



NAC Executive Insights

Managing Innovation

Key Points

- Innovation is a requirement for sustainable, profitable growth.
- Sustained innovation requires a robust innovation culture.
- For an innovation culture to exist and thrive an appropriate risk appetite must exist.
- An effective innovation culture tolerates failure as long as it occurs quickly.
- An innovation culture must encourage the transformation of creative ideas into larger, more significant and compelling creative visions.
- Tactical elements that foster and support sustained innovation define a recommended innovation infrastructure.
- Recognize that innovation is a team sport, all of us know more than any of us.

Introduction

This Executive Insight reflects the author's experience as a member of engineering, construction, and industry organizations focused on innovation within the E&C industry. Innovation, specifically sustained innovation, is a requirement for sustainable, profitable growth. It creates differentiation to win more projects either through perceived value added or lower cost of execution and associated increased profitability. Increasingly, sustained innovation serves as a differentiator to attract and retain the best talent available.

What Is innovation

The scope for innovation within the E&C industry is broad. It includes:

- New business models, services, branding and commercial strategies
- Reimagined supply chain
- Information and knowledge technologies
- Creation or application of novel processes and technologies
- New means and methods including:
 - new fabrication, assembly, and erection techniques
 - Application of new materials
 - New or significantly modified equipment (with suppliers)
- New value creation practices and approaches

- lifecycle cost
- Sustainability
- Resiliency
- Social justice
- Reimagined allocation of work in a hybrid labor environment
- Reallocation of work between human and artificial intelligence (AI)

Questions to Ask

Consider questions that should help in the shaping of E&C innovation efforts and approach. These questions include:

- How would you rate your ability to consistently deliver innovative solutions to your clients?
- How would you rate your ability to consistently create, refine, and deploy game-changing approaches to the operation and performance of your business?
- Do you have in place the innovative culture and infrastructure to turn ideas into solutions that deliver value to your clients and your company?

Innovation Culture

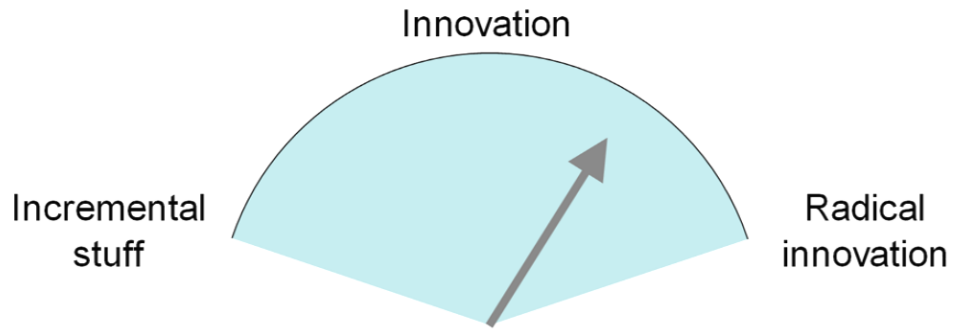
An innovation culture is a significant feature of many successful E&C businesses. It represents a combination of creativity/invention with implementation. Ideas alone do not suffice. For an innovation culture to exist and thrive, an appropriate risk appetite must exist and a clear understanding of that appetite must be present across the organization. Ideation is framed by awareness of challenges and opportunities that clients and the business are facing. Implementation of innovations is as important as ideation and must include provisions for learning, continuously improving, and sharing knowledge and insights in support of the broader innovation effort and the furthering of the ever-developing innovation culture.

An effective innovation culture tolerates failure as long as it occurs quickly, is understood, lessons are learned, and the failure supports the organization to “fail forward” and be more

“Failure is simply an opportunity to start all over, but now more intelligently.”
— Henry Ford

successful on subsequent efforts. The innovation culture must be in lock step with a firm’s strategic business objectives (SBOs) and part of the overarching strategy.

An innovation culture must encourage the transformation of creative ideas into larger, more significant, and compelling creative visions. The culture must encourage people to think bigger and not focus on incremental improvements. Speed to market is important and an innovation culture requires an understanding that fast and good is often more successful than slower and better. Consider the path to the ultimate vision to be a series of “sprints” with usable improved versions of the innovation at the end of each sprint.



To be sustaining and growing, an innovation culture in effect demands stories about people who have transitioned creative ideas into creative visions and, importantly, implemented them to become valued innovations.

An innovation culture recognizes the power of the team; that “all of us know more than any of us;” and that the universe of problem solvers extends well past the boundaries of the corporation.

Table 1 outlines some common barriers to innovation from both a company and individual perspective.

Table 1 - Select Common Barriers to Innovation	
Company	Individual
Inadequate leadership – if leadership does not talk about it, then it cannot be important	Fear of rejection
Lack of vision – short-term is valued much higher than the longer term	Fear of failure
Too bureaucratic	Fear of change
Investment vs overhead cost not differentiated	Lack of time; must bill to a project
Best people committed on projects	Does not know how to share an idea

Table 1 - Select Common Barriers to Innovation	
Company	Individual
Cyclical market excuses – good market – too busy; down market – cannot afford to invest	Lack of feedback
Silo bias – only comfortable with discipline-specific innovation	Tunnel vision
Failure to address the soft side of changes	
“Not invented here” syndrome	
Big office bias	
Lack of reward/recognition	
Ignorance	

Innovation Infrastructure

There are many ingredients required for success in achieving sustained innovation within an organization. These ingredients must be founded on an innovation culture that is strongly focused on creating value for clients and the business. On this foundation there rests several tactical elements that foster and support sustained innovation. These include:

- Simple and transparent process to surface ideas and solutions. Focus on enhancing the quality of the ideas generated. The process should avoid premature judgment or dismissal or risk undermining the fundamental innovation culture. Remember, there are no such things as bad ideas, a golden nugget may lie just below the surface.
- Transparent process to challenge and refine ideas. Some will have their value proposition sharpened, others will be reshaped and morph into something more or different than originally conceived, and others will not survive. It is essential for the idea, and its creator, to feel that they are valued. Recognize a spectrum of innovation types exist, broadly grouped as finance, process, offering and delivery. (The darker the color the greater the activity or value.)

Construction Value Creation Through Innovation										
	Finance		Processes			Offering		Delivery		
	1. Business Model - How to make money	2. Networking - structure/ value chain	3. Enabling Process - assembled capabilities	4. Core Process - proprietary that adds value	5. "Product" Performance - basic features, performance, functionality	6. "Product System" - extended system around an offering	7. Service - how we service our customers	8. Channel - how we connect our offerings to our customers	9. Brand - how we express our offerings benefits to our customers	10. Customer Experience - how we create an overall experience for our customers
Existing Innovations	Design Build; DBOMF (PPP) (Infrastructure only); Incentives	Joint Ventures; Supplier Relationships	Subcontracting processes; Distributed execution; Temporary staffing business; Equipment company	Project Management; Knowledge Sharing; Low cost country sourcing; Best of Class safety program	Workface planning	PPP (O&M offering)	Transactional; Account management	Account management and response to RFP by Business Lines	Capability; location; stability; safety	Responsiveness; execution
Future Innovations	PPP - level of service life cycle contracting; IP; Database	Competition of Supply Chains; Supply chains based open innovation	Massively Parallel Global Execution	Expanded Basis of Design; innovation as a core process; RFI free delivery; Life cycle based program management plus including sustaining capital; advanced predictive analytics applied to Big Data	Nanomaterials expertise; advanced welding systems; Smart everything; standard modules - select structures as purchased equipment and components; position enabled construction systems	Limited warranty; O&M offering; Networked everything; "Toolmaking"	Solutions provider; Deep relationships; emedded in customer organization; asset monitoring as service trigger	Consultative sales; engage inside client's "strategy cycle"; Innovation; Market creation; Strategic alliances; Strategy stage engagement	Capital efficiency; capital certainty; schedule certainty; Speed; creativity; skin in the game	Engagement; No surprises execution; Continuous improvement
Typical Innovation Focus										
Money Making Innovation Focus (2% of projects produce 90% of value)										

- Prioritize innovative ideas based on potential value to clients and the business and micro-finance select ideas for further refinement. View this process as a “seed fund “, planting what you may be able to harvest in the future. Evaluate and re-prioritize before investing more. The innovation process is much like a funnel, and it is essential to fail fast.
- Provide the space, equipment, and tools to both innovate and incubate new ideas. Early in the author’s career, innovation and incubation often occurred around the water cooler. Over the years this has morphed, and Table 2 describes some historical and modern-day innovation and incubation “watercoolers.”

Table 2 - Innovation and Incubation Watercoolers over the Years

Water cooler	Random selection of individuals with varied perspectives.
“Hands-on” physical models	Layout refinement and construction sequencing. Innovative erection and equipment frequently resulted.
“Design charettes “	Highly focused study, development, and evaluation of design solutions by multi-perspective teams within constrained periods of time. Analogous to an agile “sprint.”
Innovation hubs	Designated and equipped space to innovate and incubate ideas. In an engineering environment, it may include specialized equipment and computing capabilities as well as “innovation toys” to stimulate creativity. An open innovation/challenge aspect should be present. In a construction environment, access to specialized equipment including fabrication and testing equipment is important. Prototyping is likely to be an important element.
“Holodeck “	Immersion in a computer-generated reality that provides entirely new perspectives, engaging all a user's senses.
Model-based innovation environments	A 3D BIM model challenge by conceived innovative erection strategies and serving as a virtual test environment for new or significantly modified equipment. The use of both human and equipment “avatars” allows “hands-on” proof of concept refinement.
Metaverse	Providing a persistent (real time) and evolving environment where new challenges and opportunities emerge, fostering ideation

Table 2 - Innovation and Incubation Watercoolers over the Years

	<p>and challenge. These may be either dynamic real-time BIM models reflecting construction progress or “gamified” hybrid test environments (for example, the ASCE Future World Vision¹). Augmented reality features are present.</p>

- Identify and deploy innovation “mentors” to foster the development and refinement of promising ideas. These mentors should demonstrate a positive attitude and excel at asking “flat” and open-ended questions. Their objective is to draw out the best thinking, not guide to a particular solution. Often these mentors are innovators themselves. An added strength in good mentors is the ability to “connect the dots” or more appropriately said, help the innovator to connect the dots.
- Recognize that innovation is a team sport. Just as the random assembly of individuals around the water cooler was its ideations and incubation strength, so too is a multi-perspective challenge and innovation team. The term multi-perspective versus the more common multi-discipline is used here to emphasize that incite and contribution may come from multiple points along the supply

¹ Future World Vision is an interactive, immersive experience exploring the built environment of 2070.

chain (client, primary supplier, component and subcontractor, materials providers, labor), as well as from nontraditional perspectives (patent attorney, biologists, academia).

- Deploy multi-perspective teams in a well-structured way (Big Dig proposal - design

“BIG DIG” PROPOSAL STAGE DESIGN CHARETTES

The sheer scale and complexity of Boston’s Big Dig created opportunities for technical innovation and differentiation. Creating that overwhelming sense of an already engaged team led to assembling 40 experts from across all firms on the bidding team in Boston for a full week.

Organized into five teams, they generated dozens of potential innovations and outside the box solutions. Essentially all of these found their way into aspects of the proposal to demonstrate serious engagement and interest. Of these dozens of innovations, five were selected, covering all key aspects of the project. These were highlighted in depth in our executive summary and, more importantly, became the backbone for the presentation storyboard and key elements in the constructed project.

Innovative approaches included:

- Column pickup vs. footing pickup of the existing Central Artery
- Load transfer and site stabilization to large scale use of slurry walls
- Immersed tunnel for crossing Ft. Point channel
- “Utilidors” to facilitate relocation of utilities including crossing the Central Artery right-of-way
- Cable-stayed bridge versus the then more traditional option

charrette, *see box*) in creativity sessions as part of proposals, projects, and structured innovation campaigns.

- Respond to the periodic sudden demands for innovation associated with off-normal events or situations.
- Use “on demand” multi-perspective innovation teams. Examples of off-normal events may range from unanticipated direction challenges, failed equipment or structures, crane and bridge failures, or post-disaster response in an uncertain and potentially dynamic environment.
- Conduct innovation campaigns focused on identified, significant, existing challenges or opportunities identified as part of periodic structured opportunity analysis. These campaigns reinforce the culture of innovation and act to confirm and strengthen the innovation infrastructure.
- Strengthen the focus of innovation campaigns by soliciting client input on their longer-term needs and expectations, identifying gaps that represent opportunities for innovation.
- Put in place a well-structured intellectual property (IP) management team that is aware and acting in concert with the innovation process. This IP management team should be recommending and implementing IP protections consistent with a well-developed IP management strategy, both defensive and offensive.

- Focus on adoption and integration of value adding innovations into the business. Recognize the potential to resistance like that encountered in many change processes.
- Sustain innovation awareness both within the firm (to sustain and enhance the innovation culture) and externally (to differentiate and create a quote value adding end of “perception” with clients).
- Put in place the necessary elements of an innovation organization and metrics. Keep the organization fresh by rotating personnel. Example metrics are shown in Table 3.

Table 3 - Innovation Metrics	
Leading indicators	Lagging indicators
Clients’ engagement in innovation efforts	Project wins where innovation and IP are identified by the client as a key factor
Client utilization of company IP	Client value creation (capital efficiency)
Employee assessment of innovation culture	Enhanced project performance (cost and schedule certainty)
Participation rates in innovation activities	Recognitions for innovation
Ideas submitted; seed funded; funded	Compensation for innovation and IP
Reduction in company costs; innovations deployed for profit (monetized)	Retention rates of innovation engaged staff
Open innovation participation (clients; supply chain; others)	
ESG (Environmental, Social, Governance) benefits from innovation (GHG (Greenhouse Gas) emissions; water footprint)	

Conclusion

This Executive Insight looks at the management of innovation in engineering and construction organizations. Innovation is a requirement for sustainable, profitable growth. A structured, systematic approach is often lacking across the industry, despite its performance, productivity, and profit challenges.

Innovations are not monolithic. A spectrum of innovation types exists, broadly grouped as finance, process, offering, and delivery. Innovation requires both ideation and implementation and sustained innovation requires a robust innovation culture.

For an innovation culture to exist and thrive, an appropriate risk appetite must exist. It must tolerate failure as long as it occurs quickly and the activity can be described as a “fail forward.” It must encourage the transformation of creative ideas into larger, more significant, and compelling creative visions.

Common barriers to innovation from both a company and individual perspective are outlined and tactical elements that foster and support sustained innovation are defined. Key is prioritizing innovative ideas based on potential value to clients and the business, which has been shown to be two percent of innovations provide 90 percent of value.

Recognize that innovation is a team sport, and it must put runs on the board.

About the Author

Bob Prieto was elected to the National Academy of Construction in 2011. He is a senior executive who is effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering, and construction industries.

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