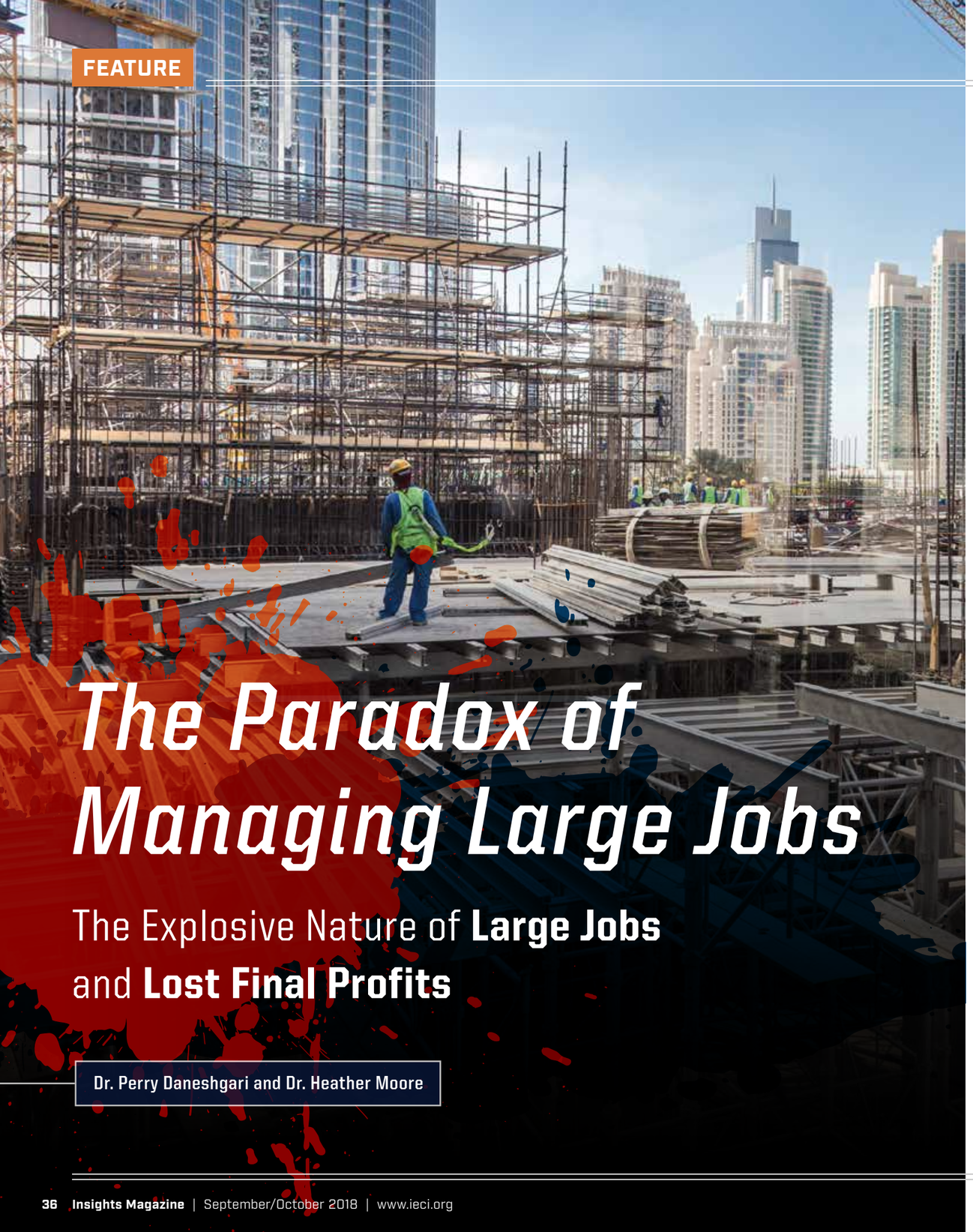

FEATURE

The Paradox of Managing Large Jobs

The Explosive Nature of **Large Jobs** and **Lost Final Profits**

Dr. Perry Daneshgari and Dr. Heather Moore

Every electrical contractor dreams about "The Big Job." The prestige and notoriety that come with it can springboard a company into growth, or at least provide a nice chunk of change in one fell swoop; or not. These jobs can also bring disastrous effects, worst of which is bankruptcy. The explosive nature of large jobs is what makes them difficult to manage. The amount of information and degrees of freedom to manage is exponential compared to a "normal" job. It becomes virtually impossible to fly by the seat-of-the-pants because the job cannot be managed with the traditional project management approaches. It requires using a data-driven approach to manage lead and lag indicators, and a company-wide team effort to support the job. No one project manager can do it alone, lest they become victim of the Killer Job that eats away all of the company's profits for an entire year. Many project managers have tried, and somewhere mid-stream in the project, we have received a call/cry for help, to implement the principles and practices that are listed in this article.

Even though a large job is nothing but a lot of small ones, over half of the electrical contractors in the United States and Canada are smaller than $5 million in annual revenue – and 82% are smaller than $10 million. So running any job larger than $10 million is analogous to running a full-blown company, which requires comparable skill and knowhow as managing a company. Issues such as management of:

1. Resources
2. Schedules
3. Purchases
4. Billing and cash flow
5. Productivity
6. Subcontractors
7. General contractors
8. Turnover
9. Personnel issues
10. Cost
11. Lack of visibility at the task level
12. Coordination with other trades
13. Material price escalations
14. Jobsite logistics, including tool and material movement

become uncanny and require a different level of feedback, response, and agility in the day to day events. The tools required for management and mitigation of the technical, business, and integration risks have to be in place, trusted, and used for navigation throughout the project.

Plans for organizational structure, reporting structure, information flow, and other elements which are the heartbeat of companies comparable to this size of job must be made. However, the tendency is to just treat the job as "a job" and forget its magnitude, which can lead to major problems and financial loss. This article will introduce the tools required to manage the risks and potential pitfalls in focusing on one indicator only.

We have implemented Agile Construction® on a couple handfuls of projects between $25 million and $650 million over the past decade, from sports arenas to high-tech production facilities, and from convention centers to datacenters (see Table 1). None of them were easy to manage. Managing any project requires risk management. But on large projects, there is typically more risk present, particularly integration risk. Below is a codification of types of risk to consider in managing the project.

1. TECHNICAL RISKS – which are the electrically-driven risks such as:

a. Code
b. Inspection
c. Design, including architectural, structural, and MEP systems
d. Installation requirements
e. Durability testing and QA/QC
f. Contamination testing
g. Electrician's knowledge
h. As builts
i. Submittals

This risk is managed with industry standard procedures, processes, and tools.

2. BUSINESS RISKS – which are monetary risks such as:

a. Invoicing
b. Timesheets
c. Material purchases
d. Subcontractor's payments
e. Bonding
f. Insurance
g. Change orders
h. Cash management
i. Project organization structure and personnel
j. Profitability

3. INTEGRATION RISK – which is defined as bringing and aligning all the pertinent elements needed to install the job such as:

a. Manpower
b. Material
c. Money

Any mishaps that happen at the intersection of the three elements listed above are due to integration risk, including but not limited to:

- Coordination with other trades for design, layout, and physical work space

TABLE 1: One small section of the WBS for a large job

Large Jobs between $25 million and $650 million

Project Name	Budgeted Hours (from WB	Spent Hours	# Change Orders
New University Building	45,946	71,273	405
Convention Center	270,390	291,153	668
Sports Arena	183,200	199,277	710
High-Tech Company HQ	36,556.00	53,421.25	- N/A
Datacenter	95,532.65	131,004.00	971
Military Lab Facility	417,632	521,512	
Commercial High Rise	N/A	N/A	N/A
High Rise Condos	59,577.00	59,589.00	19
New Outlet Mall	53,424.19	67,755.75	517

- Scheduling of work
- Reporting on work and quality of work
- Response to changes onsite
- Material problems, including logistics and laydown areas
- Managing requirements of the daily work; the entire project; the company; and the environment, such as GC, engineers, and architect/owner

Work Environment Management (WEM®) is the tool used to manage the integration risk throughout these large projects. WEM® relies primarily on usage of the ASTM standard for construction: Job Productivity Measurement, JPROJECT MANAGER (ASTM E2691), as a feedback mechanism.

Starting with the project schedule the following elements of integration are set in place, which are all part of the Process of Project Management (PoPROJECT MANAGER):

- General's Scheduled-Plan (GSP)
- Work Breakdown Structure (WBS)
- JPROJECT MANAGER (ASTM E2691) – Set up, usage, and reporting
- Electrical Scheduled-Plan (ESP)
- Three weeks look ahead Scheduled-Plan
- SIS® – Short Interval Scheduling – set up, usage, and reporting
- Change management process and protocol
- Project audit review process

The WBS is critical for the project team to see the project from the top-down organizational structure, and the bottom-up identification of the work. By putting together a WBS (see Figure 1), the jobs become visible and manageable in smaller increments. A few keys to developing WBS for a large project learned over the years are:

- You don't need to break the entire project down to the lowest level up front. Make sure the top 2 or 3 levels are broken down for the entire project, and the detailed breakdown is done for the parts of the work that are happening in the first few months. Then set a scheduled date to add detail to the high level breakdowns ahead of when the work will begin.
- It is helpful to have the structure of the WBS align with the GC's or customer's schedule. This is helpful for updating the electrical scheduled-plan.
- Expect to revisit, and revise, the WBS several times throughout the project. Especially large and long duration projects morph and mold as they unfold. The new-found knowledge and view of the project should be incorporated into ongoing WBS revisions.
- Involve the entire project team to develop the WBS. One foreman and one PROJECT MANAGER cannot run a large project. The entire field crew, project management support team, and input from subject matter experts not involved with the project should be involved to maximize the learning.

Once the WBS is created, the JPROJECT MANAGER baseline can be established.

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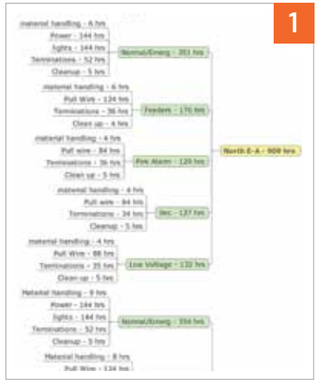
This allows the Project Manager to track job productivity on a weekly basis; depending on the size on a daily basis. Monitoring productivity on a $50M+ project is an arduous task, but it is a "must" to manage the amount of information and work on a job that size. Measuring the monthly cost-to-complete or WIP reporting process is necessary, but not sufficient to provide lead indication of deviations from expected outcome.

In addition to the JPROJECT MANAGER setup, establishing Short Interval Scheduling (SIS®) tracking is critical for projects, since it would be physically impossible to know what obstacles 100+ electricians are encountering on a daily basis. The process requires a daily schedule from each field leader on the project. It should be a quantification of tasks that can be evaluated for completion at 2:30. Then, whatever is not done is explained with a reason code that is tabulated and analyzed daily and weekly by the crew and project team. With the JPROJECT MANAGER and SIS® tools in place, the job becomes more visible for tracking the special and common causes of variation on the project's productivity. A weekly review of both measurements are then setup involving the project team plus company executives and supporting departments.

Figure 2 shows the pattern of productivity differential on several large projects ($50M) tracked with JPROJECT MANAGER. MCA, Inc. has found this pattern predictable, because of the unpredictable nature of so much work and information. The productivity at the beginning of these jobs is all over the map due to the amount of energy it takes to setup, plan, mobilize, and learn in the first 25% of the job, especially if it is the first large job a company has done.

In addition to weekly reviews of productivity trends and obstacles, the foreman can use the original WBS and weekly input from the JPROJECT MANAGER observed percentage complete to develop an ESP that coincides with the GSP. Figure 3 shows a sample of this type of connection, which shows the



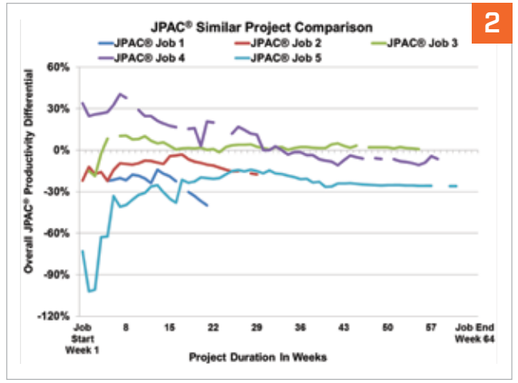
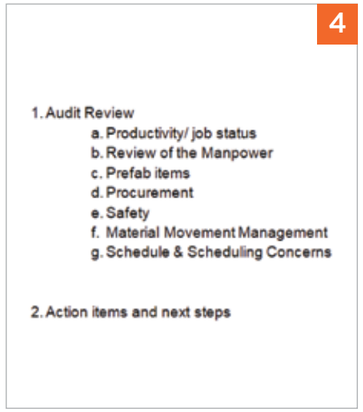


FIG. 1: One small section of the WBS for a large job

FIG. 2: Productivity Trend Comparison of Projects over $50 million

FIG. 3: Sample excerpt from electrical scheduled plan, tying in with JPAC®

FIG. 4: Audit Agenda



General where issues impacting their own work, as made visible with JPROJECT MANAGER and SIS®, would end up delaying starts of finishes of electrical tasks and therefore could delay the overall job. In addition, changes in the GSP could be monitored for their impact on the work. The schedule also integrates the required prefabrication and vendor logistics support elements so all parties supporting externalized work® can be in sync with the overall project schedule

The project audit process is also an essential component of managing large projects. Audits should be done every 25% complete with the work. Figure 4 shows a suggested list of topics for review in the audit and suggested attendees.

Running a large project is not unlike running a company, with the difference of pace and the amount of risk involved in one large undertaking. The technical and business risks alone on these large jobs need to be planned and managed with a company's good people and good procedures. However, the integration risk is the largest unknown and has the fewest tools available in the industry to manage. Setting up the WEM® tools and measurements is a first step to making this risk visible increasing their response time to the information coming from the tools.

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