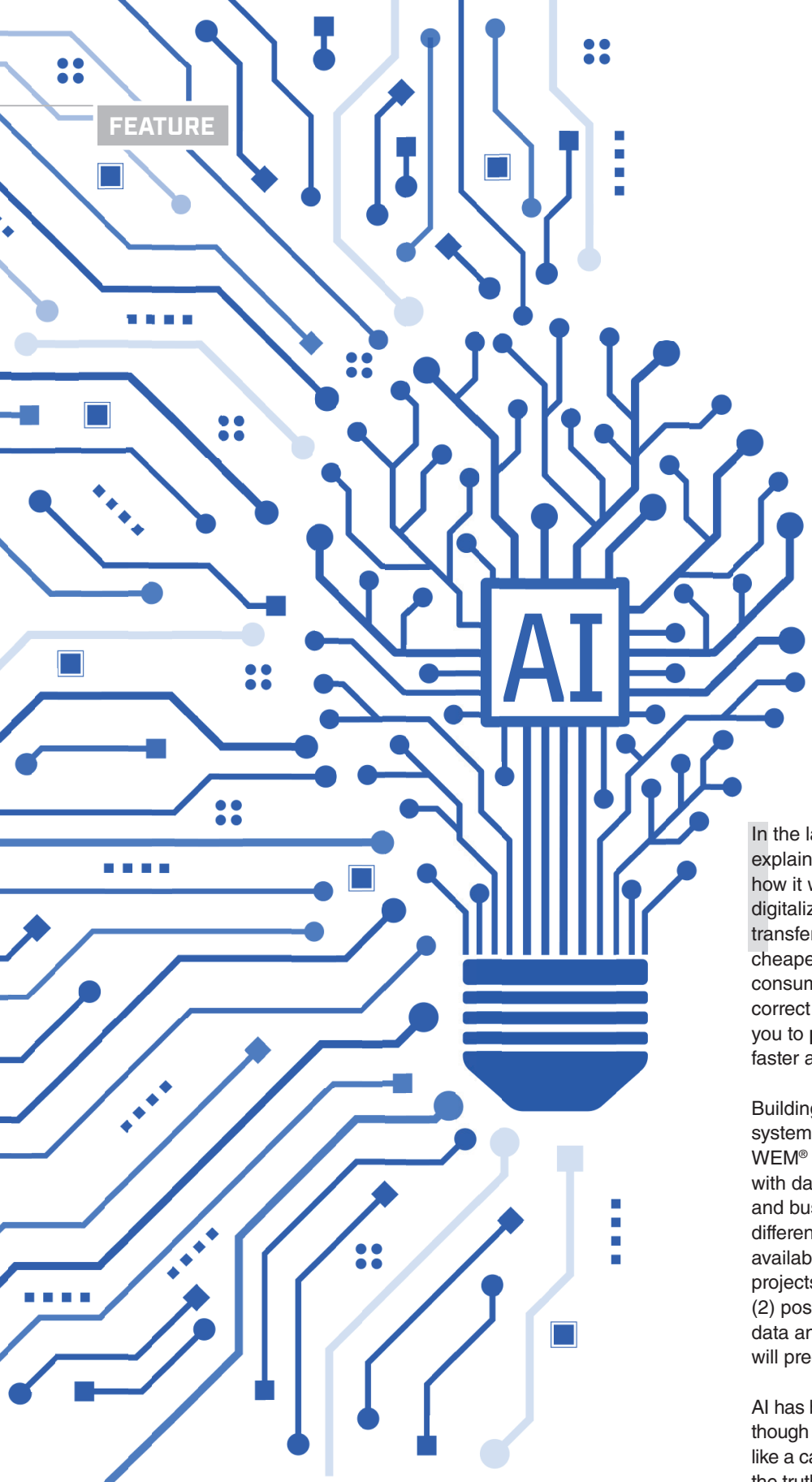
FEATURE



Using AI to Predict, Prevent, and Project Your Job Outcomes

In the last issue of IEC *Insights* magazine, we explained what artificial intelligence (AI) is and how it will unfold in construction, starting with digitalization of process and information for transferring electrical "know-how" into faster, better, cheaper project outcomes both for construction consumers and construction businesses. With the correct application and sources of data, AI will allow you to **predict, prevent, and project** job outcomes faster and sooner than ever.

Building on the industry's well-known accounting systems, we are actively implementing AI into WEM® data structures, to make the projects "talk" with data, based on each company's unique history and business model. This is a unique advantage, different than just using ChatGPT or other publicly available AI platforms that (1) do not have your projects or company history at their fingertips and (2) pose a risk of publicly exposing your company's data and information. This article will explain how AI will predict, prevent, and project.

AI has become a common term thrown around as though it's a well-known product, an object, something like a car or a boat, but nothing can be further from the truth. AI is a concept that has roots planted many decades ago. Early AI applications were well known chess games and industrial robotics, eventually

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coming into the home as the Roomba. With social media gaining voluntary access to people's personal interests and habits, AI evolved into a business tool. Along the way the scientific community adopted the benefits for datamining for predictive services such as weather, earthquake, and tsunami forecasts. NASA was early in autonomous vehicles applications with Mars rovers. The list goes on, and is expanding every day, but what is AI in construction? How does AI help the contractor?

As you can see from the evolution of AI applications there are several areas where prediction is beneficial to the contractor. Suppose you had a crystal ball that could predict whether you would make money or lose money on any project at the start of the project? Suppose you could determine whether you would win a bid, or at what price you could win an award, before you spent countless hours estimating the project? What if you could anticipate labor absenteeism or availability based on factors that are nearly invisible to you today? Would that be of interest to contractors?

MCA began decades ago working to develop **predictive** models and tools for construction. The earliest example is known in the industry as Job Productivity Assurance and Control (JPAC®), ultimately becoming the industry's first standard for Job Productivity Measurement (ASTM E2691). JPAC® was built to allow the project team to create a baseline plan, and breakdown work into tasks that could be easily assigned and monitored to produce a predicted outcome. Weekly progress updates in a simplified format allowed the end of job productivity performance to be predicted. Later versions have included projection of labor cost which has led to profit predictability with better than 95% accuracy. **Figure 1** shows the relationship between JPAC®'s measure of "productivity differential" (how far ahead or behind you are from planned productivity) and project profitability. This represents a single example of JPAC® data mining for predictive purposes and applies concepts of AI to benefit the individual contractor. Another, and broader, example occurred in 2020, when JPAC® accurately predicted the industrywide productivity impact of the COVID-19 pandemic, less than 72 hours after the start of the first nationwide, two-week shutdown. This was made possible due to the decades of data representing millions of measurements of construction installation work.

For more information about how this process works there have been several IEC *Insights* magazine articles addressing this evolution. Look for "How to Manage Your Job Using Work Breakdown Structure" (2014, Dr Perry Daneshgari and Dr Heather Moore). Also, review "Application of the New ASTM Standard for Job Productivity Measurement in Construction" (2011, Dr Perry Daneshgari). Or "Can the Future be Predicted? Of Course it Can! (2024, Dr Perry Daneshgari and Jennifer Daneshgari).

The ability to predict project outcomes using JPAC® always has been available; however, with enhancements of AI, we are improving the models with project-specific, company-specific, and market-specific data. Building on this improved predictability, you also need a system that will help **prevent** unwanted project outcomes and mitigate risk. This is where AI can really shine, by suggesting actions to take when things are not going as planned. For example, we have embedded our own experience in productivity measurement and monitoring, to suggest things like:

1. Is there a particular labor code that is problematic in this job, or all jobs?
2. Is there a process missing or that needs improvement, such as getting a job to closure when it sits at 95% complete for months?
3. Is there training needed for a new foreman who does not have experience in WBS?
4. What data can you use / take with you to explain impacts happening from other trades or the GC?

You can predict the future, use strategies to **prevent** risk, but until the job is really "done- done," it can seem impossible to know where the chips will fall. However, using AI and once again, relying on WEM® data sources, you can **project** (forecast) where projects will finish. Over the past few years, we have

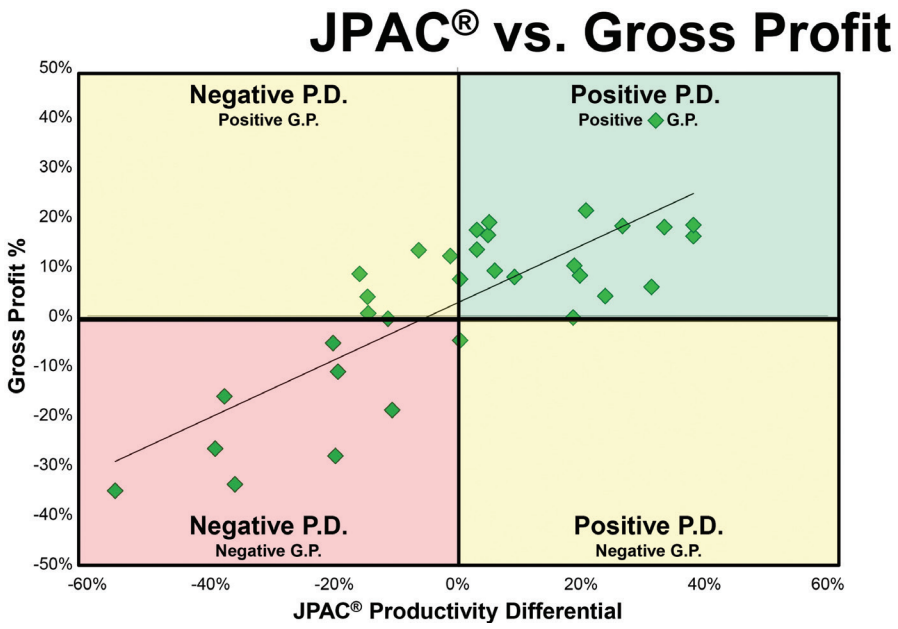

Figure 1

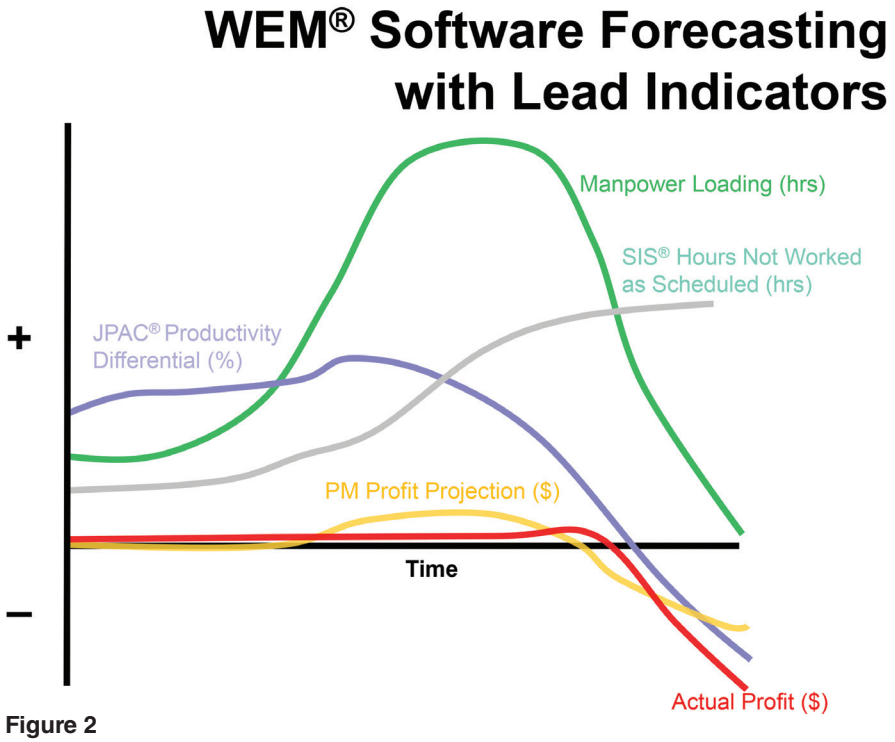

Figure 2

modeled various variables that relate to each other to allow project managers to see likely outcomes based on data. **Figure 2** shows an example of this, where our scheduling methods forecast manpower loading, thereby forecasting where productivity will be impacted by trade stacking, compression, etc. The projections in JPAC® show when a project may gain or fade from its estimated labor cost, and even be used to model cash flow. The end of the project is no longer a surprise, but it is also up to you whether you're a field leader, project manager, or executive, to believe in the power of data and how AI can be used to enhance your decision-making.

A quick look at a single case study shows exactly how JPAC® can use all available data to predict the future outcome of the job, very early in the job. In the project example shown in **Figure 3**, the black productivity differential line showed steady movement with realistic fluctuations throughout the job. The trend began to drop off indicating that productivity was declining as early as 2/3 of the way through the job. The productivity trend flattened through the last quarter of the job showing slightly less than planned, but still finishing within 5% of the original baseline plan. Unfortunately, the baseline plan was a bit less favorable than the estimate, shown by the purple line at nearly +5% relative to the baseline budgeted hours. JPAC® was predicting the trends even before the productivity faded, 16 months before the end of the job. Well before the halfway point, the red and green lines began showing significant movement. These lines represent the forecast effect of changes in productivity and labor cost management on the ending profitability of the job. Specifically, JPAC® was forecasting that maintaining the reasonable productivity line was coming at great cost. By using an increasing number of labor hours and at an increasing composite rate, that steady productivity would be expensive. The project team was not removing the barriers that reduced productivity, but rather invested in higher cost, more skilled and experienced labor to work through the prevailing conditions.

In the end, this case study example was not a complete disaster, but JPAC® not only predicted the erosion of profitability, but suggested that the strategy of adding labor cost to overcome productivity losses would not pay off in the end. The better strategy, according to JPAC®'s prediction, would have been to focus on improving the conditions and retaining the lower composite rate throughout the job.

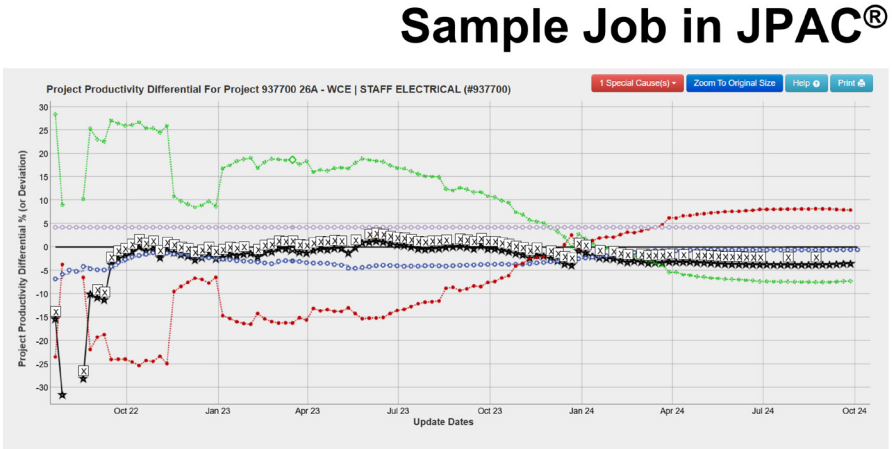

Figure 3: Sample job showing JPAC® predicted outcomes for productivity and labor cost impacts on profitability.

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