Society of Professional Engineers. June 2014. The Magazine for Professional Engineers.

[2] Bob Prieto. Is it Time to Rethink Project Management Theory? PM World Journal. Vol. IV, Issue III – March 2015.

Exhibit 1. Estimated Versus Final Cost for Oil Sands Projects in Alberta.



Source: Alberta Venture Magazine. Why more isn't better when it comes to the oil sands — and how embracing that view could save the province, and industry, billions of dollars. Dec 16, 2013. Max Fawcett

with project partners to improve overall project performance (and ultimately, corporate profits). The following case study highlights an innovative partnership between two firms – JV Driver (a Canadian industrial construction company) and Intelliwave Technologies Inc., one of JV Driver's preferred suppliers – and shows how these two firms are dramatically improving site logistics and reducing rework through effective equipment and material tracking in the oil and gas sector.

Redefining Field Logistics in Canada's Oil and Gas Industry: A Case Study

Paradigm Shift

Since 1989, JV Driver of Canada has been providing industrial construction services to the oil and gas, energy, petrochemical, forestry and mining sectors. Over that 25-year span, the company has come to appreciate the value of innovation and technology in ways that many of its competitors have yet to recognize. "Innovation is definitely a big part of what we do," said Dale Beard, president, Intelliwave Technologies Inc., one of JV Driver's Preferred Suppliers. "We're changing the way construction is done and using innovative technologies that have already been tested by other industries – not just in construction."

In the construction world, approximately two-thirds of projects' costs are spent on materials and equipment (30 percent each); the remaining 30 to 40 percent is spent on labor. Therefore, being able to manage and track these resources becomes critical in saving cost and time. "Construction has typically been very chaotic in terms of handling and tracking materials just because there are long lead times on parts," explained Beard. "Often there are multiple contractors involved and a lot of different hands in the pot, so to speak."

To overcome that obstacle, JV Driver turned to Bentley and Intelliwave Technologies to create an innovative solution that would allow them to successfully complete projects using fewer crew than usual. In response, the two software companies developed a revolutionary site management tool that integrates Bentley's ConstructSim workface planning software with Intelliwave SiteSense® RFID sensor technology. SiteSense collects RFID tag data thousands of times per tag per day by installing " ROVER" (SiteSense RFID vehicle readers) onto operational forklifts and other construction equipment which allows SiteSense to continuously read the RFID tags whenever ROVER drives within 1000 feet of each tag, whenever the forklift is performing its daily duties. This groundbreaking tool enables effective tracking, managing and installation of pipe and other tagged equipment pieces and helps crew foremen lessen redundancy and rework.

W.E. (Bill) Elkington, Chairman of JV Driver, stated, "As an industry, we need to continuously improve productivity. New technology can help with this substantially. We find SiteSense has a significant impact on the ability of the project to know where all of its materials are at any given time, and to locate that material effectively. This reduces material handling costs and improves tool time and productivity."

Wanted: Better Site Management

According to Beard, JV Driver's innovation efforts centered mainly on site management, although the company does begin identifying parts at the fabrication stage. For example, some of its larger fabricators pre-tag parts as they are made – a move that makes those parts visible to the contractor via its SiteSense web portal. "That's a component of our collaboration effort," said Beard. By utilizing SiteSense, JV Driver gains access to real-time information and answers to questions like: Is the part in production? Has it been delivered to the jobsite? Was it installed? This intelligence helps the construction firm better schedule its human resources and work lineup while also facilitating worker-to-worker communication regarding parts availability and status.

"Our clients can see within a few minutes whether they have the parts they need to build out their packages and get the work completed," said Beard. "That capability has dramatically decreased the planning and prep time, and the inefficiency of different crews or indirect labor looking around for their parts." The same concept can be applied to the equipment used on the jobsite, where generators and welding machines are often misplaced and/or sitting idle. "Workers can spend hours looking for the machines that they need on site," said Beard. "Simply being able to track the equipment and know where it is at any given time has helped out quite a bit."

Training the Troops

JV Driver has been using SiteSense across multiple projects and is already seeing the benefits of improved site management. Like any new initiative, this one has required a shift in mindset on the part of the company, its managers and its crew workers. "People are generally resistant to change," said Beard, "and some will hold off as long as they can before being forced into it." In many cases, that extra nudge results in an "ah-ha" moment and prompts users to think: Well, why haven't we been using this from the beginning?

"Some crews out in the field want to do work as usual," said Beard, "because they've been doing things a certain way for 20 or 30 years." To break through that barrier, Intelliwave's Field Engineers educate and train work crews on an ongoing basis. "JV Driver could be onboarding 100 new workers every week due to the size of their projects as well as to high industry turnover," said Beard, "so we really have to do this on an ongoing basis."

As an element of that training, the engineers help workers get through the "we think this is broken" mentality and show them that in many cases the technology tools just aren't being used properly. In

other instances, users simply don't understand the details behind the technology itself – or, they have preconceived notions about its capabilities. "We've tried to develop our systems so that they work behind the scenes and deliver on their promises," said Beard. "Still, aligning expectations across the owner, EPC and contractor levels can be challenging."

Measuring the Benefits

In 2008, The Construction Industry Institute (CII) examined the number of indirect man-hours (not related to actual tool time — such as building the plant) saved by the use of radio-frequency identification (RFID). Using boiler management as the reference point, the organization found that the average worker using manual systems spent 40 minutes searching for each of the 1,000 parts that are used to make a boiler. Those using RFID took just four minutes to locate each part. "That's a 10:1 or better ratio," Beard pointed out. "Inefficiencies in materials management during construction can delay the start-up of a new facility, and the daily loss in production due to a slipped construction schedule can result in mega cost over runs."

When assessing the progress JV Driver has made by leveraging innovation, Beard said owner buy-in has served as a key ingredient in the initiative's success. "When an owner takes it under his wing and really supports the technology as a key priority for their project, the more the EPCs and contractors buy into it," said Beard. "This is important because if there's no buy-in at the lower levels with the users, then essentially you've bought a technology that's going to be shelved."

Elkington added, "Leveraging SiteSense on materials and expanding that into personnel and equipment tracking has improved our ability to get work done. This product will revolutionize how everything on a construction site is eventually tracked and traced. It reduces man hours, helps improve safety and improves dollar efficiency."

Five Business Recommendations for Midstream Oil and Gas Construction Companies

In FMI's discussions and project work with industry leaders in the midstream oil and gas construction space, we have identified five areas construction firms must focus on to remain competitive in the future. They are:

1. ***Standardize and integrate your processes.*** More often than not, we see midstream oil and gas construction firms grappling with a multitude of project delivery models, tools and inconsistent reporting and billing mechanisms — all of which render daily business activities very challenging. Consequently, oil and gas construction firms must start looking into standardizing, codifying and documenting project management practices across the organization. This approach to standardization doesn't necessarily translate into one single project delivery method, but rather a portfolio of consistent processes for managing different types of projects across the firm.

   Matthew Pfohl, executive vice president at Sopris Systems, stated, "One of the big challenges we see in the oil and gas industry is: 'How do we get 15-20 different project delivery models and leaders to agree on consolidating business practices into three or five methods so that when we're delivering services on a global level we're providing the same level of consistency across all practices.' Although implementing enterprise applications is a critical step, business process re-engineering and organizational change management practices are essential: it's not as much totally redefining and restarting processes (even though that is potentially a situation); it's really understanding best practices within the organization and trying to build standardization and automation around them."

   Standardization is also a key step towards streamlining processes and improving communication and collaboration — all of which are critical for managing construction projects. Now is the

time to plan and invest in collaborative web and mobile-based technology platforms that can take advantage of connectivity delivered through cloud-based applications. Having the ability to deploy and use interoperable technology applications can dramatically improve interactions between the job site and back-office operations while also improving overall company performance.

2. ***Get serious about your IT budget.*** The construction industry is notoriously slow to adapt and change. As a result, it lags behind other industries in technology adoption by a fairly wide margin. According to a recent study conducted by JBKnowledge (in partnership with CFMA and Texas A&M University), "over 30% of construction companies surveyed said that their 2014 IT budget as a percentage of 2013 corporate revenue (not building volume) is less than 1%."[3]

James Benham, co-founder and CEO of JBKnowledge, stated, "40% of our survey respondents don't even have an IT department. That's like letting a high school student operate as your CFO. Deep down, most industry executives don't take technology seriously because they don't believe that it delivers real ROI."

Take a serious look at your company's technology infrastructure and lead from the top in technology adoption. Make clear to your employees that you value technology as a critical long-term investment that will shape the nature of your business in the future. Start by forming a real IT department, assign a realistic budget, hire professionals, and then include those team members in key strategic conversations. If you can't afford to hire full-time staff, find a technology outsourcing company that can provide advisory and application services that help serve your business (e.g., BIM, material and equipment tracking, etc.).

3. ***Rethink your talent pipeline.*** The recent expansion of the U.S. oil and gas industry coupled with the retirement of many experienced supervisors is causing overstretched construction firms to rethink their recruiting, training and succession plans. Successful companies are developing comprehensive construction management training and knowledge transfer programs, shifting knowledge from senior (and soon-to-be-retiring) employees to the next generation and leveraging organizational expertise and best practices across the business.

In addition, FMI recommends searching outside the industry for people who have solid business, leadership, and finance experience. FMI consultant, Dustin Bass, explained, "Instead of recruiting engineers, consider recruiting business school graduates or construction management graduates. We need project CEOs — individuals who possess the business acumen to run a substantial portion of work, manage and lead a workforce in such a way that they can achieve their maximum potential — no matter the size and scope. That said, these types of employees will need an in-depth understanding of construction business and knowledge of how to increase productivity and performance."

4. ***Build your next generation leaders.*** Fast-track leadership programs are becoming critical as experienced craft workers move into leadership and mentor roles, with training of less experienced employees occurring within a very short time frame. As one industry executive explained, "With the limited amount of skilled labor available, we took many of our company's highly skilled craftsmen and turned them into supervisors to help manage less experienced workers. These skilled craftsmen went from being welders one month to foremen the next month. This doesn't necessarily mean they're good-quality supervisors; leadership and mentoring skills are very different from technical expertise."

Intentional and individual development of a leadership candidate pool ensures that the necessary talent is available and at the highest level of preparedness when called upon. Just as the organization must develop a long-term vision, those individuals need to work toward a long-term development goal that yields a return on investment for leadership and responsibility preparation.

[3] The 3rd Annual Construction Technology Report. JB Knowledge in partnership with CFMA and Texas A&M University. 2014.

"Many companies that we've come across in the midstream oil and gas market don't understand the basic 'blocking and tackling' of construction. There is a real lack of project management skills in the industry right now and executives are using this slowdown to focus on developing those skill sets."
— Dustin Bass, FMI Consultant

5. ***Understand "incremental economics" like revenue, margin and overhead.*** A highly competitive landscape has transformed standard estimating procedures into a game of marksmanship. Understanding the total costs for each project, and getting a picture of how the costs break down, are the first steps in knowing where and how you can improve profit margins. Having a solid hold on construction costs, fixed-wage regulations and subcontractor and supplier rates is also important, both from a qualified bidder standpoint and from a strategic standpoint.

In another vein, deep knowledge of estimating can provide you with new ideas for being more productive and alert you to early warning signals that subcontractors might be in trouble. Understanding the risk brought on by your subcontractors and your employees has become a critical responsibility in today's risk-averse oil and gas construction industry.

Conclusion

As companies like JV Driver have already discovered, innovation is a key requirement for leading construction firms that want to break out of the traditional ties that bind them to mediocrity within the industry. With two-thirds of the typical project costs spent on materials and equipment, and the remaining 30 to 40 percent allocated to labor, construction firms have to tighten up their operational strategies and procedures or risk being left behind.

As the U.S. midstream oil and gas construction industry continues to post impressive growth, everything from high cost overruns to delayed projects to declining productivity will take a toll on industry bottom lines. By focusing on key metrics like the productivity formula, and by embracing new, technology-centric methods and strategies, companies can implement groundbreaking business practices that they'd never thought of before. This, in turn, will help the most progressive midstream oil and gas construction firms improve productivity and manage costs in today's extremely competitive, labor-constrained business landscape.

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