COVID-19: Rethinking Capital Investment Programs

Using AI and Advanced Analytics to assess where we are, where you will be and where you want to go

May 27, 2020
**Introductions**

**Riz Shah**  
(Alvarez & Marsal)  
*Washington D.C.*

Riz has 20+ years supporting project owners / operators, improving performance by effectively leveraging technology and analytics to enhance ROI and reducing the associated risks that can occur during execution.

**Carlo Sandrin**  
(Neuro Data)  
*Washington D.C.*

Carlo has +15 years supporting companies to make better business decisions based on robust advanced analytics modelling, machine learning and artificial intelligence.

**Mike Pappas**  
(CII)  
*Austin, TX*

Associate Director with the Construction Industry Institute and Capital Project Management Consultant providing project-specific consulting and professional education related to process improvement and implementation of CII Best Practices.
Agenda

• Current ‘qualitative’ context
• COVID19 business response
• Applicability of AI/ML to construction businesses
• Examples of data sources

• Construction industry economic influencers ‘we cannot control’
• What does the future currently look like
• Three business case studies
• How to capitalize on projected economic challenges
• Q & A discussion
COVID-19: Unprecedented Liquidity Pressure and CapEx Reductions

Several large players of selected sectors have been experiencing severe pressure on working capital lines and liquidity, leading to the need to reduce projects – and profitability forecasts.

Example of Post-Covid Adjustment on Capital Expenditures Guidance

1. Big Oil
   - 2020: 96 Bln
   - Adjusted 2020: 68 Bln
   - -29%

2. US Midstream
   - 2020: 23 Bln
   - Adjusted 2020: 17 Bln
   - -24%

3. US Downstream
   - 2020: 12 Bln
   - Adjusted 2020: 8.5 Bln
   - -29%

1BP; Chevron; ExxonMobil; Shell (data according companies’ quarterly earnings release)

2Enbridge; Energy Transfer; KinderMorgan; EPP; Williams Companies; ONEOK; Pembina (data according companies’ quarterly earnings release)

3Phillips 66; Valero; Holly Frontier; Marathon Petroleum (data according companies’ quarterly earnings release)
Challenges assessing direct Impacts on the Capital Projects Industry

Crisis effects can be observed at different levels across the value chain of the capital project industry, but quantifying them has always presented a challenge.

Examples of qualitative impacts

| Equipment & Material Vendors | Reduced visibility of demand for products and subsequent production volumes |
|                             | Increasing level of change requests on currently active purchase orders |
|                             | Reduced manpower productivity rates at manufacturing facilities |
|                             | Increasing instability in vendor’s logistics network (increasing leadtime) |

| Construction Contractors | Increasing layoffs and potential labor claims |
|                         | Reduced productivity rates at construction sites |
|                         | Liquidity shortage and constrained/expensive access to revolving credit facilities |
|                         | Potential loss of corporate competence and poor knowledge management |

| Owners                  | Significant changes in business plans and project feasibility drivers |
|                         | Sharp adjustment on selected commodities prices |
|                         | Adjustment on project and corporate financing alternatives and premiums |
|                         | Increasing amount of construction claims and contractual disputes |

Anticipated quantification of these impacts is however a highly complex task

- **Data** not at hand
- **Lack of appropriate tools**
- **Complexity** of influence factors
- **Uncertainty of timing** regarding restarting business
A crisis response program shall be implemented to mitigate financial and operational impacts both at project and portfolio levels.

**Rapid Response Phase**
Short-term actions to mitigate any risk to construction staff health as a top priority, while reducing crisis’ damage to projects and contracts.

**Recovery Phase**
Recovering capital programs cost and schedule performance by reshaping portfolio strategy and adjusting project execution according to the ‘new normal’.

**Resiliency Phase**
Long-term actions which aims to create sustainable labor health conditions, while preserving higher levels of capital efficiency.
A crisis response program shall be implemented to mitigate financial and operational impacts both at project and portfolio levels.

Crisis Management Framework on Capital Projects

**Rapid Response Phase**
Short-term actions to mitigate any risk to construction staff health as a top priority, while reducing crisis’ damage to projects and contracts.

**Recovery Phase**
Recovering capital programs cost and schedule performance by reshaping portfolio strategy and adjusting project execution according to the ‘new normal’.

“Recovery” means redefining capital spending according to the projected ‘new normal’.

*What can we expect from the new normal?*
‘Econo-physics’: a game changer for the Construction Industry
How can we apply AI/ML to a business in the construction industry?

An overview of how Artificial Intelligence and Machine Learning works

Main Features

- Data can be collected from **heterogeneous sources** and transformed to uniform representation with multiple levels of granularity.

- By modeling data collected against data we have in reality, we can *‘learn’ the patterns* that exists in thousands of data sets.

- Through the application of machine learning, data models can reach **confidence levels** greater than 90%.

- Through advanced data analytics and perturbation, data models can see if data is nonsensical, manipulated or has gaps (*improving the confidence level of its forecasting capabilities*)
AI and Advanced Analytics driving Crisis Response Plans

Accurate forecasting and scenario planning shall be considered as the key drivers for a well-designed recovery plan

Case Study

Use of unsupervised machine learning algorithm to identify relationships between various economic indicators, detect economic cycles and provide meaningful projections for ecosystems associated to future development of capital projects

Data Modelling Stages

1. **Macroeconomic Outlook** – COVID-19 impact estimation on the global economy, focusing on the manufacturing sector

2. **Commodity Prices** – Future price estimations of major global commodities, based on the evaluation of global demand and macroeconomic conditions of major economies

3. **Illustrative Company Outlook** – Major financial indicators of future performance with regard to COVID-19 impact (and correlation to commodity prices and macroeconomic outlook)

4. **What-if Scenarios**
AI and Machine Learning-based forecasting: How do we know it works?

By putting ‘blinders’ on specific data sets, and comparing them to actuals, we can see previously unprecedented levels of accuracy and confidence levels for decision making.

Building trust in your data

The projections presented were prepared using illustrative data for demonstration purposes only. The projections do not represent the opinions or recommendations of the Construction Industry Institute, the webinar presenters or their respective companies when making business decisions.
AI and Machine Learning-based forecasting: How do we know it works?

Applied to one of today’s case studies:

What will demand be for product in 2018?

The forecast... from 2015

Accuracy of > 98% at 18, 24 and 30 months
Understanding these two aspects will be critical for you to make decisions that relate to your capital projects.

**Cannot control  ‘Strategic’**
- Manufacturing
- Commodity pricing
- Weather
- Interest rates

**Can control  ‘Tactical’**
- Capital Expenditure
- Cost of goods sold
- Labor costs
- Market share

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What data will you need to conduct a similar analysis yourself?

**Overview of data sources utilized for today’s case study analyses**

<table>
<thead>
<tr>
<th>Aluminum 3Mo (AH_3)</th>
<th>3-Month London Interbank Offered Rate (LIBOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI Composite Brazil</td>
<td>ge - USA - construction spending</td>
</tr>
<tr>
<td>Tin 3Mo (SN_3)</td>
<td>Dow Jones Industrial Average (^DJI)</td>
</tr>
<tr>
<td>Confidential business information</td>
<td>ge - USA - consumer price index</td>
</tr>
<tr>
<td>ge - USA - employed persons</td>
<td>CBOE Volatility Index (^VIX)</td>
</tr>
<tr>
<td>ge - USA - government debt</td>
<td>PMI Manufacturing India</td>
</tr>
<tr>
<td>ge - USA - building permits</td>
<td>Natural gas price</td>
</tr>
<tr>
<td>ge - USA - balance of trade</td>
<td>ge - USA - employment rate</td>
</tr>
<tr>
<td>Iron Ore 65% Fe CFR China Future Quotes (US$)</td>
<td>S&amp;P 500 (^GSPC)</td>
</tr>
<tr>
<td>Treasury Yield 10 Years (^TNX)</td>
<td>Crude oil price (WTI)</td>
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<tr>
<td>Confidential business information</td>
<td>Vanguard FTSE Developed Markets Index Fund ETF Shares (VEA)</td>
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<tr>
<td>PMI Composite ISA</td>
<td>ge - USA - composite pmi</td>
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<tr>
<td>Confidential business information</td>
<td>NASDAQ Composite (^IXIC)</td>
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<tr>
<td>ge - USA - food inflation</td>
<td>Vanguard FTSE Emerging Markets Index Fund ETF Shares (VWO)</td>
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<tr>
<td>ge - USA - labor force participation rate</td>
<td>US Dollar/USDX - Index - Cash (DX-Y.NYB)</td>
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<tr>
<td>Crude oil price (Brent)</td>
<td>ge - USA - imports</td>
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<tr>
<td>PMI Manufacturing Brazil</td>
<td>Russell 2000 (^RUT)</td>
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<tr>
<td>PMI Manufacturing USA</td>
<td>ge - USA - average weekly hours</td>
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<td>Zinc 3Mo (ZS_3)</td>
<td>ge - USA - exports</td>
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<td>Copper 3Mo (CS_3)</td>
<td>ge - USA - foreign direct investment</td>
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<td>Nickel 3 months</td>
<td>ge - USA - bankruptcies</td>
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<tr>
<td>Confidential business information</td>
<td>EBITDA (million USD)</td>
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<tr>
<td>PMI Manufacturing China</td>
<td>CH FOREIGN DIRECT INVESTMENT NET INFLOWS (current US$)</td>
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<tr>
<td>Confidential business information</td>
<td>NON-OECD LIQUID FUEL CONSUMPTION (mbpd)</td>
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<tr>
<td>Confidential business information</td>
<td>UPSTREAM INTERNATIONAL - Natural Gas Sales (MCFD)</td>
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<tr>
<td>Confidential business information</td>
<td>US GFCF (CURRENT US$)</td>
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<tr>
<td>Confidential business information</td>
<td>GDP growth China</td>
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<tr>
<td>Confidential business information</td>
<td>NET REVENUE - iron ore (million USD)</td>
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<tr>
<td>Confidential business information</td>
<td>Total Petroleum and Other Liquids Product Supplied (mbpd)</td>
</tr>
<tr>
<td>Confidential business information</td>
<td>US GFCF (% GDP)</td>
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<tr>
<td>Confidential business information</td>
<td>ge - USA - gdp</td>
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<tr>
<td>Confidential business information</td>
<td>FEDFUNDS (%)</td>
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<tr>
<td>Confidential business information</td>
<td>US REFINERY OUTPUT (mbpd)</td>
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<tr>
<td>Confidential business information</td>
<td>CRUDE OIL PRODUCTION NON-OPEC (mbpd)</td>
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<tr>
<td>Confidential business information</td>
<td>CH GDP PER CAPITA (USD)</td>
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<td>Confidential business information</td>
<td>CH FOREIGN DIRECT INVESTMENT NET OUTFLOWS (current US$)</td>
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<tr>
<td>ge - USA - gross federal debt to gdp</td>
<td>BR GDP (current USD)</td>
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<tr>
<td>Confidential business information</td>
<td>US FOREIGN DIRECT INVESTMENT NET INFLOWS (current US$)</td>
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What data will you need to conduct a similar analysis yourself?

Overview of data sources utilized for today’s case study analyses

- Confidential business information
- BR CRUDE STEEL PRODUCTION (k ton)
- US GDP PER CAPITA (%)
- COGS - pellets (million USD)
- SAUDI ARABIA CRUDE OIL PRODUCTION (mbpd)
- UPSTREAM - Exploration costs (millions USD)
- BR GDP PER CAPITA (USD)
- CH COAL CONSUMPTION (million ton)
- UPSTREAM net revenues Halliburton (million USD)
- Confidential business information
- UPSTREAM operating costs Halliburton (million USD)
- GDP growth India
- BR GF CF (% GDP)
- UPSTREAM US - Natural Gas Sales (MCFD)
- Confidential business information
- Confidential business information
- ge - USA - states competitiveness index
- BR COAL CONSUMPTION (million ton)
- US CPI INFLATION (%)
- CH GDP GROWTH (%)
- UPSTREAM INTERNATIONAL - Natural Gas Liquids Sales (thousands of barrels per day)
- Confidential business information
- UPSTREAM Capital and exploratory expenditures (million USD)
- CH CRUDE STEEL PRODUCTION (k ton)
- Confidential business information
- CH GFCF (% GDP)
- UPSTREAM US - Liquids Realizations (USD per barrel)
- OECD LIQUID FUEL CONSUMPTION (mpbd)
- CH GFCF (CURRENT US$)
- UPSTREAM - Development costs (millions USD)
- BR GF CF (CURRENT US$)
- DOWNSTREAM capex (million USD)
- CH GDP (current USD)
- US GDP (current USD)
- Confidential business information
- WTI CRUDE OIL PRICE (US$/ barrel)
- CAPITAL EXPENDITURES - total (million USD)
- US NATURAL GAS CONSUMPTION (bmf/D)
- CRUDE OIL PRODUCTION OPEC (mbpd)
- BR FOREIGN DIRECT INVESTMENT NET OUTFLOWS (current US$)
- DOWNSTREAM net revenues (million USD)
- UPSTREAM INTERNATIONAL - Natural Gas Realizations (USD per thousand cubic feet)
- DOWNSTREAM Capital and exploratory expenditures (million USD)
- GDP growth United States
- CH CPI INFLATION (%)
- BR GDP GROWTH (PERCENT)
- US GDP GROWTH (%)
- NET REVENUES (million USD)
- WORLD GDP (current USD)
- US FOREIGN DIRECT INVESTMENT NET OUTFLOWS (current US$)
- ge - USA - federal corporate tax rate
- GDP growth Brazil
- UPSTREAM US - Natural Gas Liquids Sales (thousands of barrels per day)
- WORLD GDP GROWTH (%)
- SELIC (perc p.y.)
- BR IPCA INFLATION (%)
- CRUDE OIL PRODUCTION CAPACITY OPEC (mbpd)
- UPSTREAM International - Liquids Realizations (USD per barrel)
- ge - USA - competitiveness rank
- DOWNSTREAM operating income (million USD)
- DOWNSTREAM operating costs (million USD)
- BR FOREIGN DIRECT INVESTMENT NET INFLOWS (current US$)
- Confidential business information
- US NATURAL GAS CONSUMPTION (bmf/D)
- COGS (million USD)
- NET REVENUE Halliburton - pellets (million USD)
- ge - USA - competitiveness rank
- Confidential business information
- DOWNSTREAM Capital and exploratory expenditures (million USD)

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General Assessment of Crisis Global Effects

Primary forecasting on the global macroeconomic outlook, commodities pricing and output is used to support more detailed and specific scenarios generation at business unit levels.
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Primary forecasting on the global macroeconomic outlook, commodities pricing and output is used to back more detailed and specific scenarios generation at business unit levels.

Stage 2
Commodity Prices

Crude Oil Monthly Price

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General Assessment of Crisis Global Effects (5)

Primary forecasting on the global macroeconomic outlook, commodities pricing and output is used to back more detailed and specific scenarios generation at business unit levels.

Stage 2
Commodity Prices

Natural Gas Monthly Price

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General Assessment of Crisis Global Effects (6)

*Primary forecasting on the global macroeconomic outlook, commodities pricing and output is used to back more detailed and specific scenarios generation at business unit levels*
Case 1 – Oil and Gas Company

The framework aims to stress-test business units’ financials and enable rapidly adjustments on capital investment decisions to preserve shareholder value in the long-term

Data Modelling Breakdown (Capital Expenditures)

Data modelling creates a direct and natural correlation between capital spending profile and future shareholder value metrics.
Case 2 – Mining Company

The framework aims to stress-test business units’ financials and enable rapidly adjustments on capital investment decisions to preserve shareholder value in the long-term.

Data Modelling
Breakdown
(Capital Expenditures)

Data modelling creates a direct and natural correlation between capital spending profile and future shareholder value metrics.
Case 3 – E&C Contractor

The framework aims to stress-test business units’ financials and enable rapidly adjustments on capital investment decisions to preserve shareholder value in the long-term.

Data Modelling Breakdown (Capital Expenditures)

Data modelling creates a direct and natural correlation between capital spending profile and future shareholder value generation metrics.
Reshaping Capital Portfolio According to the Scenarios

An iterative approach is used to reshape companies’ capital portfolio according to the new required level of spending and test the potential impact of future projects on overall financial performance.

Iterative Data Modelling Environment (through advanced analytics)

- Corporate Finance Data Sets (*)
  - Shareholder value
  - Stock prices
  - EBITDA
  - Leverage Ratio
  - Production volumes
  - COGS

- Capital Portfolio Data Sets (*)
  - Total CapEx
  - Return on Capital Employed
  - NPV
  - D/E Ratio
  - Production volumes (BU)
  - COGS (BU)

(*) Non-exhaustive

Project Environment

- Project Information & Analysis (*)
  - Project scope
  - Process parameters and outputs
  - Raw material and energy consumption
  - Start-up date and ramp-up parameters
  - Construction costs
  - Project financing conditions

“What if we adjust a project variable (e.g.: process parameters)? What will be the impact in company’s future financial projections?”
Reshaping Capital Portfolio According to the Scenarios (2)

An iterative approach is used to reshape companies’ capital portfolio according to the new required level of spending and test the potential impact of future projects on overall financial performance.

“What-if” Scenario Example

Scenarios description:
- Scenario I: EBITDA increased by $500 million
- Scenario II: EBITDA increased by $1 billion
- Scenario III: EBITDA increased by $1.5 billion
Several actions shall be taken at project level to adapt for severe cash restrictions – however, some of them are also key to drive future project performance required on a potential economic rebound.

### Project Restructuring Roadmap

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<tr>
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</thead>
<tbody>
<tr>
<td>Review project cash flow according to updated project schedule</td>
<td>Proceed with design-to-capacity reviews</td>
<td>Optimize onsite logistics and material storage during mothballing period</td>
<td>Re-evaluate project contracting strategy</td>
<td>Re-evaluate project procurement strategy</td>
</tr>
<tr>
<td>Seek for alternative funding sources</td>
<td>Process simplification and project descoping</td>
<td>Review of technology trade-offs studies</td>
<td>Proceed with detailed due diligence on subcontractors financial strength</td>
<td>Evaluate alternative material vendors</td>
</tr>
<tr>
<td>Renegotiate debt service payment schedule (e.g.: project finance)</td>
<td>Review of technology trade-offs studies</td>
<td>Update value engineering analysis</td>
<td>Review contract incentives and risk-sharing clauses</td>
<td>Create alternative logistics plans</td>
</tr>
<tr>
<td>Redesign project financial and non-financial guarantees</td>
<td>Proceed with energy optimization reviews</td>
<td>Proceed with energy optimization reviews</td>
<td>Rebalance progressive payment terms</td>
<td>Create contingency plans for critical equipment and long lead items</td>
</tr>
<tr>
<td></td>
<td>Develop trade-off studies for detailed design changes vs. impact on construction</td>
<td>Create fast-tracked commissioning schedules</td>
<td>Create claims resolution board for rapid claim resolution</td>
<td>Proceed with detailed shop inspection on critical vendors</td>
</tr>
<tr>
<td></td>
<td>Review Staffing Plan</td>
<td>Review Constructability Reviews and reassess construction methods</td>
<td></td>
<td>Review incentives and progressive payment terms</td>
</tr>
</tbody>
</table>

Key actions:
Several actions shall be taken at project level to adapt for severe cash restrictions – however, some of them are also key to drive future project performance required on a potential economic rebound.

**Restructuring Projects for an Updated Portfolio Strategy (2)**

Preservation of long-term shareholder value and return on capital employed

**Updated Capital Portfolio Strategy**

- Project 1
- Project 2
- Project 3
- Project 4
- Project 5
- Project 6
- Project 7
- Project 8
- Project 9

**Project Restructuring Roadmap**

<table>
<thead>
<tr>
<th>Restructuring Categories / Accounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Disbursement &amp; Project Financing</td>
</tr>
<tr>
<td>Project Design and Benefits</td>
</tr>
<tr>
<td>Construction &amp; Commissioning Strategy</td>
</tr>
<tr>
<td>Construction Contracts</td>
</tr>
<tr>
<td>Equipment &amp; Materials Supply-chain</td>
</tr>
</tbody>
</table>
Questions

Please submit your questions in the questions box.

Riz Shah, Managing Director
Alvarez & Marsal Infrastructure and Capital Projects
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Neuro Data
Email: carlo@neuro-data.com
About A&M: Global Reach & Operational Breadth

37 YEARS OF EXPERIENCE ACROSS 4 CONTINENTS

The A&M Difference:

Solving complex problems is in our DNA. After 37 years of resolving some of the most urgent challenges in business history, we’ve honed critical expertise that clients at all levels of health can use to achieve rapid results.

Senior-level experts with deep industry experience. Our senior leaders, many of whom are former C-Level from industry, bring deep insight into the opportunities and challenges faced by businesses with practical approaches that work, versus theoretical approaches that fail.

Urgency for action and results. Our clients frequently comment that we drive change and rapid results where internal teams and other consultants have failed.

Objective and independent. With no audit conflicts, software to recommend, or projects to save, A&M offers objective, credible advice you can trust to be in your best interest, not ours.

### Operations
- Assessment & Optimization
- Supply Chain
- Lean Six Sigma
- Organizational Transformation
- Process Transformation

### Human Resource
- HR Operational Improvement
- Performance & Rewards
- Talent Management
- Change Management
- Program Management

### Technology Services
- IT Transformation
- “Big Bet” Initiatives
- Merger Integration & Divestitures
- Executive Technology
- Advisory Services

### Finance and Accounting
- Finance Strategy
- “Big Bet” Initiatives
- Finance & Accounting Ops
- Shared Services
- Treasury, Cash Mgt & Tax
- Accounting Advisory & Remediation
- SOX Readiness

### Merger Integration
- Integration Strategy
- Plan & Execute Day 1 / 100 Day Goals

### Capital Projects
- Project Mgt
- Contractor Selection & Mgt
- Due Diligence
- Operating Models and Procedures
- Sourcing strategy and procurement
- Cash Mgt
- Capital structures
- Org design
- Contracting

### Strategy
- Corporate & Business Unit Strategy
- Operational Efficiency