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WHITEPAPER

Fostering Innovation through Knowledge Management

The role of innovation in engineering is threatened on a regular basis by knowledge loss, unproductive information seeking and information gaps.

Knowledge management, or KM, is a group of strategies designed to mitigate these challenges by leveraging collective knowledge and providing for long-term knowledge continuity across all sectors of a company. While most organizations are aware of knowledge management as a practice, implementation can prove difficult without proper strategy, oversight and teamwork.

The interaction of knowledge, ideas and innovation, quality and compliance creates many stumbling blocks in an engineering operation. The learning curves faced by new engineers entering the workforce compound these problems. According to Schlumberger Business Consulting's 2012 O&G HR Benchmark, a new engineer requires around 8.2 years of professional experience to make non-standard technical decisions. Coupled with knowledge loss inherent in retirements and turnover, this gap results in lost productivity and revenue as well as poor technical decisions.

Since most organizations have developed organically, knowledge and business-critical information often reside in isolated silos that are difficult to query. A 2014 report found that knowledge workers like engineers spend around 25% of their working time seeking out and processing information, but they find the information they need only 56% of the time. This nonproductive seeking often results in the re-creation of existing information that simply cannot be found. Estimates are that a company employing 1,000 knowledge workers wastes at least $5.7 million per year due to searching for nonexistent information, re-creating existent information and failing to find existing information.

Engineers spend 25% or more of their working time seeking out and processing information, leaving too little time for applying information.

Knowledge Loss

Effective innovation, including the conception and development of new ideas, depends upon a solid knowledge base of existing ideas and expertise.

Knowledge loss and discontinuity threatens to weaken this foundation with every employee turnover or retirement. Most areas of the engineering profession are reaching a critical point regarding employee retirement.

For example, the Center for Energy Workforce Development estimated that close to 50% of employed power and energy engineers would be eligible for retirement by 2017. The key to establishing an effective knowledge base is to seamlessly transfer expert knowledge from retiring workers to younger engineers.

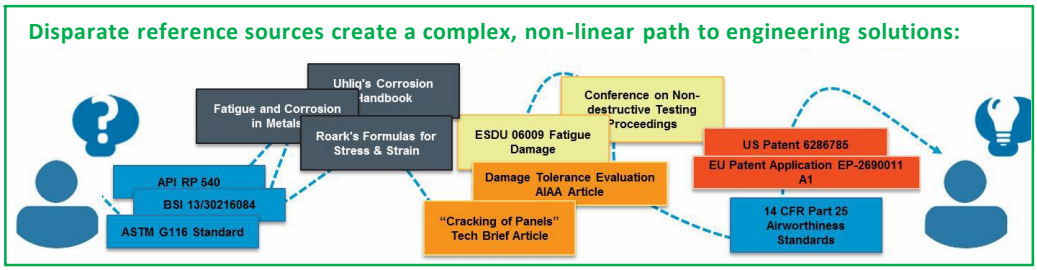
KM researchers define this personal expertise as "tacit knowledge" and sometimes contrast it with "explicit knowledge," which is available in written documentation and other sources. While tacit knowledge is often the most valuable to an organization's knowledge base, it's also often the most difficult to quantify and access. And perhaps most importantly, unaccounted tacit knowledge leaves an organization when even a single worker retires or separates. A key role of KM is to manage tacit and explicit knowledge so that innovation can occur and re-work does not.

Collaborative innovation can be simply defined as the transmission, sharing and application of knowledge throughout the research and development pipeline. In the 2008 Venturous Australia report, Terry Cutler identifies that knowledge is non-rival, cumulative, reproducible at negligible cost, an intangible asset, and can be easily reverse-engineered. These properties are central to innovation. Perhaps most importantly, the generation of new knowledge involves fundamental uncertainty and moves beyond what is already known. The combination of these assets makes knowledge available for a diffusion of innovation that can occur cheaply and efficiently.

Investing in knowledge management ensures that knowledge production, application and diffusion seamlessly occur as key parts of the innovation cycle.

The fact that knowledge is largely intangible seems to work against it when considering knowledge loss and gaps within an organization. The loss or re- creation of knowledge is rarely noticed by management, but the effects of re- work are damaging to an organization's continuity and bottom line. Investing in knowledge

Technical Professionals Need Precise Access to Relevant Knowledge Inside and Outside the Organization



management ensures that knowledge production, application and diffusion seamlessly occur as key parts of the innovation cycle.

An organization that wishes to leverage knowledge must shift its culture to that of a learning organization, one that is adept at creating, acquiring and transferring knowledge. In this way, the learning organization uses its knowledge to change its behavior and culture whenever necessary. Innovation is sometimes described as dealing with bundles of knowledge rather than a single groundbreaking technology. An efficient learning organization can identify appropriate bundles and derive value from them without duplicating resources or creating knowledge gaps.

Knowledge Management Strategies

Specific KM activities are usually grouped as either "codification" or "personalization" strategies.

Codification is IT-heavy and involves storing and organizing knowledge in a database. It may include both tacit and explicit corporate knowledge and represents a push strategy, meaning that users actively manage knowledge in a structured way.

Personalization aims to encourage direct knowledge sharing among colleagues, using IT to facilitate this sharing. It is a pull strategy in that it often consists of knowledge requests from an individual to a single expert and occurs on more of an ad hoc basis.

Codification bridges knowledge repositories and prevents the re-creation of knowledge. Improvement of enterprise search technology and repositories are common solutions to knowledge gaps, and many KM programs implement competence mapping in order to identify expert sources of individual tacit knowledge.

Improvement of enterprise search technology and repositories are common solutions to knowledge gaps.

Personalization methods are more traditional sharing activities, such as storytelling to transfer tacit knowledge, setting up communities of practice (CoPs) , knowledge fairs and apprentice programs. These activities may be supplemented by social media and groupware.

While knowledge management tactics appear straightforward and simple, implementation is more difficult. Many KM programs are undertaken with little oversight or planning, and even with proper planning in place individual employees may not be motivated to participate. Employee incentives and other counter-strategies may bolster well-implemented programs.

Boeing: A Case Study

One knowledge management program from the aerospace industry is Boeing's. Although the company has invested in KM activities for decades (it was founded in 1916), it formally scaled up the program in 2007 to deal with the organization's and industry's unique challenges.

As increasing numbers of engineers prepare to retire, companies like Boeing are taking action to prevent the loss of precious knowledge and intellectual capital.

The aerospace industry in general deals with long product cycle times, with many aircraft projected to see 50-80+ years of service. The industry is also particularly susceptible to knowledge gaps. According to a 2012 American Institute of Aeronautics and Astronautics paper, over half of the current aerospace/NASA workforce is between the ages of 45 and 60, well above the U.S. workforce average. Transferring mission-critical knowledge inherent in aging engineers is key to long-term success.

Boeing began by forming an enterprise team to investigate and oversee early KM operations. This team took inventory of the company's processes and tools and planned future knowledge management accordingly. Boeing now identifies its execution phase as a two-year period that stretched from 2010 to 2011. The initial team established tools and knowledge sharing activities, including communities of practice, a knowledge and productivity network and enhancements to knowledge capture and transfer tools. Starting in 2011, the team began to shift ownership to individual business units and focused on accelerating knowledge transfer and retention into the future.

The company's efforts span both codification and personalization activities. The KM team established functionally endorsed "Boeing Designated Experts" to help employees identify knowledge centers and connect them to leadership figures. The company also created an enterprise-wide inSite network and encouraged employees to tag their own expertise and authorities.

As for codification, the team implemented improved search functionality for enterprise content management. Their overarching Boeing Knowledge Network site serves as a hub for most KM activities. Certificates and eligibility for cash rewards in response to employee knowledge sharing and management provide an incentive for continued employee involvement.

While many organizations invest only in IT-based knowledge systems and ultimately fail, Boeing achieved a balance between personalization and codification.

Boeing's program is generally considered successful. A 2014 article in the European Journal of Business and Management found that, while many organizations invest only in IT-based knowledge systems and ultimately fail, Boeing achieved a balance between personalization and codification.

Investing in both strategies equally and changing policies to create a knowledge-sharing culture contributed to the longevity of the KM program.

Obstacles to Learning

While knowledge management is often considered within design and research and development activities, KM and organizational learning are also useful in manufacturing and supply chains. The gaps between disparate business units can become significant barriers to knowledge-based supply chain management. A 2013 paper in the International Journal of Production Economics found that supply chains that foster an intentional learning environment and knowledge transfer are significantly more flexible.

The knowledge-based view of supply chain management sees the chain as a strategically aligned social community optimized for collecting and sharing internal and external knowledge for the benefit of the business. While components of this supply chain must carefully manage internal knowledge, customer knowledge and supplier knowledge together, doing so supports productivity and innovation for the entire chain and the organization itself.

Author: Jonathan Fuller. A version of this article originally appeared on IHS Engineering360. Reprinted with permission.

Unlock Corporate Knowledge for Engineering Reuse

Accessing internal corporate knowledge is a time-consuming, tedious and often fruitless undertaking, with industry analysts IDC claiming 'knowledge workers' spend 30 to 40 percent or more of their time 'searching' for relevant answers and concepts buried in: personal folders, shared drives and networks, corporate libraries and directories, intranets and portals, email, product data and lifecycle management systems, document and content management systems, enterprise resource planning systems and more.

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CUSTOMER CARE AMERICAS
T +1 800 447 2273
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CUSTOMER CARE EUROPE, MIDDLE EAST, AFRICA
T +44 1344 328 300

CUSTOMER CARE ASIA PACIFIC
T +604 291 3600

E CustomerCare@ihsmarkit.com

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