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Seizing the power of advanced analytics in Spanish infrastructure

Embracing data-driven technology can help Spanish infrastructure companies make smarter management decisions, reduce risk, and improve project results.

by Antonio de Gregorio and Joshua Southern

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As analytics become increasingly sophisticated—leveraging AI technologies like machine learning—and combine with other digital innovations, industries as diverse as consumer goods, banking, and medicine are undergoing reinventions. But the infrastructure sector has been slow to join the digital age. In fact, McKinsey Global Institute's Digitization Index puts construction among the least advanced sectors in the adoption of the new technologies.

This scenario presents an opportunity for infrastructure owners and engineering and construction (E&C) companies that take the lead in embracing analytics solutions. By enabling businesses to generate proprietary insights from the vast amounts of data they already gather, advanced analytics can raise the quality management decisions, reduce risk, and improve project results. In essence, analytics allow business leaders to spot patterns, which can help them understand and learn from past experiences and more accurately predict future outcomes. As Spanish E&C companies increasingly struggle with margin pressure amidst challenging industry trends, adopting these technologies can provide them with a critical competitive edge.

But where are the best opportunities for applying advanced analytics? In our work with infrastructure clients, we are often asked to pinpoint real-world situations where these tools can add genuine business value. In fact, proven use cases already exist at all major phases of the asset lifecycle—applications that can allow both owners and E&C players to gain important benefits.

Advanced analytics applications in asset lifecycle phases

Analytics solutions can help infrastructure owners improve performance throughout the asset lifecycle, from capital planning through to operations and maintenance. They can enable owners to form more refined asset lifecycle curves, allowing them to align investments with the needs in design, construction, operations, and maintenance. These technologies can also help them generate deeper insights on maintenance versus replacement decisions and asset-longevity trends. Our research suggests that taking advantage of data-driven methods can generate portfolio savings of up to 15 percent—money owners and operators can reallocate to more attractive projects.

For E&C companies, the greatest value of advanced analytics currently lies in helping project teams assess market conditions, portfolio composition, and individual project performance. Firms that use these solutions can make sharper bids, thus avoiding unprofitable projects and increasing their win rates on ones with strong margin potential, potentially raising those profit margins by up to 5 percent. They can conduct savvier negotiations with subcontractors, reducing associated costs and increasing decision speed. And they can anticipate problems in on-going projects, allowing managers to intervene before potential delays and cost overruns turn into real ones.

We have identified four key phases of the asset lifecycle where infrastructure companies should explore the use of advanced analytics: capital planning, design and construction, operations, and maintenance (Exhibit 1).

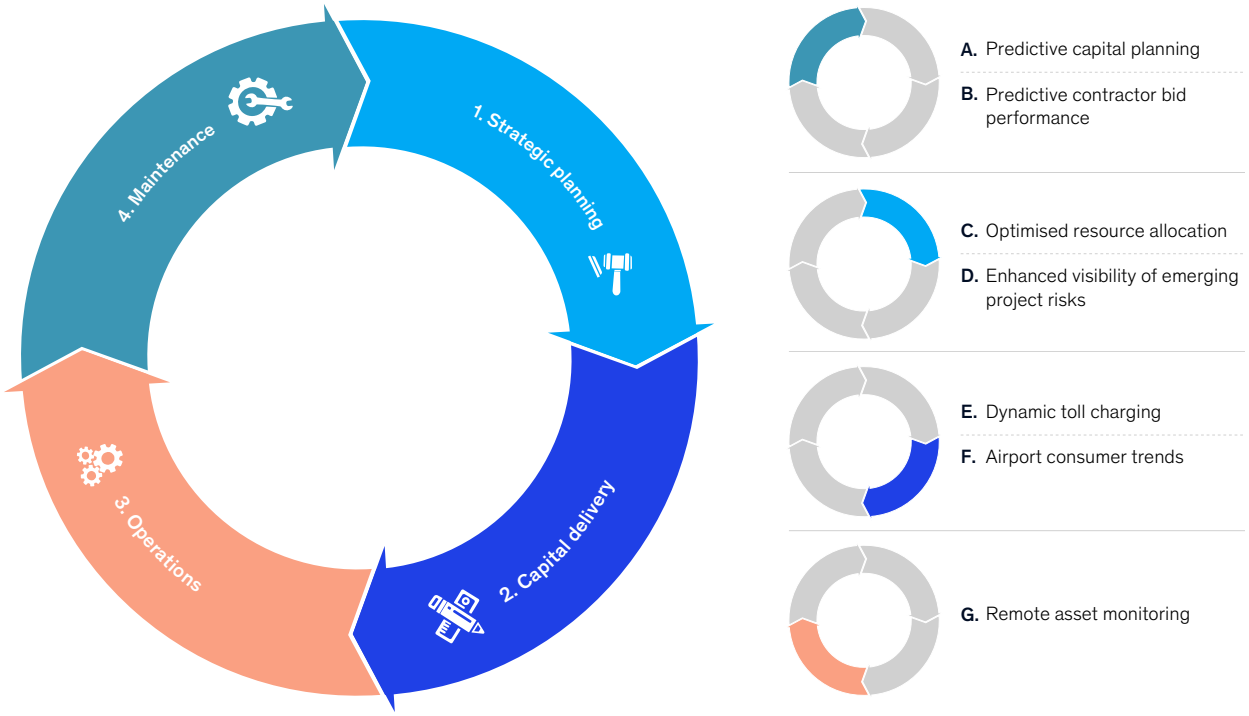
1) Strategic planning

A. Predictive capital planning: Infrastructure owners can learn from experiences in adjacent sectors, such as oil and gas and manufacturing, where organizations are using big data to spur increased performance and mitigate risk. Advanced analytics tools can take inputs from diverse sources—such as historical weather data or operations and maintenance records—then combine them with sophisticated processing systems and analyze them using machine learning modules to develop predictive insights. A common use is to forecast the probability of a given event, such as a maintenance need or shutdown.

In infrastructure, decisions to replace or refurbish an asset typically rely on broad, historically established industry benchmarks that are often conservative, rightfully advocating early replacement to avoid failure. However, advanced analytics can allow managers to better understand "instantaneous asset health" by predicting expected asset

Exhibit 1

Asset lifecycle



performance using multiple indicators compared against a wide and deep data set. For example, one organization employed predictive models and ground-movement sensors to identify anomalies during tunneling under a city. The approach led it to install a more efficient sensor array and monitoring system that enhanced its ability to conduct predictive maintenance and thus reduce overall long-term capital investment.

B. Predictive contractor bid performance: E&C companies can apply analytics tools to increase their win rates and avoid high-risk projects. One global company whose projects were very diverse had struggled to identify the reasons why some underperformed and others turned into bonanzas. The firm would rely on leadership judgement, which could be flawed or vulnerable to bias. To gain a better handle on profit drivers, it analyzed hundreds of variables (such profit margin, location and asset type) for more than 100 past projects, as well as external market factors such as total sector spending, unionization, and local workforce size. Using the insights from this analysis, the organization developed a dashboard of risk variables that could affect project margins. The system now creates a scorecard that teams can rely on in pre-bid meetings to decide whether the project is sufficiently attractive to make a bid, estimate the costs, and calibrate the size of contingency.

2) Capital delivery

C. Optimised resource allocation: Advanced analytics can help infrastructure companies significantly improve efficiency during the project delivery phase. When the oil and gas division of a global engineering firm found its engineering costs

rising and a shortage of talent constraining growth, it turned to analytics techniques and found that it could improve productivity and performance significantly by changing team design and reducing process fragmentation. Specifically, the analysis of six product-line teams and more than 100 geographical locations identified a productivity gap of 13 to 27 percent across the teams. Additionally, the analysis suggested that the company could address more than two-thirds of this gap by using advanced analytics to optimise resource allocation. Because such analytics assess a greater range of inputs—from resource characteristics to job specifications—they can identify the source and size of inefficiencies more precisely. Within 12 months of implementing the changes, the company saw a 14 percent increase in productivity, worth $35 million.

D. Visibility of emerging project risks: For E&C firms, traditional project controls often lag the incurrence of costs by days or weeks, making them effective tools for retrospective reporting but not for managing ongoing projects. The controls also do not account for the interconnectivity of different metrics and the unique combinations that may have outsized effects on performance. Advanced analytics can deliver a significant improvement on this front by allowing companies to quickly and continuously analyze project data and assess progress, enabling managers to react faster to potential problems. Teams can sometimes feel overloaded with the amounts of data a project generates, and struggle to identify the KPIs that should inform decisions. Analytics solutions can pull out the metrics that really matter from a range of sources. One E&C firm has created a list of more than 40 "tripwires" that are statistically correlated with erosion of margins. Every night, the company's analytics model crunches the day's project data and looks for these red flags; if enough of them appear, management is alerted immediately to intervene before the problem even materializes.

3) Operations

E. Dynamic toll charging: Analyzing data can help asset owners and operators gain major boosts in the revenues they derive from infrastructure services such as road tolls. One Middle Eastern infrastructure company developed a dynamic toll system that adjusts prices in real time based on traffic conditions. The technology can predict traffic volume in the fast lane, calculates demand and in this way determines a price that ensures traffic always flows smoothly—enabling the company to guarantee a specific speed to drivers who chose that lane.

F. Airport consumer trends: Another firm has used analysis of geospatial data and air passenger surveys to improve airport concession revenue. By identifying where passengers spend most of their time (more than two-thirds, it turns out, is in areas beyond security), around which gates they tend to congregate, and their demographics, spending patterns and other characteristics, the company gained a detailed understanding of the type of retail and food outlets that would generate the highest sales and in which locations. In turn, it was able to optimize advertising prices and retail rent rates, and offer targeted promotions differentiated over time.

3) Maintenance

G. Remote asset monitoring: Asset owners, in both the public and private sectors, continually must decide whether to spend money to maintain an asset, replace it with an improved one, or buy a new asset that meets a fresh set of requirements. Advanced analytics can boost the level of precision in making such decisions, helping owners prioritize replacement or repair of specific components rather than a complete asset. For example, the use of sensors can allow a department of transportation to identify bridges that need a complete reconstruction and others that require only one or two new girders to replace those presenting structural issues. The South Carolina Department of Transportation, for one, has received a Federal Highway Administration grant to evaluate the value of structural-health-monitoring technology to complement visual inspection and other information regarding specific bridges.

Analytics applications used in other sectors also can highlight opportunities for infrastructure players. In the railroad industry, for example, the use of sensors to monitor track geometry, rail

corrugation, and track-surface measurements facilitates maintenance and long-term investment decisions. One railway company switched from using industry benchmarks tied to the broad asset categories to analyzing its own condition-monitoring data to develop a list of prioritized annual-maintenance tasks. The change helped it save more than 30,000 person-hours a year and allowed the company to redirect $20 million of annual engine-overhaul spending to capital-replacement investments.

Harnessing analytics to address Spanish infrastructure challenges

Over the past decade, Spanish infrastructure players have faced challenging conditions. Margins for top E&C companies have been declining, dropping by half a percentage point since 2015 and 2018. Since investment levels in infrastructure projects have not recovered in the country, most E&C companies have concentrated on asset management, namely operation, maintenance and financial management. Many have also pushed heavily into markets outside of Spain, with some large E&C firms generating less than a quarter of their revenues in their home market in 2017. However, this diversification comes with complications, such as exposure to unfamiliar risks and challenges, increased competition from foreign companies; and a fragmented and financially struggling sub-contractor base.

To find efficiencies that can shore up their margins and differentiate them from competitors, some companies have turned to analytics tools. According to public sources, Spanish infrastructure companies are heading in this direction. For example, Acciona is developing digital twin control systems. Sacyr, meanwhile, has created a building information modeling (BIM) department dedicated to systematizing and integrating the methodology of the company.

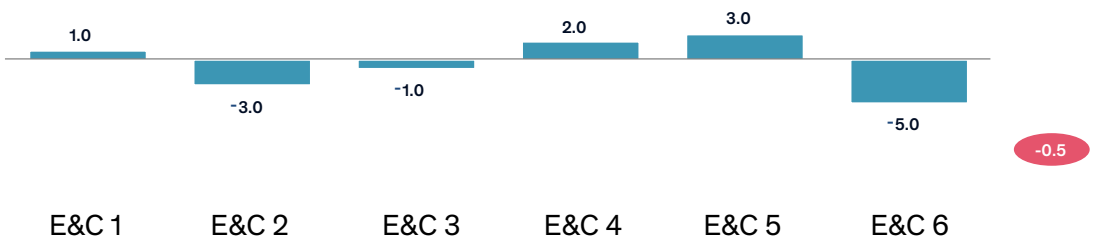
Some asset owners are also investing in new systems to store, easily access and analyze the vast amounts of data accumulated over an asset's lifecycle. Ferrovial's Centre for Asset Management (CAM), for example, is investigating a collaborative way of capitalizing on its data by linking its BIM processes with enterprise asset management systems.

The shift toward "smart cities" in Spain—relying on sensors and data collection to improve the efficiency and quality of urban services—provides yet another incentive for the country's infrastructure players to develop analytics expertise. The Santander City Lab project, a

Exhibit 2

Variation in EBITDA margin of Spanish E&C players (2015-18)

Percentage points



partnership of Ferrovial with Santander City Council and the University of Cantabria, analyzed 190 million sets of urban data to identify 192 operational efficiency levers to help improve the city's services. One such initiative is 'digital smart parking' which includes the detection of vehicles and spaces, and the reservation and payment of a suitable parking space.

Enterprise-wide adoption of analytics

While the benefits of embracing advanced analytics are increasingly compelling, making the shift is not easy. Such a transformation has to start with changes in how leaders think about data. Companies need to establish a new operating model that embraces digital initiatives as part of the core strategy. That requires significant changes in organizational structure, talent management, and corporate culture. It's vital that top leaders champion such digital initiatives and mindsets, and that employees receive the training required to deploy the new tools, troubleshoot problems, and oversee implementation.

Often, the greatest hurdle to adopting analytics solutions is the one-time backward reconciliation of data. Most firms have collected vast amounts of information over the years, but it's stored in disparate systems and inconsistent formats. As such, the first step should be to take stock of what you have—many companies will find they have a lot more useful data than they realize, such as accounting records and purchase order history—and put it into a form they can digitally analyze.

This may be a tedious and resource-intensive process, but it will set the foundation for more sophisticated data collection down the line. What's more, this one-time work will create a basis for structuring data—into data lakes, for example—that will make future analytics initiatives easier. Companies also need to establish standards for the data they collect in the future. Whether it's a full-fledged data management system or simply a set way of tagging and storing information, standards for what you want to collect and how you collect it are critical to a long-term analytics strategy.

As digitization penetrates all parts of the economy, including the infrastructure sector, capitalizing on the insights hidden in data will become vital to success. Spanish firms that hesitate to invest in the advanced analytics systems and skills needed to capitalize on the data they have collected should remember that competitors who have successfully made the move are already reaping significant benefits. One recent McKinsey analysis suggests that digital technologies, when applied comprehensively and efficiently, can reduce overall project costs by as much as 45 percent. In the long term, those kinds of savings can make the difference between being an industry leader or an also-ran.

This article was originally released in conjunction with Barcelona Building Construmat 2019. Read more of this research on McKinsey.com:

— *How analytics can drive smarter engineering and construction decisions*

— *How advanced analytics can benefit infrastructure capital planning*

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