VDOT Knowledge Management Toolkit

Introduction

The Virginia Department of Transportation (VDOT) was founded in 1906 as the Department of Highways to engineer and construct Virginia's primary roads, transforming mud routes into a modern roadway network. In the 1950's, this mission was expanded to successfully participate in the construction of the interstate highway system. Today, however, transportation needs can no longer be met by simply building more roads, and yet there is an ever increasing demand for transportation capacity and efficiency. VDOT must shift its mission from roadway construction to maintenance and system operations, which requires tremendous collaboration between previously distinct internal agency functions, with exterior state agencies, and with private industry partners. Finally, VDOT's population is aging; the hierarchical organization which served so well the demands of the first century must change in order to meet the needs of the new, but the transition depends on successfully integrating new strategies with experienced practices. Simply put, massive organizational change must be managed in a way to meet new demands and increase efficiency.

VDOT currently has about 7,500 employees, of whom approximately 30% are eligible for retirement within the next five years. The agency experienced a loss of knowledge in the mid-90's during two statewide workforce reductions, cutting 20% of total staff in less than 5 years, impacting productivity and effectiveness. To prevent a recurrence of knowledge loss, the agency created a Knowledge Management Division in late 2003 to address critical knowledge identification, collection, organization and dissemination.

Preparing for the future loss of staff starts with the premise that we need to re-think and encourage knowledge transfer in the agency. VDOT's program focuses on the transfer of tacit knowledge: identifying knowledge held by individuals or groups, and sharing that knowledge with other individuals or groups, in order to improve how business processes are approached, considered, or handled. The transfer of knowledge is evidenced when a change in performance of the organization results. In order to enhance the agency's access to the expertise and knowledge of its staff, its organizational memory, we have fostered organizational change by encouraging knowledge sharing by staff. People who are used to accessing and sharing information are better prepared to deal with change.

The program has been a demonstrated success and was recognized by the Harvard Innovations in Government Program in 2008 which funded this toolkit for the purpose of disseminating best practices.

What is KM?

Knowledge management emerged in the late 1980s and early 1990s as a response to the realization that valuable organizational knowledge, the collective knowledge that makes a company unique, was at risk and that the loss could compromise a company's ability to compete or operate in an increasingly complex environment. The original focus was on the private sector and the non-tangible assets of a company. In 1991, Skandia created a position of Director of

Intellectual Capital and during the 1990s articles and books on corporate knowledge management began to appear (Wiig, 1997). The federal government and public organizations such as the military branches began to pursue knowledge management a few years later. In 1999, the federal government appointed its first chief knowledge officer for the General Services Administration (Federal CIO Council; Rubenstein-Montano, 2001).

Rubenstien-Montano, Buchwalter and Liebowitz (2001), provide "eight key indicators that a knowledge management initiative is needed: 1) the average age of employees is senior; 2) lack of a mentoring program between experts and novices; 3) little funding for development and training; 4) lack of time for informal knowledge sharing; 5) loss of knowledgeable employees; 6) lack of capture and documentation of knowledge; 7) lack of knowledge about what other departments do; and 8) large amounts of time spent looking for information" (3.1 Overview section, ¶ 2).

Definition

Knowledge management is the identification, collection, organization and dissemination of critical knowledge within an organization. It is an attempt to identify what knowledge an organization holds, who has need of it and ensuring that it is provided at the right time (Ives, 1998). It supports innovation, through the creation of new knowledge, which provides the organization with financial benefits and returns. "Innovation, or new ways of doing things, is required both from a financial perspective, but also (and particularly in the public sector) from a modernization and democratic renewal perspective" (Bartlett, 2003, p. 351).

Knowledge Management also provides the means to transfer knowledge between individuals and groups. Knowledge transfer refers to identifying knowledge held by an individual or group and sharing that knowledge with another individual or group, resulting in a change of how the business process is approached, considered or handled. The transfer of knowledge is evidenced when a change in performance of the organization results (Argote and Ingram, 2000). Walsh and Ungson (1991) describe five repositories for knowledge in organizations: individuals, roles and organizational structures, standard operating procedures and practices, culture, and the physical structure of the workplace.

The working definition of knowledge management at VDOT is: **"Implementing ways to better utilize the expertise that we have—people and information—to improve ongoing processes and procedures and to retain critical knowledge**". This includes the following approaches:

- Getting the right knowledge to the right people at the right time
- Identifying, capturing, organizing and disseminating critical institutional knowledge
- Establishing networks between people to share knowledge
- Sharing lessons learned and best practices to avoid reinventing the wheel
- Knowing the why behind decisions and actions
- Knowing what we know
- Supporting change management
- Identifying the intangible assets of the organization

Tacit Knowledge

Knowledge held by the individual is a reflection of expertise and experience, influences the attitudes of individuals and is a knowing that informs the individual how to best accomplish a task (Constant, Kiesler & Sproull, 1994; Davenport, De Long & Beers, 1998). Tacit knowledge is based on experience and is affected by context. Individuals may be unable to express the knowledge held that assists in making decisions or performing tasks, the know-how (Koskinen, 2003). It is difficult to transfer because it is not easily written or expressed. Tacit knowledge can be shared through apprenticeships and opportunities for employees to work together and share common experiences to in turn, share that experience with others in the organization. While it might not be possible to write the knowledge down, it may be possible to demonstrate it. Polanyi (1966) defines tacit knowledge as knowing more than we can express or put into words, that we are aware or understand but would find it difficult to explain to others how or why. Therefore, tacit knowledge is more easily expressed using metaphors or through demonstration. It is tacit knowledge that is most valuable to an individual or organization because it is unique and scarce.

Tacit knowledge originates with the individual and it is necessary for that knowledge to transfer from person to person to be useful to the organization. One way of transferring is described by Nonaka and Takeuchi (1995) as socialization, the sharing of experience to create shared mental models as through apprenticeships. However, tacit knowledge must be applied carefully. According to Bontis (1999), much of the literature fails to acknowledge that while tacit knowledge can contribute to the competitiveness of an organization it can also limit its competitiveness if that knowledge does not fit the context of the desired industry.

Explicit Knowledge

Explicit knowledge can be codified and often takes the form of procedures, policies, memos, databases, and research reports. This type of knowledge is found in libraries, on websites and intranets and in file cabinets and desk drawers. Making knowledge explicit supports ownership of that knowledge by the organization. Once the knowledge is codified and made explicit it no longer belongs solely to the individual but rather the organization owns it and can make it available to all employees to benefit the organization through increased efficiency and effectiveness. "The knowledge management literature's focus on intellectual capital and knowledge assets signal intention to claim ownership, and the strategy for transforming knowledge into capital and assets is to make it explicit" (Kreiner, 2002, p 112).

Role of Culture

Holsapple and Joshi (2002) state that "an organization's values, principles, norms, and unwritten rules and procedures comprise its cultural knowledge resource …[which] influences each participant's use of knowledge as well as the interactions among participants' knowledge" (p. 53). Culture affects knowledge by determining how it is used and shared within the organization. "An organizational culture that enforces a policy of command and control to create

an order seldom provides opportunities to create knowledge" (Bhatt, 2000, Managing knowledge section, ¶1). This command and control may inhibit the informal exchange of knowledge. Sveiby and Simons (2002) found that "a culture of trust and collaboration improves knowledge sharing and organizational effectiveness in general is argued by several authors, who also link trust, collaboration and knowledge sharing" (p. 421). Participants of a senior knowledge managers' focus group "described a knowledge-sharing culture as one where people share openly, there is a willingness to teach and mentor others, where ideas can be freely challenged and where knowledge gained from other sources is used" (Smith & McKeen, 2003, Section 2, ¶ 2).

General challenges in implementing knowledge management include such things as a lack of understanding what knowledge management is and how knowledge can be managed; the reluctance of people to share what they know as they fear the loss of power; a willingness of people to share what they know but they don't have time; a willingness to share what they know but they don't know how or don't view their knowledge as critical; and a lack of processes or tools that allow knowledge to be easily shared.

One of the KM Division's critical goals then, was to foster both high sociability and solidarity. High sociability facilitates employees' willingness to seek knowledge from peers and to be a source to others. High solidarity ensures that employees share and support common goals that benefit the organization as a whole. Employees must perceive organizational leadership to be supportive of and recognize employees who share and that there is no favoritism. At VDOT all of these have been publicly embraced and communicated to employees allowing success in the program.

Who Owns the Knowledge?

There is a debate about who owns the knowledge, the individual or the organization. Knowledge held by the organization is reflected in operating procedures and systems, it is how the organization performs its work (Bryant, 2003). Knowledge held by the individual is a reflection of expertise, a knowing that informs the individual how to best accomplish a task (Constant, Kiesler & Sproull, 1994). Drucker (2001) says that the knowledge worker owns the knowledge. Ultimately, determining ownership of knowledge involves values, beliefs and behavior.

Knowledge transfer benefits the receiver and the organization, but the source of the knowledge may perceive it as costly as knowledge may be seen as a source of power or insurance that the organization will not be able to replace them thereby securing longevity in the workplace (Davenport, Eccles and Prusak, 1992; Jarvenpaa and Staples, 2001; Reagans & McEvily, 2993; Szulanski, 1996) and therefore be unwilling to share it with the organization. The individual controls what knowledge is shared, not the organization (Bhatt, 2002). The willingness to share knowledge with the organization is a reflection of trust in the organization (Brown and Woodland, 1999).

However, there is a perceived difference between sharing knowledge about the work and sharing expertise. “Sharing tangible information work may depend on prosocial attitudes and norms of organizational ownership; sharing expertise may depend on people’s own self-expressive needs” (Constant, Kiesler and Sproull, 1994, p. 400). While the individual may be an important source of knowledge for the organization, it may be difficult to persuade employees to share that knowledge…“organizations must consider their employees as an important source for organizational knowledge but must recognize the potential difficulties of trying to capture knowledge that is not only tacit but also, from the employees’ perspective, proprietary” (Staples, Greenaway and McKeen, 2001, p. 9). Age, education and the role of the individual within the organization also affect perspectives of ownership. “The higher the education level, status, age, and tenure of a person, the more likely he might value social reciprocity and hence have beliefs of organizational ownership of information and knowledge” (Jarvenpaa and Staples, 2001, p. 158). Davern (1997) discusses social networks and network capital, “the amount of favors and individual can call in at any given time. People build up these favors through their structural position within some type of social organization” (Davern, 1997, p. 293).

Need

Frappaolo and Wilson Todd (2000) referenced a 1999 survey by Delphi Group that asked companies about their primary knowledge repositories and responses indicated that on average, 42 per cent of the corporate knowledge was within the minds of employees. This percentage indicates the need for a major focus of a knowledge management program to be on identifying and facilitating the transfer of tacit knowledge. Risk of tacit knowledge loss can occur both when a large percentage of employees are eligible for retirement and when a functional area is staffed by a limited number of employees (McBriar, et. al., 2003). If undocumented, knowledge is not easily shared within the organization and instead may only be available within small groups of employees. The value of tacit knowledge to the organization can only be realized if it identified and appropriately shared.

Demographics

According to the Knowledge Management Working Group of the Federal Chief Information Officers Council (2001), “approximately 71% of federal senior executives will be eligible to retire by 2005. And unless the knowledge of those leaving is retained, service to citizens will likely suffer” (Executive Summary section, ¶ 11). State government mirrors the demographics of the federal government leading to the possibility of large amounts of critical knowledge walking out the door unless steps are taken to preserve it within the organization. One step is to encourage the exchange of knowledge to share what is known and to facilitate the creation of new knowledge.

Changing Workforce

Turnover of employees will occur in all organizations due to retirements, new opportunities for the employee and unforeseen circumstances. To prevent the loss of knowledge, organizational support of employee networks to transfer critical knowledge and information is

needed. “Managers must accept the inevitability of employee turnover, and through an understanding of social networks, make structural changes to their organization which promotes the diffusion of knowledge before crucial information is lost” (Droege & Hoobler, 2003, p. 59). Such trends as rightsizing and reorganizations destroyed or compromised tacit knowledge networks along with the pending retirements of long-term employees and the mobility of the new workforce, where the informal contract between the company and an employee moved from employment for life to employment for as long as there is mutual benefit (Smith, 2001).

Competitiveness

Knowledge, particularly tacit knowledge, provides organizations with unique assets contributing to competitiveness and affecting financial returns. The involuntary loss of organizational knowledge is costing companies millions of dollars every year. When a company finds itself in the situation of having to reinvent or buy knowledge it once had, resources are wasted. In that situation, not only is the time and money spent developing those skills lost, but there is also an opportunity cost (de Holan, Phillips and Lawrence, 2004, p. 45). If codification of the knowledge speeds the transfer between employees and making it available in that format does not threaten the competitiveness of the organization, efforts will be made to transfer tacit knowledge to explicit.

Public Organizations

Public entities in particular need to focus on capturing this tacit knowledge held by employees as evidenced by the rising human capital crisis resulting from the eligibility of over half the U.S. government employees (Liebowitz, 2003). These statistics are echoed in the employee demographics of state and local governments as well.

According to Chiem (2001), presenting knowledge sharing as a way to make jobs easier can assist is making the practices appealing to government employees. McAdam and Reid (2000) found that the public sector organizations viewed the major benefits of knowledge management to be improved efficiency and quality and public employees received intrinsic benefits related to job enrichment from participation. “The non-information sharing culture of many government agencies is perhaps one of the greatest barriers that many agency directors will face” (Auditore, 2003, p. S4).

In a study, Chiem (2001) found that government employees may perceive knowledge sharing as just more work and may resist the building of a knowledge sharing culture. Employees may be intimidated about sharing by the presence of superiors. “Employees will not share knowledge among all group members if the groups are constrained by hierarchies or perceived power imbalances—people are inhibited by their superiors” (Connelly & Kelloway, 2003, p. 295). According to Chatzkel (2002), knowledge sharing in government organizations must contend with the ‘not invented here’ syndrome and the ‘knowledge is personal power’ issues. For others, sharing knowledge seems like a lot of work for little return. “Knowledge sharing provides intangible and uncertain rewards, is not always noticed by influential others, and may involve more significant effort or sacrifice” (Connelly & Kelloway, 2003, p. 294).

Tools and Techniques

There are many tools and techniques available to promote knowledge capture, sharing and organization. Below are some that have been used successfully by the Virginia Department of Transportation.

Communities of Practice

Definition

A community of practice is a group of people "who share a concern, set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermott and Snyder, 2002, p. 4). Organizations support the transfer of tacit knowledge from one employee to another through project teams and communities of practice to create redundancy and embed the knowledge within procedures and routines. VDOT defines communities of practice as a critical tool to create networks and share knowledge that have resulted in new tools and changes in processes.

Many organizations support the sharing of knowledge through the use of communities of people interested in the same knowledge area or practice. These communities gather to share explicit and tacit knowledge within an organization or profession. "At work, communities of practice can exist solely within an organizational unit; they can cross divisional and geographical boundaries; and they can even span several different companies or organizations" (Burk, 2000, p. 18). According to Brown and Duguid (2001), communities of practice are "privileged sites for a tight, effective loop of insight, problem identification, learning and knowledge production" (p. 202). The communities support individuals in learning about the work and private interests and skills of others resulting in the construction of social and advice networks. According to Brown and Duguid (2001), "these groups of interdependent participants provide the work context within which members construct both shared identities and the social context that helps those identities to be shared' (p. 202).

Supporting the creation of communities of practice, a type of network, aids in the transfer of knowledge and new technology (defined as a work practice as well as a product). According to Allen (as cited in Hoegl, Parboteeah & Munson, 2003), "researchers have found that technology transfer primarily occurs via informal communication channels as opposed to formal documentation" (pp. 745-746). According to Burk (2000), communities of practice can "potentially speed the application of new products and procedures and provide a feedback loop" (p. 18). In addition to speeding knowledge transfer, the communities or network assist the organization in rapidly responding or adapting to changes in the environment. According to Stark (as cited in Brown and Duguid, 2001), "the ability to adapt continuously and respond proactively to environmental change—is to a significant degree determined by communities of practice" (p.

203). Brown and Duguid (2001), state that communities of practice are "privileged sites for a tight, effective loop of insight, problem identification, learning, and knowledge production" (p. 202). "With these communities of practice in place, this network emerges as the chartered source to build and deliver knowledge" (Burk, 2000, p. 18). . In a study on communities of practice, Lesser and Storck (2001) found that supporting communities assists employees in building connections and trust resulting in a positive impact on business performance. These communities assisted employees in identifying subject matter experts. When documents produced by the community were placed in the knowledge repositories and listed the experts name as an author or reviewer, the documents were seen as more valuable and trustworthy.

A Community of Interest is a group of diverse stakeholders that share a common interest and collaborate for mutual benefit. What is the Difference between a Community of Interest and a Community of Practice? A Community of Practice seeks to improve a particular business process or function. In contrast, a Community of Interest seeks to improve a particular input to multiple business processes.

How to Form a Community of Practice

Maintain a clear focus on business objectives and on the role of the CoP. For example, if this is not a group that decides on policy, be clear that you will not be developing policy. You may offer ideas or suggestions to policy groups, you may be asked for feedback or suggestions about policy, but the group needs to stay focused on the areas in which it can have an impact. A little venting can be useful, but you don't want to spend much time complaining about areas that you can't control or impact directly. Focus on what you can do that will support the business goals of the organization.

Development of the focus of a CoP may involve pre-meeting research, for us this usually means one-on-one meetings with stakeholders, both CoP members and their "customers", those that are impacted by the work of the CoP, to get a broad sense of framework.

Have the right stakeholders involved. Everyone involved in a meeting should have a clear role in that meeting. Reduce or cut out the presence of people who are there to "watch" and see what the group is doing as this severely impacts frank discussion.

Use an iterative process to gain trust and bring in new stakeholders at the right time. This is a means of evolving and ongoing improvement in the group's work. Use this iterative process to think about who needs to know what and when in order to have appropriate agency buy in to the group's work.

Think about management support of the effort, what is appropriate? We work with managers from the start, and keep them involved and informed. We make it clear that we are focusing on business objectives and that we will keep the right people informed so that no one gets concerned about their prerogatives being abused, or surprised about what is happening.

Keep the group small (few CoP are more than 15 people) to enable frank discussion. Keeping the meetings small makes it imperative that the right people are kept informed about what is happening. In most cases, it is not a good idea to surprise managers with what "their" people have been doing. In the beginning this is particularly important, as the group matures and managers see that they are kept in the loop and that they benefit from the group's activity there is more trust about the process**.**

Keep the process simple and informal and utilize existing groups and processes as much as possible to keep the burden low

Have in-person meetings as much as feasible. Our groups meet about quarterly in person. We utilize videoconference capabilities in between for information transfer, but real dialogue and breaking down problems and developing solutions comes most effectively at in person meetings.

KM facilitates. KM plays a coordinating and management role to keep meetings focused on business goals and objectives that have been identified by the CoP.

CoP develops the objective and goals. The group identifies the business objectives and initiatives on which they will focus as they are the experts in the field. They also develop the plans/next steps. The KM facilitator will be the goad, coordinator, advocate, and opponent, as needed to keep the group focused on their goals and objectives and on achieving outputs. The KM facilitator WILL NOT identify the business objectives and goals of the group. The CoP has to own this or it won't work.

Some training of team members in working collaboratively may be necessary. When you have polarized positions, it may be necessary to sensitize people to the need to talk in ways that the other members can understand. Avoid blaming language and encourage language about how to work better together in the future. Many people don't even realize how much they have fallen into this kind of language, and it may take careful re-framing of an issue to enable CoP members to understand the impact of how we think about, and talk about, issues.

Maintain an objective rather than a solution focus. What is important is achieving your objective. If you get caught up in the solution that you identified, it becomes hard to let go when others (like decision-makers or impacted stakeholders) become involved and want to change (evolve) the solution. In fact, such change is often critical to buy-in and may well be a better solution as it takes a broader perspective into account. As long as the group stays focused on the ultimate objective, it is easier to let go of the solution that it came up with as the solution evolves.

This is not a race. KM's objective is supporting staff in increasing their professional networks, in strengthening their ability to share knowledge and to learn, and to develop methods for ongoing and evolving improvement. This means we need to keep an eye of the broader impacts of the group.

It is important to identify and develop successful products and outcomes relatively early as a team-building practice and also as a measure of whether the group is meeting a need.

Measures of success. Measures of success are important to the group, and to management support of the development of CoP. From the very beginning it is important to think about how you will determine that the group is benefiting the organization. Measures, or indicators, of success include both quantitative and qualitative measures, or some combination of the two, as appropriate. For example: changes in practices and policy, time or cost savings, training or development needs to support staff, or satisfaction by the group's customers—either their bosses or other sections that depend on their work as measured through surveys, SHORT surveys.

CoP assume greater responsibility over time for the group in terms of maintaining a focus on business objectives and maintaining minutes to document decisions and actions.

Ongoing evaluation of the effectiveness of the CoP is useful to both maintain its focus on needed work and to identify when the group either has served its purpose or needs to evolve to a new form or focus. See above for examples of some measures.

Examples of Community Types

Community Type	Purpose
Best Practice	Develop, validate, codify, index and disseminate proven practices
Helping	Facilitates informal knowledge sharing, Q&A, mentoring
Knowledge Stewarding	Collect, select, update, organize, and distribute day-to-day knowledge
Innovation	Foster innovative ideas and practices

Knowledge Mapping

Access to experts within the organization is important to problem solving, building the knowledge base of employees and innovation in product construction or delivery. "The role of experts is important as they are ultimately the source of the innovations or knowledge that is being diffused. Consequently, they form local peaks in the knowledge distribution, and agents directly connected to them benefit, becoming second-order experts" (Cowan & Jonard, 2003, p. 1568). By sharing knowledge with others, the demand on the time of experts is lessened freeing the expert to focus on high value projects. It also supports the redundancy of knowledge within the organization ensuring that knowledge does not walk out the door.

According to Brown and Duguid (2001), networks that cut across the organization horizontally are where knowledge flows. Knowing which individuals are contained within the network or what expertise the individual has is necessary for managers to construct project teams to create or manage solutions to organizational challenges. It is also useful to know when the knowledge does not exist within the organization, but rather outside it and who within has access to it. In addition, knowledge of these networks and expertise can be used to provide new employees with access to necessary knowledge to perform work tasks. "New staff and staff in new roles can be productive much more quickly by accessing the institutional knowledge base"

(Burk, 2000, p. 18). When the network is disrupted due to retirements, downsizing or restructuring, or when management is unaware of the existence of the network, access to organizational knowledge and expertise by new staff or staff placed in new roles is blocked.

Networks allow individuals to access more knowledge than what may be available individually through personal education or experience or through immediate co-workers. "External memories are accessed through directories held in the mind of individual team members that identify existence, location, and mechanisms for retrieval of knowledge held by other team members or in various storage devices" (Alavi and Tiwana, 2001, p. 11). These connections may be direct or indirect.

Networks support the exchange and dissemination of knowledge. What is exchanged or shared depends on what individuals are connected. According to Cowan and Jonard (2003), "the details of who is connected to whom will clearly effect what type of information is passed, how much, and how efficiently" (p. 1558). Organizations may construct networks through the use of communities of practice or encourage employees to belong to networks that span organizations.

According to Lesser and Prusak (2001), when organizations downsize, it is often the most knowledgeable employees who leave first resulting in damaged critical social network and an increase in time needed for knowledge transfers. This often occurs when organizations offer buy-outs and early retirement incentives without considering the knowledge held by those designated as eligible, which is what occurred in the state agency for this study. These knowledgeable employees have built and maintained extensive networks used to share knowledge. "What really distinguishes high performers from the rest of the pack is their ability to maintain and leverage personal networks. The most effective knowledge workers create and tap large, diversified networks that are rich is experience and span all organizational boundaries" (Cross, Davenport & Cantrell, 2003, p. 20). Awareness of and support for these networks and the individuals within is a critical function of leadership and management as the networks are used daily in completion of work. "The traditional organization chart may show who reports to whom, but often who talks to whom is more important in getting work done and generating new ideas" (Foster & Falkowski, 1999, p. 53).

VDOT defines knowledge mapping as a tool to help us identify areas of need for succession planning and to build networks.

Organizational Network Analysis

- A visual map that shows who talks to who and what role they play in a network or group
- Can be used to gather information about leadership, knowledge transfer, and communication patterns

VDOT uses UCINet, an organizational network analysis (ONA) program, along with a web-based questionnaire developed by the University of Virginia. This tool is used to map knowledge

sharing amongst a group of individuals providing managers with a visual image of how employees connect and how knowledge is transferred amongst them.

According to Bogenrieder and Nooteboom (2004), networks have three components: structure, peoples' positions within the network and the strength of ties. Structure refers to how dense the network ties are or how many ties bind individuals within the network together. According to Rowley (1997) "in sparsely connected networks, some sections of the network may become isolated, or segregated cliques develop, restricting communication between actors" (p. 897). Positions indicate the role played by individuals within the network. A central position indicates multiple connections. "This has implications for power, in terms of access to alternative members, bargaining power, control of information and gossip, coalition formation, and a policy of 'divide and rule'" (Bogenrieder and Nooteboom, 2004, p. 292).

Another position is that of the boundary spanner, contacts who have ties with other networks and support knowledge diffusion through the networks across the organization (Foster & Falkowski, 1999). Granovetter (1973) refers to this position as a bridge between two sectors. Hislop, Newell, Scarbrough and Swan (2000) state external networking and the use of spanners leads to the introduction of change and innovation while internal, intra-organizational networking contributes to the formation of coalitions and using internal knowledge. A third position is found on the periphery of the network and may be occupied by agency experts who are tapped for knowledge as needed. It is also where the unconnected or isolated individual resides. Most individuals are general nodes of the clusters within the network-binding people together.

Ties determine how closely related nodes are within the network. The stronger the tie between two actors, the more the ties held with others are similar, creating a redundancy in knowledge (Granovetter, 2003). According to Hansen (1999), ties among team members are considered weak when they have distant relationships and their interactions are infrequent. These weak ties lead to more innovation and creativity as connections bring together non-redundant knowledge. Dense ties imply a shared context and environment between members.

Interviews

When the knowledge held by an individual employee is critical to the organization and is not widespread, we also conduct interviews adapted from *Beazley, Hamilton, Beasley, Jeremiah & Harden, David. (2002). Continuity management: Preserving corporate knowledge and productivity when employees leave. New York: John Wiley & Sons, Inc*. The purpose is to identify deeply held knowledge and an understanding of the employee's networks.

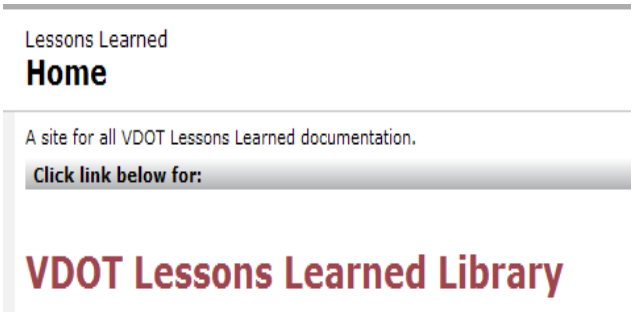
Lessons Learned

According to Bogenrieder and Nooteboom (2004), another barrier to knowledge sharing is absorptive capacity; the more different the contexts and experience of the parties are, the more energy it requires to exchange knowledge. The other side of absorptive capacity is retentive capacity (Szulanski & Cappetta, 2003), which occurs when there is initial difficulty in transferring knowledge, thus providing employees with an excuse to abandon the new knowledge. This impacts the collection of lessons learned and the transfer of best practices and must be considered in the approach.

As part of a Knowledge Management pilot, VDOT's Construction Quality Managers Community of Practice implemented an agency-wide construction lessons learned initiative in April 2007 to encourage a culture of sharing knowledge by construction field staff. Its purpose was to capture lessons from previous experiences that are shared across the agency. The community reviews the lessons for best practices that result in changes in processes, procedures and contract language. The pilot was recognized by the American Association of State Highway Officials Performance Improvement Committee with a Trailblazer Award in 2009. Below is the template we use along with pointers and tips:

VDOT

Lesson Learned



How to Produce a Lesson Learned

Pointers and Tips to Make the Process Work

Lesson

The Construction Quality Managers' Community of Practice won a national Bronze Trailblazers Award from AASHTO in 2009 for their work in creating and producing Construction Lessons Learned. The group uses a formal process to create one lesson per month that includes peer review and use of a lessons-learned template. This lesson shares information about the lessons-learned process that makes it work so well.

VDOT Lessons Learned

The lessons are archived on *InsideVDOT* in the VDOT Lessons Learned team site.

Explanation

Creating a Lesson

First of all remember, **you are the expert!** You do the work. Your knowledge and experience are valuable assets to VDOT, particularly if you are good at your job and can share ways to do what you do better.

In choosing a lesson, **pick a topic that is worthwhile to be shared with people who work in your area of expertise**. The lesson can be a description of a more efficient way to accomplish a job, can share information about a new process, standard, or specification that is required, or even can be in the form of a warning of how best to avoid a common mistake.

Whatever the topic, **stay focused on the lesson and how it can benefit those to whom it is directed**. You wish to convey the information in the quickest, simplest, and most direct manner.

Using the Process

Form a peer group to discuss lessons. Get feedback from the people with whom you work to bring forth and validate lesson ideas. Get their input. Your peers can help you keep focus and can and will contribute ideas and resources to improve your lesson, but only if you ask for their assistance. Include colleagues from other divisions or work units with whom you interact in the work on the lesson topic.

A big part of the lesson is the process used to create it. By involving others with whom you work to get their input and feedback and have them validate that the lesson is accurate and worthwhile, the lesson is reinforced within that peer group of experts and vetted for sharing with others. If you are not sure about something, ask the colleague(s) who you recognize as the expert(s) on the topic of your question.

Avoid policy, human resources, or legal issues unless you set policy, work in HR, or provide legal advice to VDOT. Lessons are not forums for discussion of issues beyond your control. Stick with what you know in the field in which you work.

The Lesson Document

Write clearly and get to the point quickly. Explain as best you can as if you were telling someone the lesson. Have others read and review it to make sure what you write is accurate and understandable. Limit how much you write. More than two pages may be too many.

If a diagram or photo can improve the lesson, use it. Use of photos or illustrations as examples can save a lot of writing.

Use hyperlinks in the lesson so readers can go to sources that are cited and get more information from the source material immediately with a click.

Create a template. If developing a group of lessons, create a template similar to the one used here. The template helps provide focus and space for each element necessary to write a complete lesson; provides a framework for familiarity by readers; helps to limit lesson size; and includes repetitive elements like the title header at the top of page 2 and the disclaimer in the footer.

List the lesson contributors so they may be contacted for questions regarding the lesson topic.

For More Information and Assistance

Contact the contributors below.

Audience	Contributors

Process Mapping

Part of identifying critical organizational knowledge is to know how and where it is embedded, and process mapping is a tool that can be used to bring that out. It is a means to encourage knowledge sharing and to develop new and innovative approaches. It is also a method that can be used to help forget old habits and how we have always done things in order to be more effective in the new environment (Martin de Holan & Phillips, 2003). Process maps can also help decrease dependence on memory (past experiences, practices and attitudes) of how things were done (Koupoulos, Spinello, & Toms, 1997) and make that knowledge widely available. Unlearning takes two steps—changing the process or policy and then changing the procedures or steps/routine. If the process is changed but not the routine, the organization has not forgotten (Tsang & Zahra, 2008)

VDOT uses a process that brings together experts to help map out the process and to provide supporting documentation for that map that clearly outlines steps and accountability. The maps should attach processes across separate functions providing a clearer picture of how the agency operates.

Assessment, Outcomes and Measurement

The Knowledge Management program has conducted an assessment each year since its inception (formalized in 2006). The assessment has looked at both qualitative and quantitative data to measure progress, accomplishments and challenges. These criteria were adopted from the research which showed that successful projects had 1) a link to economic performance or industry value; 2) technical and organizational infrastructure; 3) standard, flexible knowledge structure; 4) a knowledge-friendly culture; 5) a clear purpose and language; 6) a change in motivational practices; 7) multiple channels for knowledge transfer; and 8) senior management support. We tracked the number of projects (communities, lessons learned, knowledge mapping

and other) initiated, specific products resulting from these projects, ROI, perceptions of the program by employees and leadership, development of a knowledge transfer infrastructure, techniques and tools, and the changes in culture. Below are summaries from the past three years :

FY07: **Direct Indicators: 1)** Knowledge Management has implemented and/or maintained 46 of 51 projects that directly involve about 500 VDOT staff from all nine districts and Central Office and impact agency-wide. 2) Out of these projects have come 20 final products and outcomes this fiscal year with identifiable benefits to the agency. Among the more visible and important projects are: The implementation of the Project Record Keeping System (PRKS) with a conservative ROI of about $500,000 (based on a one hour/week savings per inspector); and resource sharing across districts in the Right of Way and Utilities function without the need to hire consultants with a conservative ROI of $1.4 million cost avoidance. **Indirect Indicators:** As VDOT's KM office has developed, other agencies and individuals outside of VDOT have expressed increasing interest about its work, evidenced by 46 requests for more information and consultations, 18 invited presentations, and 8 articles published by staff or about the program.

FY08: **Direct Indicators:** Knowledge Management implemented 40 of 48 new projects assessed for agency value and continued work on 23 that had begun prior to the fiscal year. Work in 8 projects among these 63 was completed. This work directly involved approximately 700 VDOT staff from all nine districts and Central Office and impacts VDOT agency-wide. Indirectly, given KM's work on the Construction Lessons Learned process, the VDOT Teleworking Committee, and *InsideVDOT*, more than 6,000 VDOT employees are involved. Out of these projects have come 61 final products and outcomes this fiscal year with identifiable benefits to the agency. Among the more visible and important projects are: • One community, the Area Construction Engineers (ACE), developed a streamlining action plan with suggestions that were adopted by District Construction Engineers as the statewide construction streamlining action plan. • KM supported an initiative to facilitate regional relationships between VDOT and partner agencies to develop Incident Response Management. The benefit for VDOT will be to improve incident clearance times through developing better working relationships with partner agencies. • KM conducted an organizational network analysis on an extremely successful construction project for the State Fair. Data was gathered on efficiency, innovation, communication speed, effectiveness, and time saved. This analysis provided actual data on how networks operate to develop information effectiveness and efficiency. **Indirect Indicators:** Other agencies and individuals outside of VDOT have expressed increasing interest about KM's work, evidenced by 18 requests for more information and consultations, 11 invited presentations, and 2 articles published by staff or about the program. The KM Program has been recognized both nationally and internationally as reflected in its finalist status in 1) The KM Reality Award, KMWorld 2007, and 2) the Harvard Innovations in Government Award, 2008.

FY09: **Direct Indicators:** Knowledge Management worked on 71 discrete projects that ranged from supporting communities of practice to special assignments. This work directly involved approximately 900 VDOT staff from all nine districts and the Central Office and impacts VDOT agency-wide. Indirectly, through KM's work on the Construction Lessons Learned process and *InsideVDOT*, the agency's intranet, more than 6,000 VDOT employees are involved. The work crossed all business lines of the agency. Specific projects included one with the Environmental

Division has resulted in an annual cost savings of $300,000 to the agency. This savings was achieved by working with VDOT experts to streamline the state environmental review process. This process-

mapping project now serves as a model for other groups within the agency and will result in a clearer map of agency processes and identify where they intersect. This fiscal year the construction communities of practice—District Construction Engineers, Area Construction Engineers, Construction Quality Managers, and Project Controls—evolved into a new phase. The District Construction Engineers began assigning projects to relevant CoPs to address specific areas regarding strategic planning in construction. The findings returned by the CoPs were integrated into their strategic plan. What has resulted is new to VDOT: a statewide vertical and horizontal integration of expertise represented by different communities of practice made up of VDOT's experts—people responsible for implementing and managing the agency's day-to-day construction work—contributing their expertise in significant ways to help develop the strategic plan for construction. KM has worked with a special committee of the Emergency Response Task Force to develop a comprehensive suite of documents that will establish a statewide Command and Control Standard Operating Procedure (SOP), along with complete processes detailing how VDOT will respond to incident types: crashes, terrorist attacks, HAZMAT spills, and weather-related events. The Command and Control SOP for Emergency and Incident Response was completed along with the weather-related process this fiscal year. The lessons learned process has been successful. AASHTO recognized the merit of Construction Lessons Learned (CLL) by awarding the Construction Quality Managers a 2009 Trailblazer Award. Perhaps more important is the recognition and buy-in within the agency. In surveying users, almost all—97%—of VDOT's construction inspectors and construction managers said that the CoP should continue to develop and distribute construction lessons learned; 94% said that the CLL have been a means of learning and sharing information; and 92% said the CLL have provided information that they have used. The CoP has gotten feedback, not just from field staff, but from non-construction staff, from consultants, and from FHWA as to CLL usefulness. The program has required thought, close listening to users, willingness to change original plans for the process, teamwork, and effort to maintain it over a two-year period even in the press of other ongoing needs. The sharing of lessons learned has resulted in increased knowledge and ensures that VDOT learns from staff experience. **Indirect Indicators:** Again this year, the VDOT Knowledge Management Program was contacted by other state and national organizations to consult on KM tools and techniques, as listed in Appendices 6 and 7. Members of staff were also invited to publish an article in an international journal about VDOT's communities of practice and were recognized by national organizations for the division's work.

Other Resources

Clark, K. C. & Hammer, M. L. (2008). Communities of Practice: The VDOT Experience. *KM Review, 11*(5).

Hammer, M. L. & Clark, K. C. (2009). Organizational Memory. In Marcia J. Bates and Mary Niles Maack (eds.) *Encyclopedia of Library and Information Sciences* [3rd ed.].

McNabb, D. (2007).. *Knowledge management in the public sector: A blueprint for innovation in government*. New York: M. E. Sharpe.

NCHRP Synthesis Study 37-02 on Preservation of Knowledge (Note: NCHRP: National Cooperative Highway Research Program)

Other Toolkits:

KNOWLEDGE MANAGEMENT TOOLKIT for the Crisis Prevention and Recovery Practice Area
http://www.undp.org/cpr/documents/whats_new/UNDP_Toolkit_LowRes.pdf

Dare to Share
http://www.daretoshare.ch/en/Dare_To_Share/Knowledge_Management_Toolkit

Overseas Development Institute Tools for Knowledge and Learning
http://www.odi.org.uk/resources/download/153.pdf

Consultative Group on International Agricultural Research and KM4Dev Community Toolkit
http://www.kstoolkit.org/

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