Sharper estimating tools for getting projects done on time and on budget

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By applying predictive analytics to data an organization already has, planners and procurement teams can better predict the cost, work, and risk involved in construction projects.

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A series on operations transformation in a public-sector organization

With demand for services rising faster than tax revenues, public entities around the world face unprecedented pressure to do more with less. Many think they must make a stark choice: cut service quality, cut availability—or cut both. This series of articles follows a large US public agency that chose another option: find radically better ways to deliver services by completely transforming its operations. Within 36 months, the agency booked nearly $2 billion in cost efficiencies, while also building the capabilities of more than 10,000 people to make those changes sustainable.

A crucial reason that construction projects are so difficult to plan and negotiate is that while project owners are responsible for meeting quality, timing, and cost targets, the actual engineering and building work is usually done by third-party contractors. That tension creates a procurement challenge: How can an owner feel confident that contractors' cost estimates are reasonable, or that their proposals are achievable and realistic?

One major US public-sector agency faces these questions hundreds of time a year across a sprawling portfolio of infrastructure assets. Historically, the organization relied on experienced planners, managers, and negotiators to deliver satisfactory project outcomes, but it wasn't enough. Similar projects varied significantly in cost, and too many suffered budget overruns or construction delays.

When the organization looked more closely at its planning processes, it realized that teams didn't have a reliable, standardized way to create up-front estimates of project costs. They instead had to base their budgets on personal experience of similar jobs, or use contractor estimates as a baseline for negotiation—hardly a position of strength.

Adding power to prediction

In search of a better approach, the organization turned to its historical project data, and to powerful analytic techniques. The first step combined information on more than 10,000 past construction projects into a single database, which pulled from engineering and project management systems, HR records, and procurement contracts. The resulting detail provided insight into the most important aspects for each project: the engineering and construction work required, the associated costs, and any delays or overruns that occurred.

Once analysts categorized the projects into a dozen basic archetypes, such as bridges, roads, or buildings, they could start isolating which

factors had the biggest impact on overall project costs. Eventually, for each project archetype, they whittled more than 100 potential variables down to the dozen or so that mattered most. Some were predictable: in road construction, for example, the top factors included the road's length, number of lanes, location (urban, suburban or rural), and choice of construction material. But others were less obvious, such as the need to comply with severe-weather standards in certain locations.

Finally, the analytical team applied advanced multivariate regression techniques to quantify the influence of the critical factors on project cost. Analysis of outliers allowed the team to refine the coefficients, producing a robust, automated estimation tool that could predict the cost of a construction project with a high degree of accuracy using only a few input variables.

Making the tool accessible, relevant, and actionable

The organization's project planning teams were not data analysts, so its next step was to build a user-friendly front end to the analytical system. Now, once planners choose the project type and enter the top project variables, the system generates cost and schedule estimates.

For further validation, the system automatically identifies the past projects that most resemble the current proposal. From that list, the planner identifies and ranks the most relevant examples, and data from those projects is used to calibrate the model used in the estimating process. And, as a further aid to planning, the tool identifies the most important risk categories for each project archetype, highlighting those risks in its output reports.

Supporting procurement, risk management, and portfolio planning

Access to fast, accurate cost and time estimates has transformed the organization's planning and procurement activities. For every project, procurement teams now enter contract negotiations with a clear idea of what work will likely be required, how much it should cost, and how long it should take.

That knowledge lets them have robust, fact-based discussions with contractors. Rather than waste time haggling over hours and fees, negotiators can focus on the factors that really make a difference to project success, such as refinements to project scope or engineering specifications. And they can devote more attention to appropriate risk-mitigation strategies, such as the inclusion of design audits and constructability reviews to reduce delays and cost overruns caused by engineering errors.

The tool's impact now reaches well beyond the planning and negotiation of individual projects. The organization is also using the system to conduct what-if analyses to evaluate the relative costs and risks of different engineering approaches and budget-allocation decisions.

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The introduction of the model has allowed the agency to negotiate project cost reductions of up to 40 percent, while more focused and effective risk management processes are also helping to reduce delays and cost overruns. Across its full project portfolio, those changes are expected to result in savings of up to $800 million a year■

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