



NAC Executive Insights

Knowledge Management

Key Points

- Knowledge management focuses on knowledge as a strategic asset. Knowledge is the most significant asset of most engineering and construction companies.
- Telltale signs for the need of knowledge management are laid out.
- The benefit of knowledge management includes increased productivity and stronger personal engagement.
- Knowledge management encompasses both explicit and tacit knowledge.
- Knowledge management is more about people, culture, and connections than tools and new technology.
- Knowledge management is a push/pull process.
- Knowledge communities, also known as communities of practice, play a key role in successful knowledge management programs.
- New knowledge types are emerging, driven by artificial intelligence (AI).
- Readiness of knowledge communities is important to successful management efforts.
- Knowledge communities require strong stewardship.
- Knowledge platforms represent a type of digital “water cooler,” where different perspectives may turn into new insights.
- A powerful concept of knowledge assemblies is emerging that reverses the traditional push/pull mechanisms.
- Knowledge management success factors and challenges are discussed.

Introduction

Knowledge management is the process of creating, sharing, using, and managing knowledge and information. It refers to a comprehensive, holistic, and multidisciplinary approach to achieving organizational objectives by making the best use of knowledge.

This Executive Insight looks at:

- What knowledge is.
- Telltale signs indicating the need for knowledge management (KM).
- Benefits of knowledge management.
- Knowledge communities, emerging knowledge, and their readiness, operation, and administration.
- Knowledge platforms.
- The emerging concept of knowledge assemblies.

- Success factors and challenges.

This Executive Insight seeks to convey many core concepts and observations and is presented in a highly outlined versus narrative form to ensure key thoughts are not lost in text.

Knowledge Management

Knowledge management is the process by which an enterprise gathers, organizes, shares, and analyzes its knowledge in a way that is easily accessible and understood by employees.

What is Knowledge?

Know what you are trying to manage. This is especially true in the area of knowledge management, where the very nature of knowledge and information is changing rapidly. Is it a discrete data element, such as the boiling point of water? Is it the calculation of required flows to maintain the temperature of a nuclear reactor? Is it the design of a pump or the coolant system which keeps that reactor in check? Or is it the stream of tweets from a stakeholder group concerned about the potential for temperature rise from secondary coolant waters?

The answer is all of the above and much, much more. Of utmost importance, knowledge is *the* greatest asset of practically all engineering and construction companies: an asset that goes home every night and hopefully comes back safe and healthy in the morning,

So, what is knowledge?

- Strategic asset
 - Intangible asset, arguably the most valuable asset in an enterprise
- Derived from connecting people, supported by effective tools and lifelong learning
- New knowledge derived from interactions/sharing of knowledge
- Structured and unstructured data
- Unassembled and assembled (more valuable)
- Generate, curate, use, learn (gain new insights)

Knowledge includes:

- Experiences
- Process activity model tasks
 - Includes instructions and reference to other relevant knowledge objects
- Means & methods
- Go-by documents
- Templates
- Standard tools and standards
- Design margins

- Preferred computational tools
- Design reuse
- Lessons learned
- Best practices
- Relevant company specific policies, procedures, and forms
- Industry and external knowledge (including client knowledge)
 - Avoid becoming a knowledge island.
- Insights (that lead to wisdom)
- Company owned intellectual property (controlled)

Telltale Signs Indicating the Need for Knowledge Management

Arguably, some form of knowledge management is required for all enterprises. Some enterprises, however, are clearly in more need. These organizations exhibit some telltale signs, which include:

- Decisions made with available information
 - Without regard to relevance or timeliness
- Knowledge is viewed as power within the organization
- Unable to access the required information efficiently or timely
- Identification of the most relevant expertise in the organization is challenging
 - But it exists
- Valuable knowledge is lost when people leave the organization
- Valuable knowledge is not leveraged
- Technical differentiation is eroding
- Current resources are under leveraged
- Keep relearning the same lessons
- Inconsistent utilization of knowledge and execution is increasing the risks faced

Benefits of Knowledge Management

Having defined knowledge and the telltale signs that one might benefit from knowledge management, it is appropriate to define a couple of the over-arching benefits a knowledge management program should deliver. These can be grouped into two categories, organization focused and employee focused.

Additional benefits undoubtedly exist and some may be specific to the current condition of a particular organization or its forward leaning strategy.

- Increased productivity of labor force
 - Work sharing reduces overall demand for talent.
 - Time waiting for information is reduced.
 - More time on task
 - Continuous learning maintains capabilities of workforce.
 - Integration into performance reviews become self-reinforcing.
- Increased sense of personal contribution
 - Knowledge contribution/sharing

- Recognition for personal expertise (formal, informal)
- Peer feedback
- Requests to mentor
- Opportunity to be a change agent

Knowledge Communities

A core feature of successful knowledge management is represented by the various knowledge communities which comprise the firm. These knowledge communities are also known as “Communities of Practice.” They become the foundation and organizing principle for a firm-wide knowledge management strategy.

- Knowledge communities are home to and facilitate:
 - Expertise and technical knowledge across project phases.
 - Explicit and tacit knowledge
 - Knowledge sharing and collaboration across the organization.
 - Push – notices of knowledge object additions; newsletters
 - Information that people will pay attention to
 - Pull – contributions of knowledge objects; responding to requests; collaborative focused community efforts
- Knowledge flows, unimpeded, across geographic boundaries.
- Expertise on demand (respond to queries).
- Knowledge retention.
- Strengthened project baselines.
 - Scope completeness improved.
 - Baseline cost estimate templates foster inclusion of all elements of scope and services.
 - Reflect actual costs that may be subject to advanced analytics.
 - Baseline schedules reflect realized construction productivities.
 - Risks encountered inform scope, schedule, and budget; they also link to risk management register and supporting likelihood and consequence data.
- Foster/require common business processes and tools.
- Typically organized by functional area and/or industry.
 - Specialized forums/wikis/blogs operate under broad umbrella
- Create/curate knowledge objects.
- Supports community focused research.
 - New intellectual property (IP) and differentiation developed.
- Assess industry best practice and reference solutions.
- Innovative solutions for client developed.
- Underpin continuous process improvement.
- Framework for career path (skills, expertise, experience, training, knowledge sharing behaviors, engagement) provided.
- Assessed for continued readiness, relevance to business needs and contribution.

Emerging Knowledge

Traditional knowledge, such as described in the preceding section, is being extended by new applications of artificial intelligence (AI). This emergent knowledge includes:

- Derivative knowledge gained from application of AI.
- Recommendations ranked by confidence in the solution.
 - Not just relevance
- Answer focused, not search result focused.

Knowledge Community Readiness

Organizational and project success is founded on readiness. The same is true of successful knowledge management programs. Readiness includes:

- Knowledge management regarded as a core functional area.
- Alignment on corporate SBOs (strategic business objectives).
- Alignment on knowledge management principles.
- Committed to knowledge sharing.
- Committed to standard tools and processes that enable knowledge and work sharing.
- Adequately resourced.
- Committed to required behavioral change and necessary change metrics are in place.

Knowledge Community Operation/Administration

Effective knowledge management program operation and administration requires:

- Strong stewardship
- Easy to use portals
- Effective curation
 - Review by subject matter expert (no “gigo” – garbage in; garbage out)
- Documentation/quality meta-data
- Integration with company standard project execution processes

Knowledge Platform

People, culture, and connections arguably account for 90 percent of the success of a knowledge management program. The remaining 10 percent is associated with the knowledge platform, which is *sine qua non*, or absolutely essential.

The knowledge platform:

- Supports distributed global execution (work sharing).
 - Digital “water cooler” (A virtual water cooler is an online digital solution to the “water cooler conversation.”)

- Reduces need to move people around.
- Collaborative technologies support knowledge transfer, especially to new hires.
- Hosts knowledge objects (repository; database).
 - Interoperability of data throughout the life cycle
 - Breaks down knowledge silos
- Maintains process model for project execution.
 - Parallel function to project execution platform
- Facilitates discussion forums on emerging company and industry trends.
- Retains knowledge in business downturns.
- Success stories support future sales.

Knowledge Assemblies

AI and Big Analytics are shaping the knowledge landscape. They also are transforming many others. Think about the designer who logs onto his or her workstation to set out on the next task. Having logged in, the knowledge management system knows who they are, which project they are working on today, and what the next step in the project work process is. Recognizing these attributes and others, the embedded AI assembles for the designer all relevant knowledge at their fingertips. The assembling of this knowledge in ready to use formats eliminates the time usually spent gathering information, looking up reference standards, and downloading the most up to date company work process and computational tools.

Knowledge assemblies:

- Emerging concept
 - Integrates push/pull (reverse)
 - Knowledge management on steroids
- Assembled data, knowledge, and insight
 - Big Analytics driven
 - Utilizes semantics
 - Captures the value in unseen connections and relationships
 - Rule based, directly supporting work processes
- Instance-driven combination of knowledge objects/assets
 - User
 - Intended use (client, project, location)
 - Phase of project/task (timing)
- Streamlines project execution by eliminating work process steps, automating knowledge assembly and design, tightly integrating supply chain, and accelerating best practices and innovation into deliverables.
- Reduce latent risks by fostering consistent completeness and scope of approach.
- Fosters tighter design, construction, and operations & maintenance (O&M) integration.
 - Adds life cycle value.
- Accelerates project execution cycles.
 - Automates/eliminates work processes.

- Use and maturation fosters continuous process improvement.
- Supports tighter customer and supply chain integration.
- Foundation for predictive analytics in operating phase.
- Supportive of dynamic risk models.

Four examples what knowledge assemblies might encompass are reflected in the following table.

Examples of Knowledge Assemblies			
Project Planning Knowledge Assembly	Project Engineering Knowledge Assembly	Tunnel Knowledge Assembly	Equipment Knowledge Assembly
Strategic Business Objectives and top level KPIs	BOD ^X (Expanded Basis of Design ¹)	Geotechnical report	Community or practice expertise
Client imposed constraints/upset value	Scope evaluation for completeness	Actual ground conditions encountered	Procedures (project execution; community based process activity tasks)
Historical project data (specific, location, client, industry, facility type)	Design related tools, go-bys, templates, forms	BOD ^X	Specifications (procurement; industry referenced)
Prior plans	Collaboration analytics to identify emerging issues and thinking	Design related tools, go-bys, templates, forms	Supplier data
Alternatives to be considered	Optioneering	Bill of materials	Supplier analytics
Economic forecasts and data	Design reuse	3D model elements (GIS as relevant)	3D (7D) model
Stakeholder and other relevant social/cultural data	3D model elements (GIS as relevant)	Bid documents	Part history including material traceability
Political/legal/regulatory information	Materials analysis	Bid evaluation	Maintenance records (reflects ultimate integration into enterprise asset management system)
Health, safety, environmental, sustainability, resilience information	Bill of materials	Construction management reports	Instructional assembly, installation, start-up, commissioning, testing, maintenance

¹ BOD^X or an expanded basis of design, extends the traditional, more technical basis of design developed in response to owner's project requirements by explicitly adding in a construction basis of design and an operations and maintenance basis of design. Up front consideration of how we want to build, operate, and maintain the project differs from more traditional subsequent constructability and O&M reviews.

Examples of Knowledge Assemblies			
Project Planning Knowledge Assembly	Project Engineering Knowledge Assembly	Tunnel Knowledge Assembly	Equipment Knowledge Assembly
			and troubleshooting videos/links
Supply chain data, assessments and insights	Supply chain analytics (capacity)	Construction notes	
Predictive analytics related to baseline elements of scope, schedule, cost and risk	Cost and schedule modeling	RFIs received and their responses	
		Inspection reports	
		Equipment list	
		Startup & commissioning documentation	
		Maintenance and operating manuals	
		Maintenance records (reflects ultimate integration into enterprise asset management system)	

Success Factors

Successful knowledge management programs are not easy and certainly have their fair of challenges. Successful knowledge management programs:

- Have strong corporate sponsorship.
- Align knowledge retention with SBOs and enterprise strategy.
- Think global/enterprise wide.
- Recognize the boundarylessness nature of knowledge.
- Knowledge behaviors are a core element of enterprise culture.
- Encourage a collaborative professional culture.
- Solid knowledge community leadership
- Emphasize continuous process improvement from the outset.
- Make technology easy to use in real time.
- Use effective forums/wikis/blogs.

Knowledge Management Challenges

Challenges typically encountered in knowledge management programs include:

- Weak change management program
- Existing data
 - Accessibility
 - Quality
 - Consistency
 - Completeness (meta data minimums)
 - Ability to aggregate/integrate
- New data
 - Data sources
 - Changing sources
 - Meta data
 - Volatility
 - Interoperability and cross-domain linking
 - Effectiveness of reuse
 - Accessibility
 - Application of Big Analytics

Summary

Knowledge is a strategic asset. There are clear telltale signs that indicate the need for knowledge management. Benefits include increased productivity and stronger employee engagement. Knowledge management is more about people, culture, and connections than tools and new technology.

Readiness of knowledge communities is important to successful management efforts. They also require strong stewardship.

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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