



Knowledge Transfer Needs and Methods Final Report

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December 2012

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INE/AUTC 12.32

FHWA-AK-RD-12-26

**Alaska Department of Transportation & Public Facilities
Alaska University Transportation Center**

REPORT DOCUMENTATION PAGE			Form approved OMB No.	
Public reporting for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestion for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-1833), Washington, DC 20503				
1. AGENCY USE ONLY (LEAVE BLANK) FHWA-AK-RD-12-26		2. REPORT DATE December 2012		3. REPORT TYPE AND DATES COVERED Final Report
4. TITLE AND SUBTITLE Knowledge Transfer Needs and Methods			5. FUNDING NUMBERS AUTC#510009 DTRT06-G-0011 T2-11-09	
6. AUTHOR(S) Dr. Robert A. Perkins Dr. F. Lawrence Bennett				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Alaska University Transportation Center P.O. Box 755900 Fairbanks, AK 99775-5900			8. PERFORMING ORGANIZATION REPORT NUMBER INE/AUTC 12.32	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Alaska Department of Transportation Research, Development, and Technology Transfer 2301 Peger Road Fairbanks, AK 99709-5399			10. SPONSORING/MONITORING AGENCY REPORT NUMBER FHWA-AK-RD-12-26	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT No restrictions			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The State of Alaska has an aging workforce. There is a paucity of workers in the 25 to 45 year age group. The Alaska Department of Transportation and Public Facilities (AKDOT & PF) has almost one third of its workforce eligible to retire within five years. In earlier research we examined this problem with respect to recruitment, retention, and succession planning. This project will focus on issues related to knowledge transfer, the passing of knowledge from more experienced employees to newer employees, especially in the engineering and technical areas. Both the state and the AKDOT&PF are well aware of the employment demographics and knowledge transfer issues. These are indeed problems nationwide problems and in developed countries worldwide. Here we propose to review the knowledge transfer needs of the AKDOT&PF, the current practices with respect to the many tools available, and meet with AKDOT&PF managers and professionals in focus groups to determine which tools are likely to be effective in enhancing knowledge transfer. We plan to identify barriers to knowledge transfer, such as managers' reluctance, corporate culture, and history. Following reviews, this project will present recommendations to the AKDOT&PF with tools that can be implemented to enhance knowledge transfer.				
14. KEYWORDS: Labor force (Kabkb), Labor relations (Kabkr), Knowledge (Mxrdk), Personnel retention (Ccbt)			15. NUMBER OF PAGES 121	
			16. PRICE CODE N/A	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT N/A	

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This research was funded jointly by the U.S. Department of Transportation Research and Innovative Technology Administration Program and the Alaska Department of Transportation and Public Facilities, through the Alaska University Transportation Center at the University of Alaska Fairbanks. The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views of the Alaska University Transportation Center or the Alaska Department of Transportation and Public Facilities. This report does not constitute a standard, specification, or regulation.

Robert A. Perkins, Professor of Civil and Environmental Engineering, University of Alaska Fairbanks, was the principal investigator and responsible for all work on the project. Dr. F. Lawrence Bennett, Professor Emeritus of Engineering Management, University of Alaska Fairbanks, was the lead investigator and principal author.

Citation:

Perkins, Robert A. (2013). "Knowledge Transfer Needs and Methods," Final Report, INE/AUTC No. 510009, Alaska University Transportation Center, University of Alaska Fairbanks, 115 pages.

SI* (MODERN METRIC) CONVERSION FACTORS				
APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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Executive Summary

This report examines knowledge transfer (KT) in the Alaska Department of Transportation and Public Facilities (ADOT&PF). The department's fund of knowledge is threatened because of retirements, pending retirements, and changes to workforce demographics. As turnover occurs, newer employees must acquire the knowledge needed to make good decisions. In most cases, this knowledge must be transferred from the more experienced employees to the less experienced. This report examines the vast literature about knowledge management and transfer, especially literature that pertains to governments, state highway departments, and transportation agencies. The review found that many agencies face similar challenges and some report success at improving KT. This report then summarizes interviews from about 60 current ADOT&PF employees regarding the types of knowledge they need for their jobs and the techniques used to acquire that knowledge. Although the differences were not striking, the report found some differences between employees with fewer than 10 years with the department and those with more than ten years. Where enough employees responded to determine the effectiveness of KT, the report notes six knowledge types that more than 25% reported as fully or partly ineffective. These were 1) regulations policies and procedures and compliance with these, 2) review process and findings, 3) project management process, 4) working with agencies and elected officials, 5) manuals, 6) budgeting, cost accounting and control. Regarding the specific techniques used, most reported on the job training, communities of practice, and document repositories as most common techniques, while exit interviews, knowledge fairs, yellow pages, and knowledge mapping as the least common. This report recommends 1) supporting formal and informal meetings both within and across specialist groups; 2) recognizing the limitations of manuals and Standard Operating Procedures (SOPs) as well as helping newer employees learn to supplement and update manuals and SOPs; 3) making job shadowing and double fills a priority; 4) recognizing the need for informal KT between various specialty groups; 5) recognizing the value of formal "lessons learned" meetings and presentations, but also recognizing the need for less formal sessions; 6) developing yellow pages and communities of practice, and dedicating resources to update the system; and 7) capturing more of the knowledge of departing experts with a semi-formal debriefing to rising professionals and managers.

Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF), and the Departments of Transportation (DOTs) in many states, are confronting large losses of their most experienced technical and managerial employees to retirements. Does the loss of these employees imply loss of their knowledge—their knack for getting the job done? Or can this knowledge be transferred to the rising technical and managerial employees? The ADOT&PF and the Alaska University Transportation Center (AUTC) sponsored “Knowledge Transfer Needs and Methods”, AUTC Research Project Number 51009, in 2011 to examine knowledge transfer practices in the ADOT&PF and note improvements that might be made.

For an organization, knowledge is the “capacity for effective actions or decision-making in the context of organizational activity” (DeLong, 2004). That is, the ability to get things done and make effective decisions. Knowledge is the most important asset of the technical organization.

Knowledge is based on data and information. Knowledge implies the capacity to use information to get things done and make decisions.

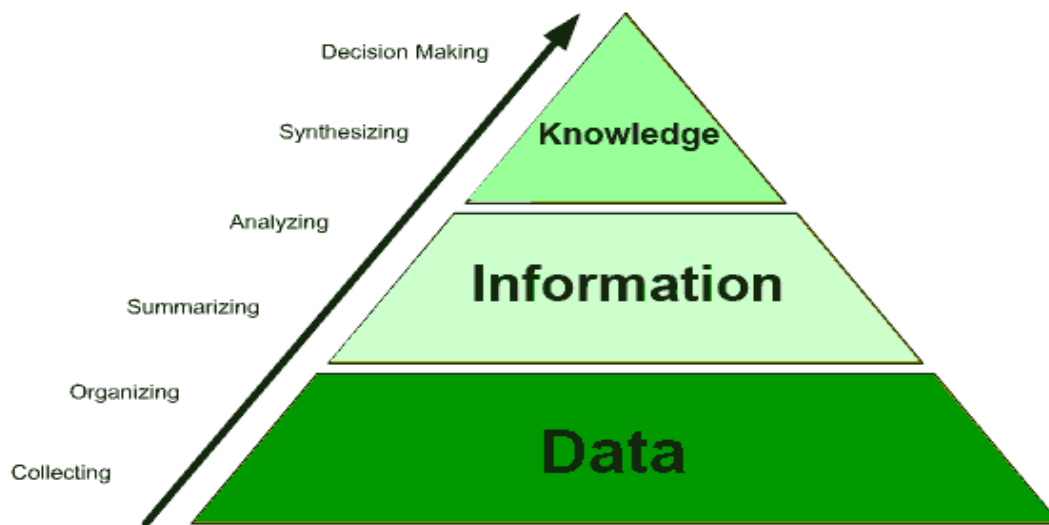


Figure 1. Relationship of data, information, and knowledge to decision making.

Knowledge might be *explicit*, which means knowledge transferable by media, or *tacit*, knowledge which cannot be transferred by media. (We noted in our research that for technical professionals, knowledge is often of mixed form—it involves both explicit technical knowledge and tacit “knack”).

Knowledge is an asset of the organization and must be managed. New information, circumstances, and technology must be added to the knowledge base, even as some of the existing knowledge obsolesces or leaves the organization. Since knowledge resides with individuals, transmitting knowledge between individuals is a critical phase of knowledge management (KM) and the subject of this research.

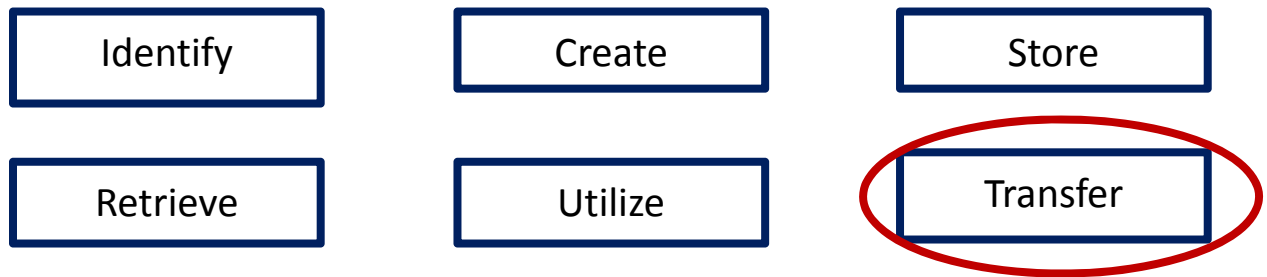


Figure 2. Main components of Knowledge Management.

This report will review knowledge transfer (KT) practices of other organizations, government organizations, and other DOTs; analyze the KT practices of the ADOT&PF; discuss findings with ADOT&PF managers; and list suggestions for enhancing KT in the ADOT&PF.

This Study

The Purpose

As stated in the proposal for this project, “The objective is to produce a set of implementable recommendations to assist ADOT&PF in capturing and transferring many types of knowledge from senior managers and technical experts to those who can use this knowledge to perpetuate the department’s on-going efforts.” Thus, the intent is to suggest practical guidelines for KT in the department, based on the department’s current practices and future needs, to include both explicit and tacit knowledge.

Recognizing that all ADOT&PF managers are probably too busy already, the proposal promises “One thing our report will NOT conclude: ‘Here is a form and the ADOT&PF should ask each manager (in their spare time?) to fill out the form and list all the important things they know and map the transfer of knowledge

Water from an Ancient Well

The music of Adbullah Ibrahim, South African jazz pianist and composer, reflects his deeply religious life and the musical influences of his childhood in multi-cultural Cape Town—traditional African songs, gospel music, ragas, modern jazz, and other Western styles. In 1984, Ibrahim composed a lovely, haunting melody, “Water from an Ancient Well.” The title refers to the elderly folks of his African tribe; the ancient well is those elders and the water, the knowledge and wisdom they possess.

The most disastrous thing that can happen to such a tribe is to be overrun by a rival tribe and to have its elders taken away, leaving the remaining members floundering with no direction and purpose. A tribe in such condition has no future because it has lost its past.

A YouTube performance of “Water from an Ancient Well” can be found at <http://www.youtube.com/watch?v=KKgCU5R5q3w&feature=related>.

within their department” One important consideration is to suggest tactics appropriate to the routine and culture of those possessing the knowledge.

The Process

The project began with an extensive review of the literature relating to KM in general and then KT as one aspect of KM. Many sources deal with KT in general. There is also an extensive literature on KT in government and a substantial amount relating to transportation agencies. Of particular interest to this project, the research team reviewed the KT practices of several state DOTs.

The research team also conducted a series of interviews with a selection of professional and technical ADOT&PF employees from Pre-construction, Construction and Maintenance & Operations. The purpose was to identify the types of knowledge—both explicit and tacit—they possess, how that knowledge is transferred, and how effectively the transfer is accomplished. The interviewees were also queried as to their familiarity and experience with various oft-used KT methods or strategies.

After the interview responses were analyzed and summarized, researchers conducted a focus group meeting with the Northern Region management staff to present an overview of the field as found in the literature, to clarify KT needs within ADOT&PF, describe the results of the interviews, solicit suggestions for how to match needs with possible strategies and methods, and determine other activities the

research team should undertake prior to completing the project.

At the focus group meeting, the research team was encouraged to proceed as planned; to recognize the department’s use, at least in the Northern Region, of

software not previously mentioned; to utilize many of its preliminary recommendations; and to add several other suggested recommendations. Attendees felt that the interview results generally represented well the KT status within the department.

The final step was the development of this report, including a set of conclusions and recommendations.

Organization of the Report

The balance of this report proceeds along the lines described above. We begin with a background section based on the literature review and past and current ADOT&PF practices. We then set forth descriptions of a large number of KT techniques enumerated in the literature and indicate their possible use for the department. Next, the process for conducting the employee interviews is described, followed by a summary of those findings.

Results of the focus group meeting are then set forth, including a discussion of our interview findings. The main body of the report ends with conclusions and recommendations. Appendices include an annotated reference list, a listing of other references and sources, a copy of a useful KM document published by the State of New Hampshire Department of Administrative Service, and some excellent and comprehensive information that is available on the web from the Swiss Agency for Development and Cooperation.

Key Concepts about KM as a Business Process

--from *European Guides to Good Practice in Knowledge Management*

- The organization needs to define its mission, vision, and strategy in regard to KM.
- A culture of motivation is necessary, in which people are respected, feel a sense of trust, belonging, and empowerment.
- Knowledge activities are seen as an integral part of wider business processes, and should be value-adding, clearly communicated, understood, and accepted.
- Roles and responsibilities must be made clear.
- Individuals need to be acknowledged and rewarded for their contributions.
- The environment must be conducive for people meeting, working together, and sharing ideas and experiences.

Quoted in Preserving and Using Institutional Memory Through Knowledge Management Practices. M. Ward, 2007. Washington DC: Transportation Research Board. NCHRP Synthesis 365, 114 pp.

Background

Literature Review

This section draws heavily on an extensive literature search—citations for which are provided in Appendix A and Appendix B, the former containing annotations for 29 of the most relevant sources. It became apparent that the literature on KM is overwhelming in numbers. The project proposal noted that an Alta Vista search generated 154 million hits on the term “knowledge transfer.” Much theoretical and philosophical material is extant, and a great deal concerns information technology applications. But there are also many reports of practical applications and successes. The challenge, of course, is to select from the large number of sources material relevant to ADOT&PF’s practical needs. In much of the discussion that follows, we refer to some of the literature found in the appendices.

Knowledge, Knowledge Management, and Knowledge Transfer

The introductory section of this report suggested some helpful definitions (we hope) related to knowledge and its management. Here is one oft-cited definition of knowledge: “the combination of data and information, to which is added expert opinion, skills, and experience, to result in a valuable asset which can be used to aid decision making. Knowledge maybe explicit and/or tacit, individual and/or collective” (Ward, 2007). Thus, knowledge is more than data gathered from a field trial (“data”), and it is more than the statistical analysis of that data (“information”). It combines analyzed and summarized data with experience and skill to provide an asset that is useful in making decisions.

The concept of knowledge as an asset has been around at least since 1969, when Peter Drucker wrote in his classic *The Age of Discontinuity*, “...knowledge has become the central ‘factor of production’ in an advanced, developed economy... knowledge has actually become the ‘primary’ industry, the industry that supplies to the economy the essential and central resource of production... knowledge is now the main cost, the main investment, and the main product of the advanced economy ...” (Drucker, 1969). As the field of KM developed in the 1990’s, this idea began to take hold; organizations must manage their physical, financial, and human resources assets, but they must also manage their knowledge assets. A survey conducted for the Transportation Research Board (TRB) and reported in 2007 concluded, however, that “knowledge is generally not seen as an asset of sufficient importance to warrant organization-wide attention” (Ward, 2007).

So, the challenge for the ADOT&PF is to manage the organization's knowledge—call it institutional memory, perhaps—that resides within individual members of the department but also within various project records, guidelines, manuals, memoranda, and other written records, in a way that is both effective—it gets the job done—and efficient—it does so in ways that are not unduly costly, time-consuming or otherwise burdensome. In the context of this project, ADOT&PF has an interest in this challenge in at least two respects: 1) the capture and transfer of knowledge, both tacit and explicit, from employees who leave the organization due primarily to retirement but also to take other jobs, or who are transferred within ADOT&PF to other sections and/or other locations; and 2) the transfer of knowledge, again both explicit and tacit, between individuals and sections as part of the department's on-going activities, be they design, maintenance, construction, headquarters operations, financial planning, or whatever.

What sort of knowledge do employees recognize as existing in the department? A later section of this report will provide details about a survey of a subset of technical and professional employees asked to identify various KT practices. A sampling of the kinds of knowledge identified in the survey includes the following:

Explicit Knowledge

- Various manuals: construction, drainage, right of way, environmental
- Plans and specifications
- Laboratory testing procedures
- State statutes and regulations
- Lessons-learned databases
- Field books
- Property records
- Cost data
- Design status reports
- Change orders
- Site Manager software
- Survey equipment operation instructions
- Training materials
- Regional maintenance station profiles
- Deferred maintenance inventories
- Snow and ice control plans

Tacit Knowledge

- Maintenance and operations processes: crack sealing, equipment operation, tire chain installation
- Various review processes: materials, claims, permits, subdivisions
- Personnel matters: supervising, making the job enjoyable, conveying expectations, job duty clarification
- Team building
- Project manager roles and responsibilities
- Effective relations between project and functional groups
- Priority setting
- Dealing with contractors
- Dealing with the public; community involvement processes
- Dealing with other agencies
- Budget process
- Use of accounting system
- Department's cultural values
- Design nuances
- Project lessons learned
- Knowing where to go and whom to talk to in order to gather information, have questions answered, etc.
- Report preparation (and other documents)

In the course of our interviews it also became clear that many interviewees believe that much of the department's knowledge must be considered a combination of explicit and tacit. Examples are listed below. Note some to-be-expected repeats from the above lists.

Explicit and Tacit

- Use of various manuals, rules and regulations (such as those listed under "explicit" above): Professional services manual, traffic control manual, construction manual, procurement code
- Storm Water Pollution Prevention Plan (SWPPP) requirements and procedures
- Project development process
- Design process
- Budgeting process
- Process for relocating individuals and businesses
- Any knowledge gained through face-to-face training

- Many personnel management matters, such as performance evaluation
- Project engineering
- Project delivery methods (design/build, etc.)
- Highway Safety Improvement Program
- FAA Advisory Circulars
- Use of Maintenance Management System
- Integration of new software into the design and construction process
- Use of bid tabs
- Document management
- Public involvement
- Organizational knowledge
- Lessons learned

Knowledge Management and Transfer

Knowledge management “focuses on the capture, using and sharing of knowledge” (CTC & Associates, LLC, 2010). Thus, KM refers to maximizing the use of knowledge by employing various business management practices. The *Australian Standard* (2005) describes KM in an all-encompassing (and somewhat wordy) way as “a trans-disciplinary approach to improving organizational outcomes and learning, through maximizing the use of knowledge. It involves the design, implementation, and review of social and technological activities and processes to improve the creating, sharing, and applying or using of knowledge.”

The State of New Hampshire Department of Administrative Service has produced a manual entitled “Knowledge Management & Transfer Model” (State of New Hampshire, n.d.). A table from that document (see Table 1 below) suggests various methods for identifying and collecting, storing, and transferring knowledge, as follows:

The analysis of all of ADOT&PF’s KM practices is well beyond the scope of this project. The intent is to examine and make recommendation regarding knowledge transfer, which is one aspect of the overall KM discipline. Please see Figure 2, which shows the major components of KM, how they fit together, and the position of KT in the typical flow of knowledge.

<p style="text-align: center;">Knowledge Management A systematic approach to finding, understanding, and using knowledge to achieve organizational objectives.</p>				
Identifying & Collecting Knowledge		Storing Knowledge		Transferring Knowledge
1. Best Practices 2. Documenting Processes 3. Expert Interviews 4. Knowledge Audit 5. Knowledge Maps & Inventories	+	1. Document Repositories and Management Systems Databases	+	1. After Action Reviews 2. Communities of Practice 3. Co-op/Internships 4. Job Aids 5. Knowledge Fairs 6. Learning Games 7. Mentoring 8. On-the-Job Training 9. Storytelling 10. Training

Table 1. KM Methods (from State of New Hampshire Department of Administrative Service, n.d.)

Thus, we focus here on KT. According to Hammer (2010a), “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.” For our study, then, we looked at ADOT&PF’s knowledge resources and asked: what they are, how they are held, how they are shared among individuals and/or sections, and whether such sharing is effective. Further, we ask whether they need to be shared in the first place, and, if so, whether improved strategies can be developed for that transfer.

What methods, or strategies, do organizations use to transfer knowledge between and among individuals and sections? Although terminology may vary among organizations, there is a sense of agreement in a common set of methods that can help in the KT process. Given below is a long, though not exhaustive, list of several such strategies; the descriptions are taken in part from the New Hampshire manual. (New Hampshire DOA, n.d.)

After Action/Lessons Learned Reviews: debriefings that identify, analyze, and capture experiences, what worked well and what needs improvement, so others can learn from those experiences.

Best Practices: identification and use of processes and/or practices that result in excellent products or services.

Co-op/Internships: formal arrangements that provide for an experienced person to pass along knowledge and skills to a novice, often so that students can obtain practical on-the-job experience and academic credit as part of their educational experience.

Communities of Practice (COPs): groups of individuals who share knowledge about a common work practice over a period of time, though they are not part of a formally constituted work team and generally cut across traditional organizational boundaries.

Document Repositories: collections of documents that can be viewed, retrieved, and interpreted by humans and automated software systems.

Double Fills: the practice of the employee who is leaving a position and the replacement employee occupying the same position for a period of time, to allow the new employee to have knowledge about the position transferred easily and effectively.

Exit Interviews: structured meetings with departing employees, to capture critical parts of their job knowledge.

Expert Interviews: sessions where one or more people who are considered experts in a particular subject, program, policy, process, etc., meet with others to share knowledge.

Job Aids: tools that help people perform tasks accurately, such as checklists, flow diagrams, reference tables, and decision tree diagrams.

Job Rotation: job assignments in which an employee occupies different positions for several weeks or months each, so that knowledge about those jobs can be transferred directly.

Job Shadowing: less active and shorter term than job rotation, a practice in which an employee observes another in the everyday conduct of the job.

Knowledge Fairs: events that showcase information about an organization or a topic, either internally or externally.

Knowledge Maps and Inventories: catalogs containing references to information/knowledge available in an organization and where it is located.

Mentoring: pairing an experienced, skilled person (mentor) with a lesser skilled or experienced person (protégé), with the goal of developing or strengthening competencies of the protégé.

On-the-Job Training: an experienced employee teaching a new person how to perform job tasks, either in an informal, unstructured manner or more formally with training materials, schedules, and records of the training.

Peer Assist: knowledge and experience sharing among two teams, based on dialogue and mutual respect, typically used by a work team starting up a new project or task that calls upon another team with experience in the respective field of activity.

Process Documentation: developing a written and/or graphical record of a specific work process.

Storytelling: construction of fictional examples or telling of real stories to illustrate a point and effectively transfer knowledge, either informally or as a part of more structured presentations.

Training: a large variety of activities, instructor-led or self-directed, designed to facilitate learning (of knowledge, skills, and abilities or competencies), including classroom instruction, simulations, role-plays, computer or web-based instruction.

Yellow Pages: special kind of knowledge map listing knowledge areas, persons knowledgeable in those areas (usually within the organization but sometimes outsiders as well), and contact information.

The literature abounds with case studies, other experiences, research projects, and recommendations from an almost endless variety of organizations, from both the private and public sectors. The oil and gas industry, for example, embraced KM early and reports considerable success (Carrillo, 2004; Leavitt, 2002). Our recommendations to ADOT&PF, at the end of this report, will draw from both private and public sector experience. The balance of this background section will

be confined to public sector KT practices, with emphasis on public transportation agencies.

One point that many writers emphasize is the importance of human factors in the transfer of knowledge; much depends on openness, trust, and a willingness to share knowledge. A knowledge-sharing culture has been described 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” (quoted in Hammer, 2010a). While much has been written about various information technology applications to KM (for example, Rao, 2005), in the view of many, such emphasis is misplaced. Gaptu and Govindarajan (2000) caution that, while technology infrastructure can be useful in KM, it should be considered an “enabler,” not “the answer.” Ardichivili, Page and Wentling (2002) are even more forthright: “... the chief reason [for the failure of KM to become the magic key to organizational success] is an overemphasis on technology-based solutions—from search-and-retrieval tools to decision-support and data mining systems—and a lack of attention to the human side of the enterprise, especially the dynamics of knowledge creation, dissemination, and use at the group and organization levels.”

“E-mail is not to be used to pass on information or data. It should be used only for company business.”

Source unknown;
quoted in Meredith,
J.R. and S.J.Mantel
(2012)

Knowledge Transfer in Government

Literature related to KT in the public sector in general is oriented, in part at least, toward the concern of succession planning and capturing the workers’ knowledge before they retire (Calo, 2008).

Another paper describes two New York State successes, one involving knowledge sharing between state agencies and another between state and local agencies (Pardo, 2006). A book by McNabb (2006) covers collecting, categorizing, processing, distributing, and archiving organization knowledge before converting and disseminating the knowledge to those who need it. We include in Appendix C the complete manual on KT prepared by the State of New Hampshire (State of New Hampshire, n.d.) In addition, it should be noted that the State of Alaska Department of Administration has prepared a helpful manual, *Knowledge Transfer in State of Alaska Agencies* (State of Alaska, 2008), that includes, *inter alia*, an easy-to-use compendium of several KT techniques and activities.

Some of the other broad themes found in the literature about KT in government relate to: 1) knowledge transfer partnerships (KTPs) between businesses and government entities that are formed to facilitate transfer of knowledge to businesses (Knowledge Transfer Partnerships, 2012); and, 2) the on-going challenge of transferring information and knowledge derived from university research results to private and public entities that can benefit from those results (Reardon, Lavis, and Gibson, 2006). The latter is a primary task of ADOT&PF's Research, Development and Technology Transfer section.

Knowledge Transfer in Public Transportation Agencies

Early in the current century, the Transportation Research Board (TRB) and the American Association of State Highway and Transportation Officials (AASHTO) established a committee whose charge was to develop a sustainable method for meeting the information needs of the transportation sector and to recommend an appropriate funding structure. The result was a report that recommended the development of a federal transportation knowledge network and several similar regional networks (TRB, 2006). The recommendation was implemented, with the result that there are now three regional networks (eastern, midwestern, and western), a national transportation coordination function in the form of a federal network, and an advisory committee (Spy Pond Partners, 2009).

As an example of these networks, the following is extracted directly from the website of the Western Transportation Knowledge Network (Western Transportation Knowledge Network, n.d.) and explains its membership, and activities:

The Western Transportation Knowledge Network (WTKN) is a diverse group of transportation organizations from AASHTO Region 4 focused on improving the access to transportation information, data and research to help the entire community. Membership includes libraries representing state departments of transportation (DOTs), academic institutions, transit agencies, metropolitan planning organizations (MPOs) and private industry.

WTKN members work to benefit participating organizations, through collaboration and regular communication. WTKN also partners with other groups that share an interest in the access and use of transportation information, such as AASHTO, TRB, SLA [Special Libraries Association] Transportation Division. WTKN members have established channels for communication and information

sharing. The diversity of membership provides a broader view of how transportation information is created and consumed.

Another example of a national program oriented toward transportation KM is the National Transportation Library (NTL). Congressionally authorized in 1998 by the Transportation Equity Act for the 21st Century (TEA-21), NTL was charged with coordinating information sharing among other transportation libraries and information providers so that the entire transportation community would have access to materials. In 2008 a new NTL was formed through merger with the US Department of Transportation (USDOT) library (About the National Transportation Library, n.d.). Consistency of funding from USDOT has been a challenge, with the result that the library has been able to operate only within a narrow definition of its mission (TRB, 2006).

A major contribution to the literature about transportation agency KM was authored in 2007 for the TRB (Ward, 2007). The basis for the report was a questionnaire given to a large number of state transportation agencies that inquired about their KM practices. Of special interest to this project is a section of the questionnaire related to capturing knowledge from experienced, retiring, or exiting employees.

Selected Knowledge Transfer Activities in other state DOT's

A review of KT activities in other state transportation agencies indicates that most are facing similar challenges: the need to capture knowledge from an aging workforce soon to retire, the changing nature of the government workplace, the increasing need to share knowledge with the public, downsizing of the workforce, and hiring freezes. But some states have active KT programs. In this section we cite several examples of KM progress underway within state departments of transportation.

The Virginia Department of Transportation (VDOT) includes a KM Division that comprises a KM Office, the Virginia Local Technical Assistance Center and the VDOT Research Library (Virginia Department of Transportation, 2012). The division's director has published widely in the field of KM, producing some excellent guidelines and case studies (Hammer, 2010a; Clark & Hammer, 2008; Hammer, 2010b; Novak and Hammer, 2009). A VDOT Knowledge Management Tool Kit provides guidance on when a KM initiative is needed and describes several tools and techniques currently in use at VDOT. For example, VDOT has an active Communities of Practice program with over 40 such communities.

By 2006, the Pennsylvania Department of Transportation (PDOT) had established a successful KM program (Dering Consulting Group, 2006). It was judged to have deployed both its explicit and its tacit knowledge exceptionally well. Six years ago, PDOT was looking forward to developing a KM strategic plan based on worker needs, work force demographics, available technologies, and existing KM assets.

The Maryland Department of Highway Administration developed a KM program in response to the classic pressures of a changing workforce (Burke, 2011). The department's 2012-2015 business plan includes a section on workforce development, comprised of subsections on strategic staffing, recruitment and retention, KM succession planning, core training, mandated training, workplace injuries, and safety-sensitive employees (Maryland State Highway Administration, 2012). The subsection on KM is comprehensive and challenging; it is repeated here in its entirety:

“Sub-Objective 4.3C Knowledge Management

Ensure employee awareness of, access to and use of the most current policies and procedures and key processes through an (State Highway Administration) SHA-wide knowledge management (KM) portal.

Performance measures:

- ☐ Number of key processes and number of current policies.
- ☐ Number of key policies and documented processes published to the portal.
- ☐ Percent complete.
- ☐ Number of FAQs posted on the SHA-wide KM portal.
- ☐ Percent of RCs participating.

Strategies:

- ☐ Each office/district validates and documents their key policies, procedures and processes and enters them through an SHA-wide KM portal by June 30, 2015.
- ☐ On a quarterly basis, each RC will create, validate and update as needed, FAQs answering their most relevant questions.
- ☐ Placeholder: Strategy for communication/marketing benefits.”

It should also be noted that most state transportation agencies maintain transportation libraries, and many of them take pride in their roles as KM

professionals. The Minnesota Department of Transportation (MDOT) (2012) is an example. Their website links to numerous databases, MDOT forms, laws, and resources such as standards, statistics and associations, as well as the more common links to transportation-related literature, in both hard copy and electronic form. While such efforts are only part of the totality of managing explicit and tacit knowledge, it is important to acknowledge their contributions.

ADOT&PF Knowledge Transfer Activities

Below we discuss in detail the findings of our research. Here we note some programs currently in use.

Within the Program Development Division is the Transportation Information Group who, among other important tasks, is responsible for Traffic Data Systems (TDS) which includes a document management system,

[which keeps] track of corporate information in a central, searchable location. Historical corporate knowledge is instantly available to all staff members rather than being maintained in private e-mail archives, on individual work stations, scattered throughout multiple server directories or in paper format in one's file cabinet or desk area. Other benefits include providing a back-up system so there are no lost documents and having faster access to documents (Stickle, n.d.).

The categories of data in the system are:

Asset Management

Highway Safety

Road Network/GIS

Road Weather

Traffic

Traveler Information

Intelligent Transportation Systems (ITS)

Much of this data and information is quite program-specific; that is, the data is accumulated to meet the needs of specific program requirements, usually federal. For example, GIS is chiefly used in Program Development (formerly Planning) to

support federal reporting, such as highway performance monitoring. Data on all the state's roads was in tabular format on a mainframe but has been transferred to a GIS system. Certainly the GIS technology could be used for other program areas such as pavement management, maintenance, transportation asset management, and crash reporting, but at this time, data is stored in division-specific silos and it is difficult to cross boundaries.

These valuable efforts are very much KM, but not in and of themselves KT. Closer to our definition of KT is the Northern Region Design section's use of Pinnacle Series software to manage workflows. Closely tied to the AutoCAD system in use—Civil 3D—Pinnacle can walk a new designer through the required steps in the project development and design process. Associated with the steps might be files and notes from other designers. Much of the effort to transfer knowledge seems to relate to the design programs themselves, but clearly other data, such as geotechnical reports, surveys, and as-builts, might be made available.

Both the TDS and Pinnacle technology could aid in KT and will be discussed briefly below.

The ADOT&PF has a robust training program for specific tasks such as the Storm Water Pollution Prevention Guide or for equipment inspection. Along the same lines, ADOT&PF's Technology Transfer (T2) has a strong library and links to the TRB and other libraries. We note these here as overarching programs that might be associated with KT and discuss the programs more below, following the interviews.

Interviews

Interview Process

To gather information on current KT practices within ADOT&PF, an individual interview was conducted with 61 technical/professional employees who were nominated by their supervisors. Each interview consisted of two sets of questions. The first was very open-ended; the second was more structured.

The first set of questions asked, in essence:

1. What do you know?
2. How is what you know transferred?
3. How effective is that knowledge transfer?

In other words:

1. Identify some piece of knowledge, whether explicit or tacit, that you possess or need to possess in order to perform your job.
2. Describe the way(s) in which that knowledge is transferred from employee to employee or section to section.
3. Is that knowledge transferred effectively so that it can be utilized by the person or section receiving it?

Each interviewee was asked to name as many pieces of knowledge as they could identify (within the interview's time limit) and for each describe the transfer and its effectiveness.

The second set of questions presented a list of generally recognized KT methods/techniques/strategies (on-the-job training (OJT), storytelling, mentoring, etc.) and asked whether the interviewee was aware of the use of each within that person's work area. Responses were thus "yes" or "no," with an opportunity to add appropriate comments.

Interview Findings

As with most open-ended questions, the analysis and evaluation of responses from the first set of interview questions were challenging, and the analysts took some liberties in interpreting and categorizing those responses. From the 61 interviews, 390 pieces of knowledge were identified. These “pieces” were not necessarily unique; in many cases, more than one interviewee named the same piece of knowledge, such as “project development process” or “construction manual.” In total, 390 responses were offered and recorded.

It was of interest to analyze the proportion of responses that identified a piece of knowledge as explicit, tacit, or a combination of explicit and tacit. Further, since the responses might differ between younger and more experienced employees, the data was summarized for employees who had been with the department for ten years or fewer and for those with more than ten years at the department. The results are shown in Figure 3.

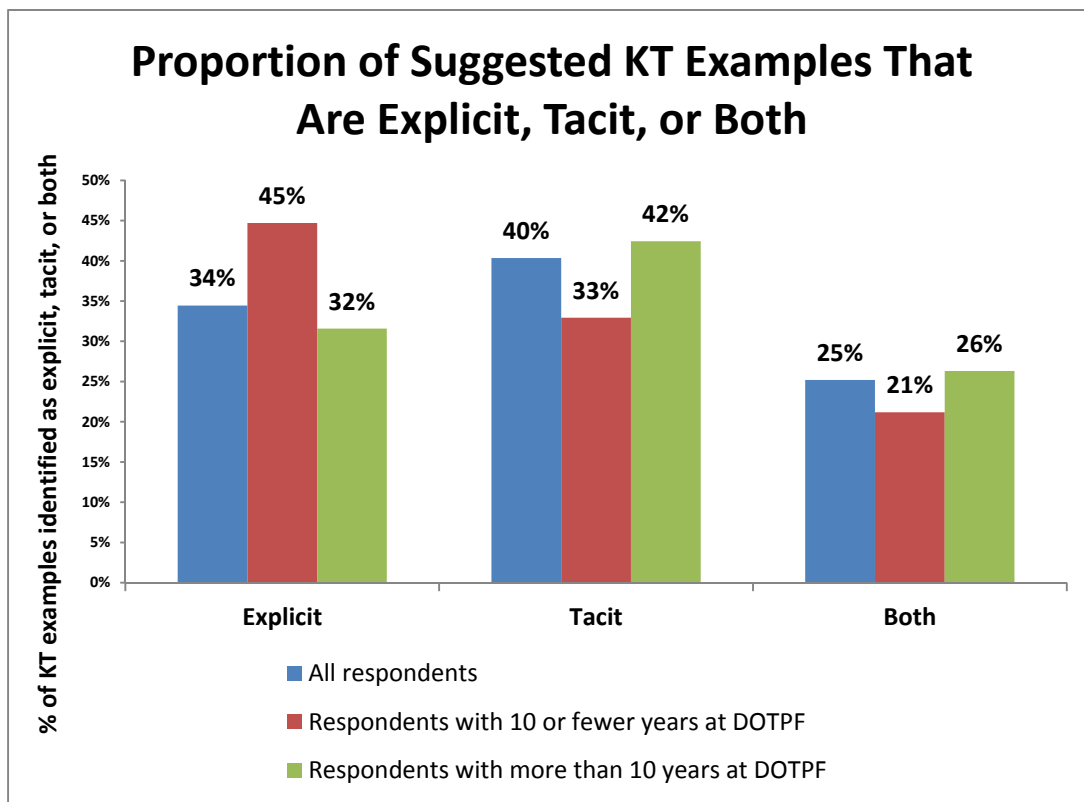


Figure 3. Proportion of KT Examples that are Explicit, Tacit, or Both, by experience level.

In total, 34% of the knowledge examples were identified as explicit; a somewhat higher proportion, 40%, were considered tacit; and the remaining 25% were

considered a combination of the two. Thus, 65%, or nearly two-thirds, had some element of tacit knowledge. We see a smaller proportion of tacit knowledge types from the younger employees, with 54% of their examples considered tacit or both explicit and tacit. Perhaps younger, less experienced employees are less inclined to recognize tacit knowledge as a type of knowledge, or perhaps their work experience to date has been more related to technical matters in which explicit knowledge is likely to be more prominent.

Next we analyzed the effectiveness of KT for examples suggested by our interviewees. Figure 4 shows the results.

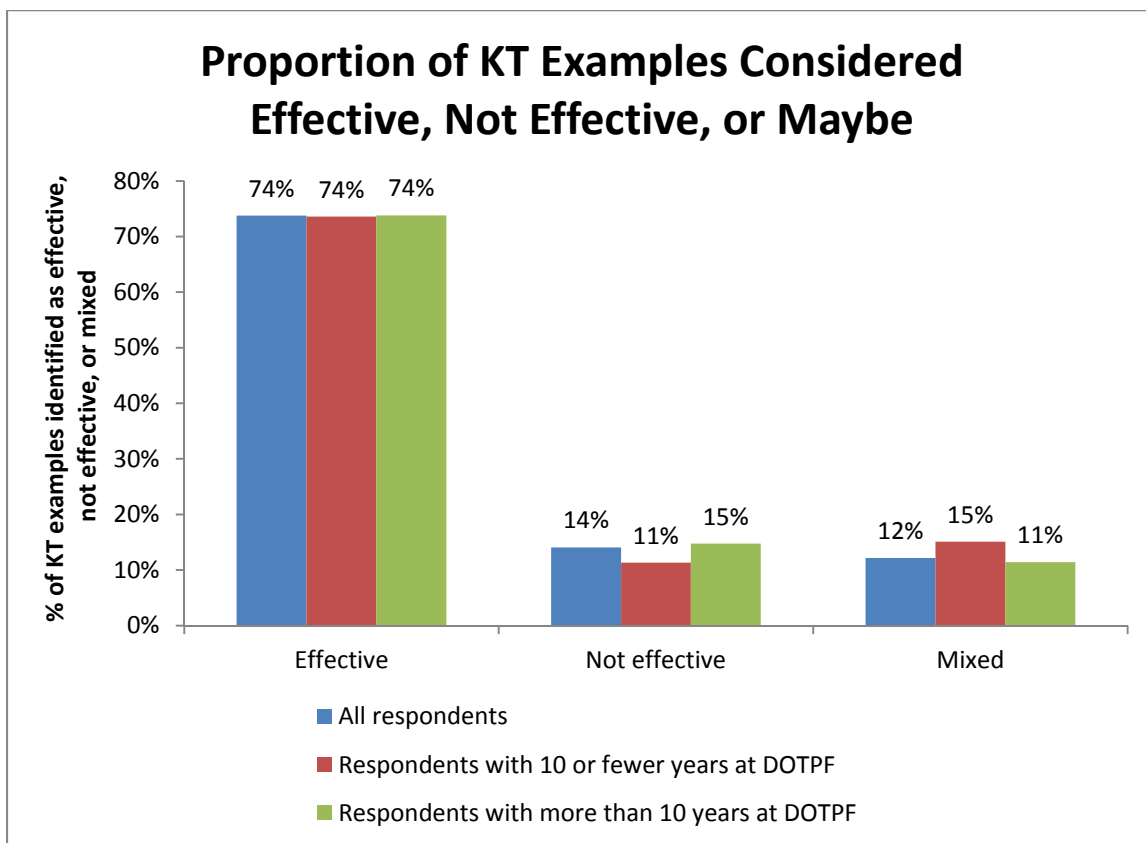


Figure 4. KT Effectiveness of Interview Examples, by experience level.

With little difference between younger and older employees, nearly three-quarters of the suggested knowledge examples are believed to be transferred effectively. In this graph, “mixed” indicates the interviewee considered the transfer process to be partially effective. It seems significant that 86% of the pieces of knowledge identified in the interviews are transferred effectively or partially so. In Table 2 we show the 27 categories into which the responses were grouped, along with the number of times the pieces of knowledge within them were mentioned. Separation

of the data into these somewhat arbitrary categories was based on our judgment and the nature of the responses.

<u>Type of Knowledge</u>	<u>Number of Times Mentioned</u>	<u>Type of Knowledge</u>	<u>Number of Times Mentioned</u>
<u>Project History; Lessons Learned</u>	38	<u>Regulations, Policies and Procedures</u> (procurement, SWPPP, vehicle operations, etc.)	35
<u>Managing Personnel</u> (Transfers, civil rights, motivation, supervision, conveying expectations, leadership, performance evaluation)	32	<u>General Information Sharing</u> (meetings; one-on-one; "training;" "OJT")	30
<u>Manuals</u> (Design, Construction, M&O, Traffic, Survey, ROW, etc.)	30	<u>Construction Methods; Equipment Operation</u>	23
<u>Project Management Process</u>	23	<u>Budgeting; Cost Accounting & Control</u>	22
<u>Design Practice</u>	21	<u>Review Process & Findings</u>	15
<u>Working with Agencies & Elected Officials</u>	13	<u>Data Management</u>	10
<u>Design Information & Recommendations</u>	9	<u>Program Information</u> (HSIP, FAA, preventive maintenance, AIP, STIP)	9
<u>Working with the Public</u>	9	<u>Certification and Permitting Process</u>	8
<u>Safety Information</u>	8	<u>Project Development Process</u>	7
<u>Plans & Specs</u> (standard and other)	7	<u>Communication Guidelines</u> (writing, speaking)	7
<u>General Guidance; "Rules of Thumb"</u>	6	<u>DOTPF General Background</u>	6
<u>Information Sources</u> (Where to go for information)	5	<u>Long Range Planning and Visioning</u>	5
<u>Project Closeout</u>	4	<u>Contractor Relations</u>	3
<u>Performance Data</u> (Pavement Performance; Tire Wear)	2		

Table 2. Times mentioned for each knowledge type, from first set of interview questions.

In Table 2, the most common types of knowledge identified by interviewees in response to our open-ended question related to history and “lessons learned” from specific projects; a wide range of policies, regulations and procedures; and a

variety of knowledge regarding personnel matters. Knowledge about project closeout, contractor relations, and performance data generated some response but were mentioned least frequently.

We now turn to a more detailed analysis of those knowledge types mentioned most frequently in the interviews. Results of the eleven most “popular” types of knowledge from Table 2 are shown in the tables appearing below. In each, we show the type of knowledge; the proportion of the examples within that type that were considered explicit, tacit, or both; a sampling of the specific examples; and the degree to which the transfer of the knowledge examples within that type was deemed effective. Following each table, we comment on the explicit/tacit proportion and the degree of effectiveness.

- **Project History; Lessons Learned**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Project History; Lessons Learned</u>	31%	34%	34%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Power Point @ regional meetings; database; one-on-one oral; word of mouth; project manager meetings; statewide roundtable; field book libraries	82%	18%	0%

Comments:

1. This type of knowledge is an almost equal combination of explicit, tacit and both.
2. About 4 of 5 transfer methods are considered effective.

- **Regulations, Policies and Procedures (procurement, SWPPP, vehicle operations, etc.)**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Regulations, Policies and Procedures (procurement, SWPPP, vehicle operations, etc.)</u>	53%	21%	26%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Learn by doing; oral explanation; on your own; read it and ask/answer questions; training sessions; on website; review during orientation & at staff meetings; OJT; mentoring; apply to specific project	70%	11%	19%

Comments:

1. As expected, this type of knowledge is considered either explicit or a combination of explicit and tacit, in about 4 of 5 cases.
2. Transfer of this kind of primarily explicit knowledge is either effective or partially so in about 90% of our responses.

- **Managing Personnel**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Managing Personnel</u> (Transfers, civil rights, motivation, supervision, conveying expectations, leadership, performance evaluation)	13%	52%	35%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Word of mouth: instruct them whom to talk to; teach by doing; they observe how you treat people; communication, communication, communication; mentoring; storytelling; one-on-one; courses; give people a chance to be in the trenches; modeling behaviors you want people to have; conveying values of the organization; ask questions (HR); letters from HR; OJT; learn by doing; making mistakes; some discussion; Academy for Supervisors; weeklong course DOTPF-wide; learn by doing; making mistakes; some discussion; policy & procedures manual	78%	17%	4%

Comments:

1. This is a very mixed bag of knowledge examples, but it is clear that most knowledge related to personnel management is not purely explicit.
2. Though not completely effective, over 80% of the examples were totally or partly effective.

- **General Information Sharing**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>General Information Sharing</u> (meetings; one-on-one; "training;" "OJT")	19%	54%	27%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Presentations + informal discussion; at breaks and lunches; one-on-one; potlucks that include both engineering and environmental; training; staff meeting discussions; webinars; double fill	100%	0%	0%

Comments:

1. These responses were keyed to types of transfer rather than types of knowledge.
2. For the types shown, most (more than 80%) were tacit or a combination of tacit and explicit.
3. Many of the transfer methods were informal, and all were considered effective.

- **Manuals**

<u>Manuals</u> <u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Manuals (Design, Construction, M&O, Traffic, Survey, ROW, etc.)</u>	90%	0%	10%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
"Here it is." Have them read and ask questions. Some available on server. Apply to a specific issue.	57%	29%	14%

Comments:

1. Nearly all of the knowledge contained in these manuals, and the explanations used to transfer and understand them, are explicit.
2. Respondents suggested that about 30% of attempts to transfer this type of knowledge are ineffective.

- **Construction Methods; Equipment Operation**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Construction Methods; Equipment Operation</u>	32%	55%	14%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Asking questions; informal; word of mouth; learn by doing; ask questions; videos; learn by watching; shop meetings with "lecture"/demo; rotation among crews; annual workshop; review with foremen between workshops; hands-on demo; emphasis on <u>why</u> (= safety); e-mail updates to camps and each mechanic; reverse mentoring	79%	5%	16%

Comments:

1. Although checklists, manuals and other job aids exist for this kind of knowledge, nearly 70% of the knowledge is considered to be tacit or a combination of explicit and tacit.
2. 95% of the knowledge examples were thought to be transferred fully or partially effectively.

- **Project Management Process**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Project Management Process</u>	22%	57%	22%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Classroom; OJT; DOA courses & informal mentoring; informal meetings every morning between Group Chief and PMs; informal meetings between PMs and their staffs; formal classes; informal oral discussion with another project engineer; one-on-one; point to manual to be sure method is correct	69%	13%	19%

Comments:

1. Nearly 80% of knowledge about the project management process is considered to be fully or partially tacit.
2. About one in three of the knowledge examples in this category were judged to be transferred ineffectively or with only partial effectiveness.

- **Budgeting; Cost Accounting & Control**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Budgeting; Cost Accounting & Control</u>	18%	55%	27%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Written instructions; tacit: asking questions; storytelling; show specific section for specific need; then print screen; manual; we have resident expert; spreadsheet (data taken from database); supervisor takes him through the steps; user's manual; then hands-on -- explain what he's doing; bring someone else into the process; OJT	50%	31%	19%

Comments:

1. Knowledge about the department's financial matters—how it is developed and how it is used—is mostly tacit or a combination of tacit and explicit (less than 20% purely explicit).
2. Half the knowledge examples in the category were considered to be transferred ineffectively or partially so.

- **Design Practice**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Design Practice</u>	16%	42%	42%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Meetings; experts; best practices; training; informal oral discussion with another project engineer; experience; mentoring; OJT; learn by doing; regular staff meetings (make sure there is always a takeaway); peer reviews; community of practice tell people where to look for information	75%	0%	25%

Comments:

1. Less than 20% of the examples of design practice knowledge were considered purely explicit, with nearly 85% tacit or a combination of tacit and explicit.
2. All of the examples were judged to be transferred effectively or partially so.

- **Review Process & Findings**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Review Process & Findings</u>	29%	43%	29%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
Person-to-person; review a typical process; sit down w new employee; show old examples; checklist; training	70%	20%	10%

Comments:

1. This category includes knowledge about the process for conducting reviews as well as the results of those reviews.
2. This type of knowledge is about 30% purely explicit and about 45% purely tacit.
3. 80% of the examples were judged to be transferred completely or partly effectively.

- **Working with Agencies & Elected Officials**

<u>Type</u>	<u>%Explicit</u>	<u>%Tacit</u>	<u>%Both</u>
<u>Working with Agencies & Elected Officials</u>	0%	91%	9%
<u>Transfer Methods</u>	<u>%Effective</u>	<u>%Ineffective</u>	<u>%Mixed</u>
In-person explanation; discuss with [AG office, for example] to establish procedures; trial and error; observation & involvement; get to know personalities; explain that you must "do homework" in advance; sit down and talk about an issue; one-on-one; mentoring; invite less experienced person to meeting; training; OJT; experts	67%	0%	33%

Comments:

1. Not surprisingly, this kind of knowledge is essentially all tacit.
2. 2 of 3 knowledge examples were judged to be transferred effectively.

We now summarize the findings for effectiveness of the KT process by tabulating the “ineffective” statistics by knowledge types. Table 3 shows the percent of knowledge examples in each category whose transfer was judged fully or partially ineffective. We confine the listing to those knowledge types for which at least 8 responses related to effectiveness were obtained, believing that smaller response rates would produce unreliable, and possibly misleading, results. [Note that Table 3 contains 13 entries, whereas the previous Table 2 “Times Mentioned for Each Knowledge Type, from First Set of Interview Questions” contained 17 entries that were mentioned 8 or more times. This apparent discrepancy is explained by the fact that some of those 17 entries did not generate 8 or more effective/ineffective responses.]

Table 3 reveals that different types of knowledge at ADOT&PF are transferred with varying degrees of effectiveness. If we assume a 25% or smaller ineffectiveness rate can be considered “good,” then the first seven types of knowledge in Table 3 are being transferred effectively. The other six knowledge types would seem to deserve serious attention and improvement. The type of knowledge judged to be transferred least effectively encompasses the budgeting process, interpreting accounting reports and records, and similar aspects of project finance. The respondents awarded second place to “manuals.” They cited several types of manuals; indicating they contained obsolescent information, it was difficult to obtain knowledge about how to interpret and use them, and the manual contained nuances that required special knowledge to understand. Third in line is the matter of working with other agencies and elected officials; transfer of this

almost completely tacit knowledge type involves such practices as observation and involvement, getting to know personalities, sitting down and talking about an issue, and one-on-one knowledge sharing and mentoring. In our recommendation section, we offer some suggestions for improving the transfer of the six types of knowledge found to be least effective in our interviews.

Percent of respondents stating KT method was partly or full ineffective when at least 8 respondents rated the effectiveness.	
<u>Knowledge Type</u>	<u>%</u>
General Information Sharing	0%
Safety Information	0%
Project History; Lessons Learned	18%
Construction & Equipment Methods	21%
Managing Personnel	22%
Data Management	22%
Design Practice	25%
Regulations, Policies & Procedures & compliance therewith	30%
Review Process & Findings	30%
Project Management Process	31%
Working with Agencies & Elected Officials	33%
Manuals (Design, Construction, M&O, Traffic, Survey, ROW)	43%
Budgeting; Cost Accounting & Control	50%

Table 3. Percent of knowledge examples in each type whose transfer was judged fully or partially ineffective.

Despite deciding to confine the results presented in Table 3 to those types for which at least 8 useable responses were obtained, in the authors' experience and judgment, two other categories may be cause for concern and worthy of departmental improvements. One is information sources, or "where to go and whom to ask" for information. In our recommendation section, we suggest that a structured approach to a directory of such sources could be developed in a cost effective manner. The other type of information that did not attract a significant amount of concern but seems worthy of attention is categorized as "ADOT&PF general background." It would seem that enhanced knowledge about the department's organization, leadership, mission, inside and outside relationships, and processes, obtained during orientation should be available as well in written and/or electronic form to help to prepare employees for the jobs they do and the decisions they make.

Since the second set of questions demanded yes/no responses (plus comments, if any), analysis of these was relatively straightforward and could be reduced to statistics. In each interview, the employee was presented with a list of commonly used KT techniques and was asked to indicate which they used in their activities at ADOT&PF. Figure 5 displays the results of the analysis.

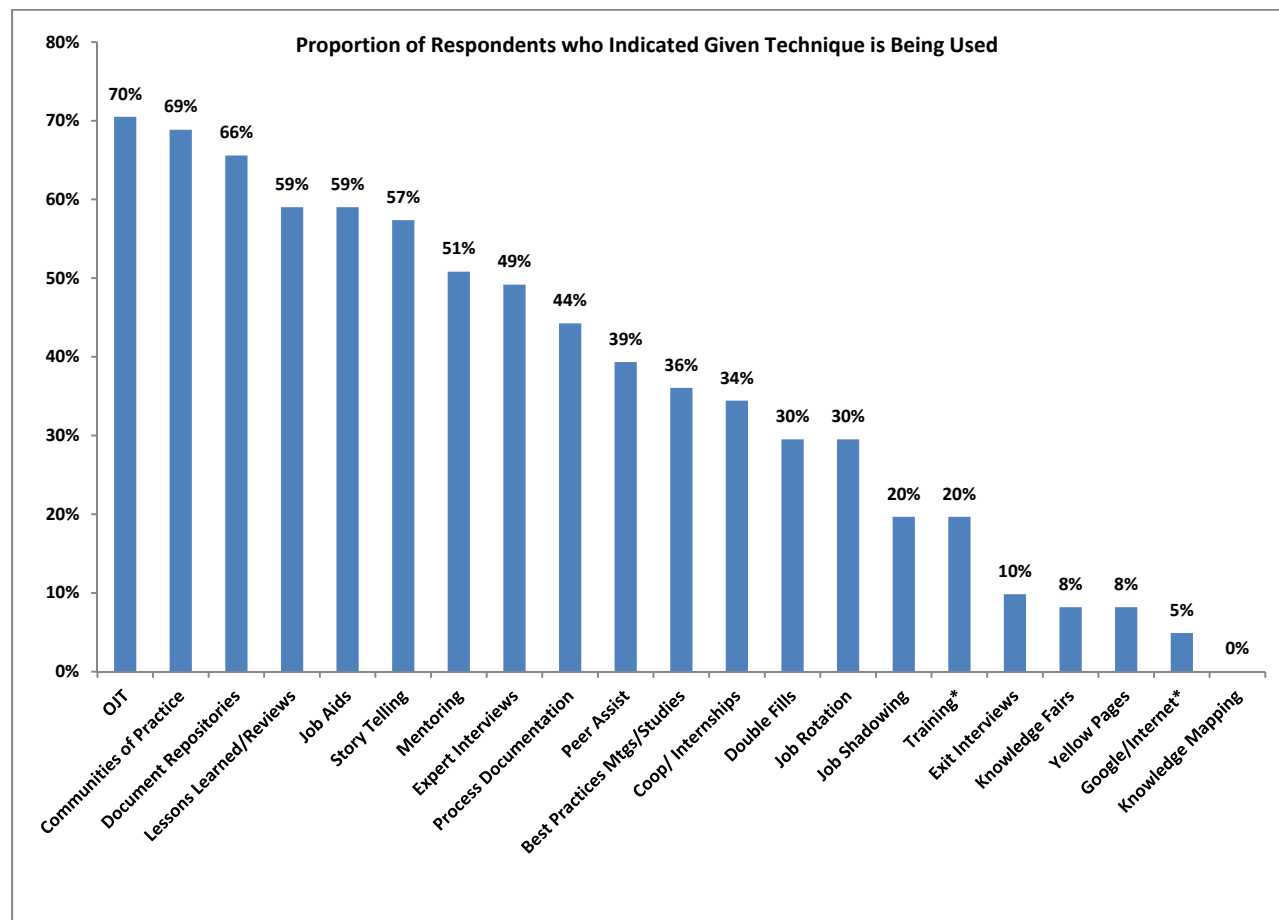


Figure 5. Proportion of respondents who indicated a given KT technique is in use (* = technique included in only one of the three sets of interviews).

Figure 5 makes it clear that many commonly used KT techniques are actively used within the department. OJT, communities of practice, document repositories, lessons learned and project reviews, job aids, storytelling, and mentoring were all cited by more than half of the respondents.

On the other hand, it appeared that many of the techniques were not familiar to the interviewees or, if they were familiar, they were not used extensively. Why? Perhaps they have been tried and discarded as ineffective, perhaps they have been judged impractical, perhaps they lack the support structure or leadership support to sustain them. Among those, double fills, exit interviews, and yellow pages, if not

others, seem worthy of a larger degree of use, with a potentially positive impact on KT at relatively low cost.

Here we note some information from the proportion of respondents when separated by length of time—less than ten years versus greater than ten years.

- Almost twice as many older employees felt knowledge was being transferred by document repositories.
- Also, the older employees more often felt knowledge was being transferred by Lessons Learned and Reviews. This has a straightforward explanation – more senior employees are invited to these sessions far more often than newer employees.
- Likewise, almost twice as many of the older employees felt knowledge was often transmitted by storytelling. Although one could interpret this disparity as meaning the older employees are telling the stories and the younger are not paying attention [the author of this report has 67 birthdays], a more benign interpretation is that the older employees realize they learned things from listening to stories during their career. In any case, storytelling is an excellent way to transmit tacit knowledge since the story relates to past events in which the listener generally has no ego invested. Thus the listener can hear past events to get a “feel” for the people and circumstances involved.
- A striking contrast emerges regarding “coops and internships” with only 13% of the newer employees believing knowledge is successfully transferred in this manner, while 41% of the older employees believed this category was a common practice. Again, ADOT&PF had a strong “EIT” (Engineer in Training) program in years past that involved transferring young engineers between different sections and even regions. These engineers tended to stay with the department. In recent years they have fewer young engineers in the program and has not utilized the relocation between departments and regions, which results in fewer younger engineers participating in programs.

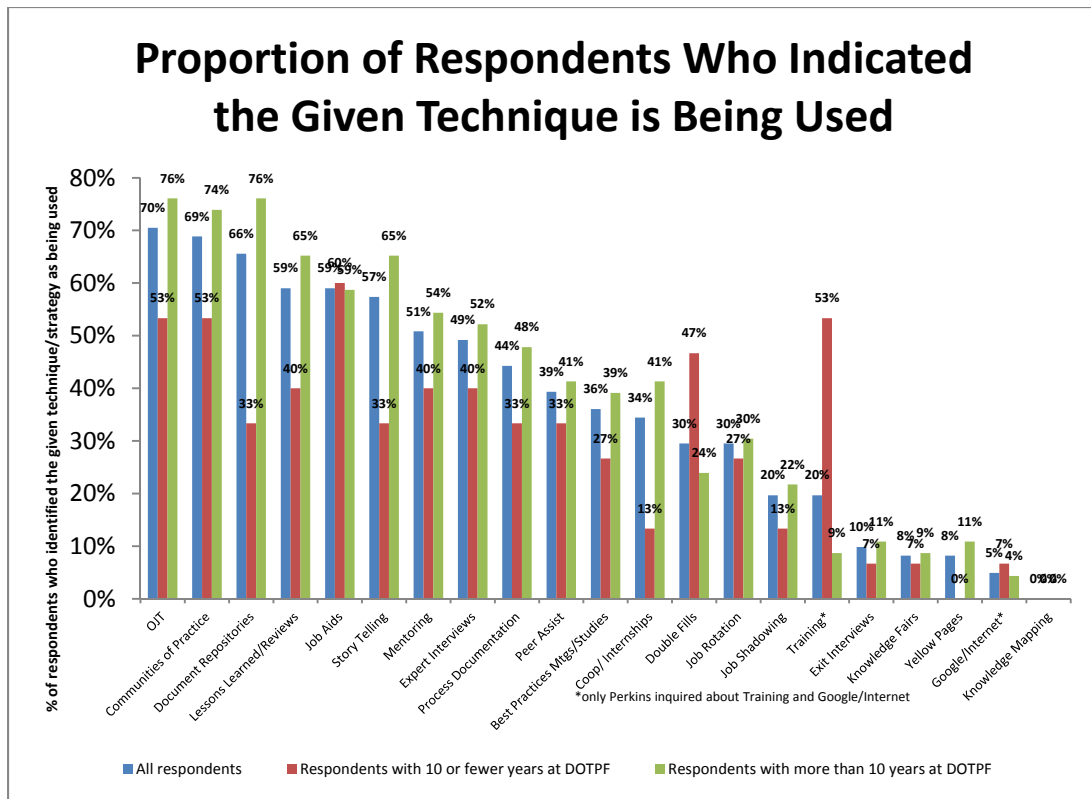


Figure 6. Proportion of respondents reporting a particular KT technique is in use, based on years with the department, greater than ten years or less than ten years.

2012 Focus Group Meeting

On 12 December 2012 we met with the ADOT&PF Northern Region management group to explain our research findings, present our preliminary recommendations, and gather feedback. The preliminary recommendations are summarized here:

- Continue face-to-face manager meetings, lessons learned, including funding support for travel, etc.
- Provide adequate time for job shadowing and other transfer from retiring employees.
- Incorporate support areas (e.g., environmental) within line areas to encourage tacit knowledge transfer (versus just giving manual or instructions).
- Resolve issues related to use of manuals (timeliness, updates, on-line accessibility)
- Encourage more formal communities of practice.

- Develop more formal means for capturing knowledge from retiring employees (interviews, panel discussions, etc.).
- Provide easy means of accessing documents in repositories (effective indexing, etc.).
- Support both informal and more formal mentoring.

At the meeting, the managers also noted:

- Special software such as Pinnacle and AASHTO Transport were useful tools.
- A section chief mentioned that people can't find the data they need, even though the data is available somewhere. The senior people can find it, but others can't. We interpreted this as the senior managers' tacit knowledge is needed to find explicit knowledge for others.
- Another section chief brought up the concept of timing of knowledge transfer within a career. Initially, a lot of profound knowledge is not needed to make decisions, but more is needed later in a professional's career.
- A senior manager brought up the training the chief and other very senior managers who change with political terms.
- A group chief brought up the issue of bringing back retirees to train newer employees; not all retirees were good at mentoring during their tenure, so preference should be given to those who are good at helping new people learn.
- Participants noted that knowledge gaps need to be identified in the rising generation, and these may not be the same gaps identified by the retiring generation.

Conclusions

- ADOT&PF is already demonstrating considerable success in KT. About three-quarters of the knowledge examples cited in our interviews were considered to be transferred effectively.
- Overall, there is little difference between senior and less experienced employees regarding to KT effectiveness.
- Effective KT at ADOT&PF varies with the type of knowledge, from almost completely effective for some types to about 50%, or partially ineffective, for other types.
- The degree of use for different KT techniques varies widely, with 70% using OJT, to none or very small percentages using exit interviews, yellow pages, and knowledge mapping. Some of these infrequently used techniques have potential for enhancing KT within the department.

Recommendations;

Here we consolidate some of the tentative recommendations, integrate the managers' remarks from the focus group, and add some later reflections:

1. Continue transfer of tacit knowledge by funding and supporting formal meetings of managers, Lessons-Learned sessions, participation in AASHTO sub-committees, as well as barbecues and other informal meetings of staff, both within disciplines—such as Right-of-Way—and across disciplines—such as Northern Region Airports.
2. Manuals and similar sources of explicit knowledge need constant updating. Regarding KT through manuals, consider transferring not only the knowledge already in the manual, but also the knowledge of how to update and supplement the manual.
3. Job shadowing and double- fills are an excellent method of transferring the tacit knowledge associated with a job to a likely replacement. We recognize there are often personnel and budgetary constraints which make this difficult. Here we are simply recommending that job shadowing, double fills or other intensive training of the replacement be made a priority by the department with suitable planning and budgeting.
4. Individuals with specialized knowledge, such as environmental, can supply technical expertise to a project by working in cross-functional teams. In large projects where all the individuals are co-located and “share the same

water cooler,” both tacit and explicit knowledge needs of the various team members is transmitted directly. For smaller projects, where cross-functional team members are not co-located and remain within their specialized units, we recommend special efforts be made to enhance team interaction and KT. Travel, video conferencing, team meetings, and similar interactions should be looked at as opportunities for learning.

4. Earlier in an employee’s career, there should be some special efforts made to help the employee understand the “General Background of ADOT&PF.” Presumably at hire there is some general orientation or “on-boarding” but later in one’s career more general information is needed. It would seem that enhanced knowledge about the department’s organization, leadership, mission, inside and outside relationships, and processes, obtained during orientation but also available in written and/or electronic form, would help to prepare employees for the jobs they do and the decisions they make.
5. Employees expressed a learning gap regarding “project processes” including “environmental.” They referred to the usually complex set of rules associated with federal funding and the many approvals that are needed. Although all these rules and lists of the needed approvals are explicit knowledge, applying them to a particular project is daunting for newer managers. Here the most is learned in OJT or informal mentoring. We note that most project manager Lessons Learned sessions refer to technical matters: “what we did when we encountered unexpected permafrost.” Rarely are matters such as funding delays, permitting problems, and so on, discussed; for instance, “if we had done this we would not have had problems getting the permit.” Recognize that many of these problems and their solutions are difficult to discuss in public venues. Therefore, mentoring, informal Lessons Learned sessions, and notes from retiring employees are vital.
6. We believe that the Yellow Pages concept could be combined with the notion of Community of Practice and perhaps current software into a web-based resource. There are good general guidelines in Appendix C and in the VDOT toolkit (Hammer 2010a), under COPs. ADOT&PF should first develop a master list of disciplines, specialty areas, and sub-areas within the department, then provide contacts for personnel active in those areas, particularly those with special expertise. Next, the designated personnel could provide links to documents on the ADOT&PF server or to external sites, which might include persons or organizations outside ADOT&PF. The most important part of this concept is that time and resources must be provided for one individual in each sub-area, who is responsible for calling a

semi-annual meeting of the community, probably by teleconference, in order to update the site and create opportunities for the sub-area members to become familiar with each other and discuss new information. Another important part of the site would be a keyword for each person or data-set for more accessible searching. This area or sub-area could then be linked on Pinnacle or a similar workflow process. In addition, retirees might be asked to participate in the contact list. In addition to allocating time for a dedicated employee in each sub-group and some general IT help, the department might provide some incentives or recognition for the communities most effective in contributing useful information to their community and others in the organization.

7. Capturing the knowledge of retiring employees is sometimes possible through an Exit Interview or a process whereby the departing employee shares the “things I did that made a difference” with an interviewer. Often others in an organization do not know all that the departing employee has done or was doing on a regular basis. The effectiveness of the exit interview will vary tremendously with the personality of the employee and the interviewer. If there were not resources for a sufficient period of job shadow or double fill, a definite exit interview process is needed to capture, if nothing else, a list of “things not in the job description,” for the replacement. A variation on this (which we recommend) is to expand that exit process to include two or three rising managers who, while not the current replacement, are likely future replacements for that or similar jobs. This should be made part of the out-processing routine, whereby the departing employee gives a one or two hour very informal talk, which might include: three things I did that made a difference; five administrative or procedural barriers to getting my job done and how I (sometimes) overcame them; five technical barriers or problems in my work and how I (usually) overcame them.

Appendix A

Annotated References

Ardichivili, A., V. Page and T. Wentling (2002). "Virtual Knowledge-Sharing Communities of Practice at Caterpillar: Success Factors and Barriers." *Performance Improvement Quarterly*. V 15 N 3, 94-113.

"... the chief reason [for the failure of KM [knowledge management] to become the magic key to organizational success] is an overemphasis on technology-based solutions — from search-and-retrieval tools to decision-support and data mining systems — and a lack of attention to the human side of the enterprise, especially the dynamics of knowledge creation, dissemination, and use at the group and organization levels." The paper explores barriers and success factors for on-line knowledge-sharing communities of practice (COPs) and includes a helpful definition of community of practice. Caterpillar began virtual COPs 1997; by 2002 there were 600. The study reports benefits, success factors, barriers. "... to understand how to overcome ... barriers, we need to better understand the mechanisms of trust among community members and the organizations."

Burk, M. (2000). "Communities of Practice." *Public Roads*. V 63 N 6.

<http://www.fhwa.dot.gov/publications/publicroads/00mayjun/commprac.cfm>

This is a good general overview of communities of practice, which the author describes as "simply expansions of one-on-one knowledge sharing." Although focused on organization at the Federal Highway Administration, the ideas apply to any knowledge management program. Guidelines for developing a COP are given. The success of any such community depends on its members; a COP must best suit the interests and working styles of its members rather than using a format and process dictated by the organization.

Canas, A.J., D.B. Leake, and D.C Wilson (1999). "Managing, Mapping and Manipulating Conceptual Knowledge." Institute for Human and Machine Cognition.

<http://www.ihmc.us/users/acanas/Publications/AAAI99CmapsCBR/AAAI99CmapsCBR.html>

The paper describes the use of case-based reasoning for managing aerospace design knowledge. The technique extends the concept mapping technique, which makes internal knowledge explicit in visual form, by applying such maps to new problems.

Carrillo, P. (2004). "Managing knowledge: lessons from the oil and gas industry." *Construction Management and Economics*. V 22 N 4, 631-642.

This study was performed because of increasing interest in knowledge management (KM) among leading UK construction organizations. It looked at how eight Canadian oil and gas companies manage their knowledge. Among several conclusions: the need for KM must be driven by senior management, peer recognition has more sustainable impact than financial reward, people-centered techniques work best for sharing tacit knowledge, whereas IT tools are effective in sharing explicit knowledge.

Chakravarthy, B., S. McEvily, Y. Doz and D. Rau (2003). "Knowledge Management and Competitive Advantage." Chapter 15 in Easterby-Smith, M and M.A. Lyles, eds. *The Blackwell Handbook of Organizational Learning and Knowledge Management*. Malden, MA: Blackwell Publishing.

The authors argue that it is not knowledge *per se* but rather KM—accumulation, protection, and leverage of knowledge—that is the source of a firm's competitive advantage: "... characteristics of knowledge are primarily valuable for defending existing advantages, while the processes [the firm] uses to accumulate and leverage knowledge have greater implications for creating new sources of advantage."

Chang-Albitres, C.M. and P.E. Krugler (2005). "A Summary of Knowledge Management Information Gathered from Literature, Web Sites, and State Departments of Transportation". College Station, TX: Texas Transportation Institute. <http://d3koy9tzykv199.cloudfront.net/static/0-4505-P1.pdf>

Produced for the Texas Department of Transportation, this report is especially pertinent to our project due to its sections on historical background, the nature of knowledge, the role of information technology, and KM integrations into business. It also describes other states' experiences with KM, which we have captured in other references. Sections on the Texas Transportation website and software are less helpful, since they are at least eight years old.

Clark, K. and M. Hammer (2008). "Communities of Practice: The VDOT Experience." *KM Review*. V 11 N 5, 10-15.
http://findarticles.com/p/articles/mi_qa5362/is_200811/ai_n31169931/

By 2008, the Virginia DOT (VDOT) had formed over 40 COPs. The paper provides guiding criteria for building a knowledge-sharing culture. It then gives recommendations for developing and maintaining COPs as they

mature, including maintaining a clear focus on the COP's objectives and role, having the right persons involved, maintaining appropriate management support, keeping groups small and their processes simple and informal, and meeting in-person, rather than electronically, whenever possible.

CTC & Associates, LLC (2010). "Knowledge Management on the Transportation Sector." *Transportation Synthesis Report* prepared for Wisconsin Department of Transportation, 19.

This recent report is a valuable comprehensive review of literature sources related to transportation knowledge and its management. It includes such topics as managing information in the transportation library, capturing and managing knowledge in transportation agencies, COPs, person-to-person technology transfer, and KM practices in the public sector, other disciplines and industries, and in the international community. Many of the references cited in this closure report are described in the CTC report.

Dering Consulting Group, Fleming, G, and Pennsylvania Department of Transportation (2006). *PennDOT Knowledge Management*. Final report, 1-189. Abstract available at: <http://tris.trb.org/view.aspx?type=MO&id=840395>

KM at Pennsylvania DOT is a success story. "PennDOT has accumulated a vast amount of both of these forms of knowledge [tacit and explicit], and it has deployed these assets exceptionally well over time." Now, a strategic plan is needed, based on worker needs, work force demographics, availability of enabling technologies, and availability of existing knowledge assets.

Drucker, P. (1969). The Age of Discontinuity: Guidelines to Our Changing Society. New York, NY: Harper and Row.

Many authors still cite this classic book, in which Drucker emphasized the importance of knowledge as an asset.

European Committee for Standardization (2004). *European Guide to Good Practice in Knowledge Management*.
<http://www.cen.eu/CEN/sectors/sectors/iss/cen%20workshop%20agreements/Pages/knowledge%20management.aspx>
European Committee for Standardization (2004). *European Guide to Good Practice in Knowledge Management*. "Part 2: Organizational Culture."
<ftp://cenftp1.cenorm.be/PUBLIC/CWAs/e-Europe/KM/CWA14924-02-2004-Mar.pdf>

The guide is intended for employees, managers, directors and anyone else involved in a KM program at European organization. In particular, Part 2 confronts the oft-needed cultural change that must take place to enhance and gain a greater value from knowledge. Sections include getting the support and active involvement of an organization's members, organizing for implementing KM, and setting an appropriate climate for KM implementation. The guide could almost serve as the textbook for a class in organizational culture.

Fong, P.S. and L. Chu (2006). "Exploratory Study of Knowledge Sharing in Contracting Companies: A Sociotechnical Perspective." *Journal of Construction Engineering and Management*. ASCE V132 N 9, 928-939.

This paper reports on a questionnaire survey of UK and Hong Kong construction companies involving personnel from tendering departments with a 21.5% response rate. It begins with a discussion of knowledge concepts and knowledge sharing. Major topics include work areas in which knowledge and experience are shared, practices used for sharing, organizational and personal barriers to knowledge sharing, reasons for sharing, critical factors, and benefits.

Gilmour, D. (2003). "How to Fix Knowledge Management." *Harvard Business Review*. October, 16-17.

The author suggests that (as of 2003) KM practices have not shown a payoff. "Last year, US companies spent \$4.5 billion on software and other technologies that claim to foster information sharing among employees. Where's the payoff?" Instead of a "publishing" model, in which "someone collects information from employees, organizes it, advertises its availability, and sits back to see what happens," he recommends a "brokering" model. A brokering approach connects people who should be connected, in a collaborative manner. One software product continually surveys all of a company's data sources — e-mail and network folders, for example—and alerts those employees with similar interests that the information is available.

Gupta, A.K. and V. Govindarajan (2000). "Knowledge Management's Social Dimension: Lessons from Nucor Steel." *MIT Sloan Management Review*. V 42 N 1, 71-80.

Based on experience at a private sector manufacturing company, the paper draws the important conclusion that, while technology infrastructure can be very useful in KM, it should be considered the "enabler," not the "answer."

Hammer, M. (2010a). "VDOT Knowledge Management Toolkit." Virginia Department of Transportation.

<http://www.innovations.harvard.edu/cache/documents/11767/1176770.pdf>

This helpful toolkit, prepared by the VDOT's Knowledge Management Officer includes background information, definitions and a large reference list. It quotes Rubenstein-Montano et al. on "eight key indicators that a KM initiative is needed" (including the average age of employees is senior). KM is defined at VDOT as "Implementing ways to better utilize the expertise that we have – people and information – to improve ongoing processes and procedures and to retain critical knowledge." It distinguishes between tacit and explicit knowledge and asks a key question: Who owns the knowledge? Tools and techniques include 1) COPs, 2) knowledge mapping, 3) lessons learned, 4) process mapping.

Hedesstrom, T. and E.A. Whitley (2000). "What is Meant by Tacit Knowledge? Towards a Better Understanding of the Shape of Actions." *Proceedings of the 8th European Conference on Information Systems*. ECIS 2000.

Although over ten years old, this paper is a good review of the concept of tacit knowledge. Two quoted definitions are "personal knowledge embedded in individual experience and involv[ing] intangible factors such as personal belief, perspective and value system" and "non-codified, disembodied know-how that is acquired via the informal take-up of learned behaviour and procedure." It points out that the term "tacit knowledge" is used in various inconsistent and confusing ways in the literature. For example, some define tacit knowledge as any knowledge that has not yet been formalized, whereas others limit tacit knowledge to that which cannot be formalized.

Martin de Holan, P., N. Phillips and T.B. Lawrence (2004). "Managing organizational forgetting." *MIT Sloan Management Review*. V 45, 45-51.

This prize-winning paper "is based on the intriguing premise that, although companies often focus on creating organizational processes and structures that allow them to learn quickly, an organization's effectiveness is equally determined by what it chooses to remember, to unlearn or not to learn in the first place. In other words, real learning and real growth require a selective, discriminating and active approach to acquiring and utilizing knowledge." (from the Richard Beckhard Memorial Prize citation)

Mughal, F. (2010). "Beyond the Tacit-Explicit Dichotomy: Towards a Conceptual Framework for Mapping Knowledge Creation, Sharing and Networking." *Journal of Knowledge Management Practice*. V 11 N 2.

"Tacit knowledge is the most effective type of knowledge for an organization in terms of both value and utilization...However, organizations need to ensure that the tacit knowledge must be transformed into explicit, expressible, and easy to understand knowledge before transferring it." (This premise is often debated.) The author shows a matrix of four knowledge-sharing mechanisms, and suggests that each gives rise to a certain type of knowledge network which is dependent on the mechanism: Individualized-Personalization; Individualized-Codification; Institutionalized-Codification; Institutionalized-Personalization, where personalization = informal and inexpressible, and codification = formal and expressible (embedded in databases or repositories).

Novak, M.J and M. Hammer (2009). "Tacit Knowledge Transfer in a State Transportation Agency." Ohio Transportation Engineering Conference. October 27 & 28, 2009.

This is an excellent recent reference with a large reference list. It starts with an interesting "brief history of human civilization," including food-gathering era, Neolithic Revolution, Industrial Revolution, Post-Industrial Revolution. It then discusses knowledge workers, explicit v. tacit knowledge, knowledge management definition, Drucker ([Age of Discontinuity](#)) and the knowledge economy, with a helpful list of the characteristics of knowledge workers. It then turns to the public sector, with some emphasis on the coming retirement of public sector workers and how to capture their knowledge. (as well as how to take care of older workers who remain behind. It discusses challenges of the changing government workplace, "knowledge draining factors," and what public sector leaders can do. The paper includes a case

study of the V DOT and tacit knowledge networks, with implications and recommendations.

Powers, V.J. (n.d.). “Knowledge Retention Captures Critical Knowledge Before Baby Boomers’ Walk Away”. Houston TX: American Productivity and Quality Center. <http://www.apqc.org>

After citing well-known predictions of the loss of key employees, and therefore key knowledge due to large numbers of near-future retirements, the article suggests several guidelines for capturing that critical knowledge. One method is to identify such critical knowledge. Another is to calculate the cost of losing such information (implying that some knowledge might not be worth retaining). It is important to leverage information that is already in place in the organization.

Rao, M., ed. (2005). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Oxford: Elsevier Butterworth –Heinemann, 1-438.

The introductory chapter, “Overview: The Social Life of KM Tools,” — written by the editor—gives a good introduction to the topic, but with great emphasis on tools and techniques (as implied by the book’s title) instead of the people/organizational aspects. He does admit that the non-IT aspects are equally as important. The balance of the book consists of a large number of case studies. Throughout the book are a multitude of references, albeit at least eight years old. One has to work hard to find much KT from retiring and leave-taking employees.

Spy Pond Partners, LLC, and S. Tucker (2009). “Implementing *Transportation Knowledge Networks*.” Transportation Research Board’s National Cooperative Highway Research Program Report 643, 1-74 .

This report on NCHRP Project 20-75 describes the development of a business plan for implementing transportation knowledge networks (TKNs) in the United States. The necessity of sharing many types of transportation knowledge between state transportation agencies and other entities including the US Department of Transportation led to this plan whose three major elements include three regional TKNs (eastern, midwest and western), a national TKN coordination function, and an advisory board. The project builds upon previous TRB efforts to improve access to transportation information, including the work reported in National Cooperative Highway Research Program (NCHRP) Special Report 284 cited herein. At this writing

(late 2012), the three recommended regional TKNs and the federal TKN have been established.

State of Alaska Department of Administration Division of Personnel & Labor Relations. (2008). "Knowledge Transfer in State of Alaska Agencies." <http://doa.alaska.gov/dop/fileadmin/StatewidePlanning/pdf/WorkforcePlanning-KnowledgeTransferInStateOfAlaskaAgencies.pdf>

The report emphasizes the connection between KT and succession planning. There are three main sections: 1. Identifying knowledge to be transferred 2. Selecting appropriate knowledge transfer techniques (with explanations of each) 3. Three articles on after-action reviews, exit interviews, and online inventories are taken from Canada School of Public Service, Roundtable on Organizational Memory, (2007). *Lost and Found*.

State of New Hampshire Department of Administrative Service Division of Personnel (New Hampshire DOA) (n.d.). "Knowledge Management & Transfer Model (Techniques and Forms)." <http://admin.state.nh.us/hr/workforcetoolkit.html>

This manual begins with definitions and a discussion of tacit v. explicit knowledge and the importance and benefits of a KT program. (Note the emphasis on KT.) It includes a flow chart of KT process (from DeLong). It describes suggested steps in developing and implementing a KM/KT plan: 1) Identify critical tasks and activities 2) Define each task and activity 3) Develop knowledge transfer plan. It then sets forth KM/KT, categorized by 1) identifying and collecting, 2) storing, and 3) transferring, with guidelines for using most of them. The third of these three is most relevant to our project.

Swiss Agency for Development and Cooperation (SDC) (2009). "SDC Knowledge Management Tools." http://www.sdc-learningandnetworking.ch/en/Home/SDC_KM_Tools

This website comprises a well-organized summary of a number of techniques, many of which apply specifically to KT.

Tong, J. and R. Ayres. (2009). "Knowledge Needs: Uncharted Area in Knowledge Management" International Conference on Organizational Learning, Knowledge and Capabilities (OLKC). www.feweb.vu.nl/olkc2009/Papers/5BJinTong.pdf

The paper suggests knowledge needs maps as a means for people to express their knowledge needs. (whereas current knowledge maps are used to

advertise locations of available knowledge). It reviews knowledge mapping schemes: knowledge yellow pages, knowledge concept mapping, knowledge application mapping, and knowledge competence mapping. It discusses two knowledge transfer models: knowledge market (Davenport & Prusak) and transaction-oriented (Tong & Ayres). And it describes two types of knowledge needs maps: subject-based and task-based.

Transportation Research Board (TRB) (2006). “Transportation *Knowledge Networks: A Management Strategy for the 21st Century*, Special Report 284.” 1-88

TRB and AASHTO charged a committee to advise on developing a sustainable administrative structure for meeting the information needs of the transportation sector and to suggest an appropriate funding mechanism. This report resulted from that study and recommends the development of regional and federal transportation knowledge networks (TKNs). A follow-on study, described in NCHRP Report 643 cited herein, provides guidance for implementing the recommendations.

Tsoukas, H. (2003). “Do We Really Understand Tacit Knowledge?” Chapter 21 in Easterby-Smith, M and M.A. Lyles, eds. *The Blackwell Handbook of Organizational Learning and Knowledge Management*. Malden, MA: Blackwell Publishing.

In the debate over whether tacit knowledge can and should be converted to explicit knowledge, the author argues strongly against that notion. He suggests that the basic “ineffability” of tacit knowledge means that the idea of translating or converting it is unsustainable.

Ward, M. (2007). “Preserving and Using Institutional Memory Through Knowledge Management Practices.” Transportation Research Board’s National Cooperative Highway Research Program Synthesis 365, 1-114.

The paper is a major contribution to the literature on KM in transportation agencies. It reports the results of a questionnaire survey of state transportation agencies about their KM practices. There are many valuable references and helpful definitions. It provides a good background for the introductory section of our report. There are several categories of KM activities (p 12): one is “transferring knowledge from one human mind to another in ‘non-tangible’ form (often termed ‘tacit’) through, for example, COPs, face-to-face discussions, interviews, or roundtable sessions.” The first questionnaire question is most relevant to our project—Special efforts to

capture knowledge of experienced retiring or exiting employees. Some of the 42 ideas will be helpful. The paper includes some interesting non-transportation case studies, but little about KT from exiting employees. Several annotated literature surveys are found in appendices, including one (96-99) titled “Challenges Owing to High Rate of Retirements and Leave-Taking,” which includes much more than just KT.

Appendix B

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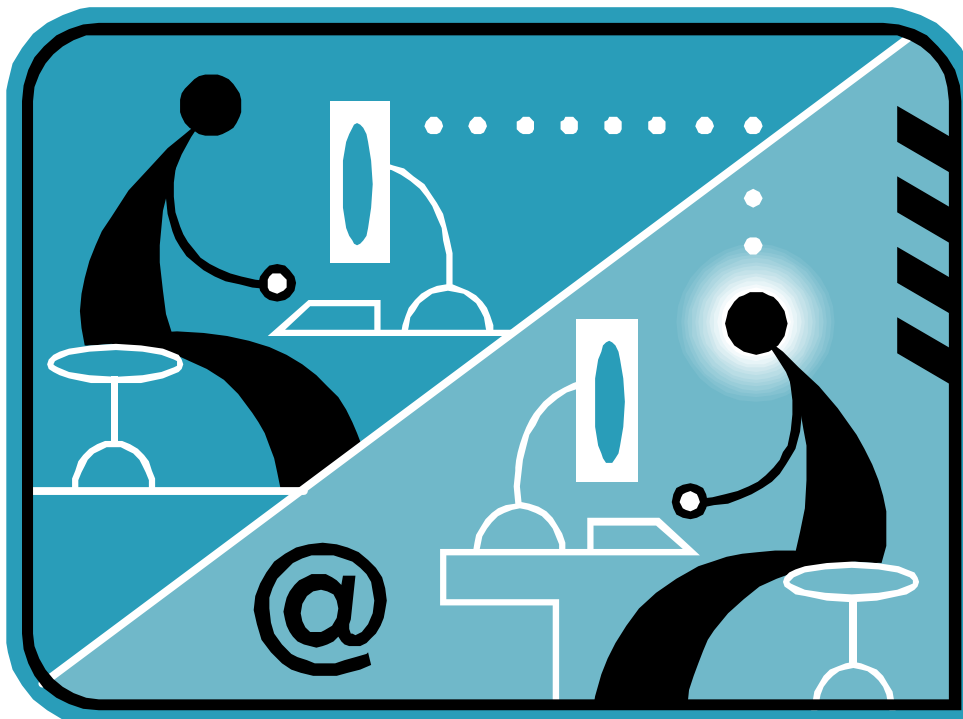
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Appendix C

State of New Hampshire Knowledge Management & Transfer Model

Note: Page numbers referenced in Appendix C do not refer to page numbers as shown in this report.

Knowledge Management & Transfer Model {Techniques and Forms}



**Division of Personnel
Department of Administrative Service
State of New Hampshire**

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Introduction

This document is intended to help state agencies retain critical organizational knowledge. The goal of Knowledge Management is not to capture all knowledge, but rather manage the knowledge that is most important to the organization. It involves applying the collective knowledge and abilities of the entire workforce to achieve specific organizational objectives.

State agencies should feel free to adapt and use information and tools on the following pages as necessary within their organization. It is provided to be a starting point for sharing knowledge and experience, allowing those who remain with the organization to continue providing quality service.

Capturing and sharing critical knowledge and expertise should be occurring continuously among employees. In many cases, however, it is not and this need becomes pressing when a valued employee is preparing to retire or change positions. When an organization is considering implementing a knowledge transfer plan it is important to answer several questions:

1. Is the organization going to fill the vacant position or reassign the duties?
2. Are all the duties of the position still important to the mission of the organization?
3. Is there a need to update the position description?
4. Will the position change, remain as is, or be eliminated once the employee leaves?

What is knowledge transfer?

David DeLong's book "Lost Knowledge" describes knowledge as the "capacity for effective actions or decision-making in the context of organizational activity".

Accordingly, lost knowledge would decrease this vital capacity and help undermine organizational effectiveness and performance. The goal of transferring knowledge to others [known as Knowledge Transfer] is to:

1. Identify key positions and people where potential knowledge loss is most imminent.
2. Assess how critical the knowledge loss will be.
3. Develop a plan of action to ensure the capture of that critical knowledge and a plan of action to transfer it.

Why is knowledge transfer important?

A significant percentage of the state's workforce is nearing retirement age over the next ten years. These employees have acquired a tremendous amount of knowledge about how things work, how to get things done and who to go to when problems arise. Losing their expertise and experience could significantly reduce efficiency, resulting in costly mistakes, unexpected quality problems, or significant disruptions in services and/or performance. In addition, faster turnover among younger employees and more competitive recruiting and compensation packages add significantly to the mounting concern about the state's ability to sustain acceptable levels of performance.

What are the benefits of a knowledge transfer program?

Knowledge transfer [KT] programs prevent critical knowledge loss by focusing on key areas. Some of the immediate benefits of KT programs are:

1. They provide reusable documentation of the knowledge required in certain positions or job roles.
2. They result in immediate learning and knowledge transfer when carried out by individuals who can either use the transferred knowledge themselves or have responsibility for hiring, training, mentoring, coaching or managing people within an organizational unit.
3. They reduce the impact of employee departure.
4. They integrate staffing, training, job and organization redesign, process improvements and other responses.
5. They aid in succession planning.
6. They prevent the loss of knowledge held only in employees' heads when they leave the organization or retire.
7. They enhance career development.

Generally Accepted Definitions for Knowledge Management and Transfer

Knowledge Management (KM) refers to practices used by organizations to find, create, and distribute knowledge for reuse, awareness, and learning across the organization. Knowledge Management programs are typically tied to organizational objectives and are intended to lead to the achievement of specific outcomes such as shared intelligence, improved performance, or higher levels of innovation.

Knowledge Transfer (an aspect of Knowledge Management) has always existed in one form or another through on-the-job discussions with peers, apprenticeship, and maintenance of agency libraries, professional training and mentoring programs. Since the late twentieth century, technology has played a vital role in Knowledge Transfer through the creation of knowledge bases, expert systems, and other knowledge repositories. To understand knowledge management and knowledge transfer, it is helpful to examine the differences between data, information, and knowledge.

Data is discrete, objective facts. Data is the raw material for creating information. By itself, data carries no judgment, interpretation or meaning.

Information is data that is organized, patterned and/or categorized. It has been sorted, analyzed and displayed, and is communicated through various means. Information changes the way a person perceives something, thus, affecting judgment or behavior.

Knowledge is what is known. It is richer and more meaningful than information. Knowledge is gained through experience, reasoning, intuition, and learning. Because knowledge is intuitive, it is difficult to structure, can be hard to capture on machines, and

is a challenge to transfer. We often speak of a "knowledgeable person," and by that we mean someone who is well informed, and thoroughly versed in a given area. We expand our knowledge when others share theirs with us. We create new knowledge when we pool our knowledge together.

The Working Council of the Federal Chief Information Officers Council in its publication "Managing Knowledge at Work: An Overview of Knowledge Management" illustrates these differences in the simplest terms:

Data	=	Unorganized Facts
Information	=	Data + Context
Knowledge	=	Information + Judgment

What is Tacit versus Explicit Knowledge?

A key distinction made by the majority of knowledge management practitioners is the distinction between tacit and explicit knowledge. Tacit knowledge is often subconscious, internalized, and the individual may or may not be aware of what he or she knows and how he or she accomplishes particular results. At the opposite end of the spectrum is conscious or explicit knowledge - knowledge that the individual holds explicitly and consciously in mental focus, and may communicate to others. In the popular form of the distinction, tacit knowledge is what is in our heads, and explicit knowledge is what we have arranged into an organized system.

- Tacit knowledge is often difficult to access. People are not aware of the knowledge they possess or how valuable it may be to others. Tacit knowledge is considered more valuable because it provides context for people, places, ideas, and experiences. Effective transfer of tacit knowledge generally requires extensive personal contact and trust.

- **Explicit knowledge** is relatively easy to capture and store in databases and documents. It is shared with a high degree of accuracy. It may be either structured or unstructured:

- ▶ **Structured** - Individual elements are organized or diagramed in a particular way for future retrieval. It includes documents, databases, and spreadsheets.

- ▶ **Unstructured** - The information is not referenced for retrieval. Examples include e-mail messages, images, training courses, and audio and video selections.

Knowledge Transfer Practices

Elements of this framework for Organizational Knowledge Retention are Interdependent

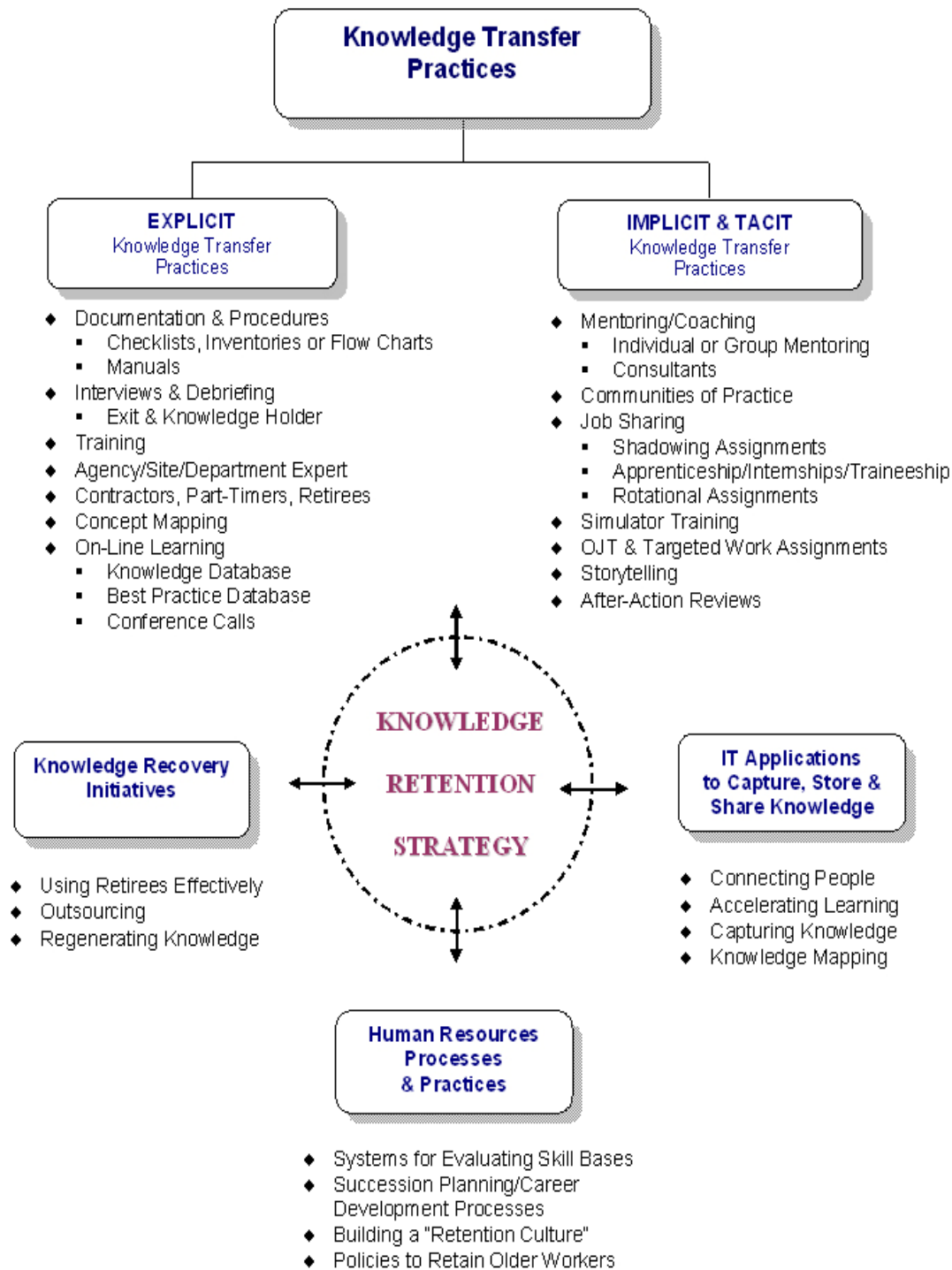


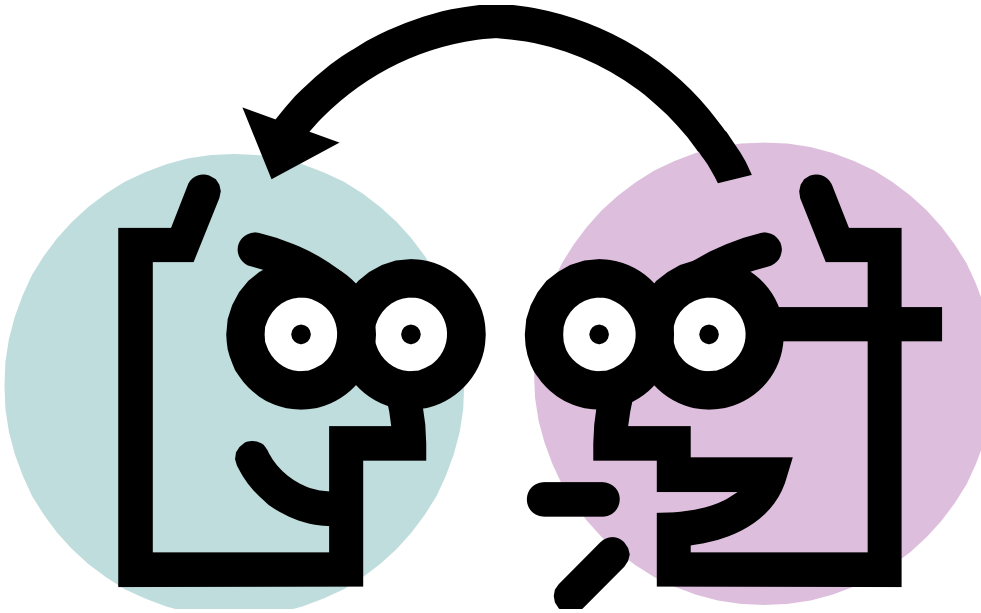
Figure 1. Source: Adapted from DeLong, *Lost Knowledge: Confronting the Threat of an Aging Workforce*

Developing and implementing a knowledge management/transfer plan

A knowledge transfer plan allows you, along with the employee, to target the knowledge and expertise that should be shared with the remaining staff. It also allows you to evaluate how critical a task is to the mission of the organization.

In addition, having an employee complete a knowledge transfer tool provides a positive framework for the departing employee to look back over their career and document their accomplishments and worth to the organization. It also provides a mechanism for the employee to give honest feedback on the necessity of actual tasks and activities.

State agencies should feel free to adapt and use information and tools on the following pages as necessary within your organization. It is provided to be a starting point for sharing knowledge and experience, allowing those who remain with the organization to continue providing quality service.



Instructions For Completing A Knowledge Transfer Form

There are three simple steps to complete the worksheet:

1. Identify critical tasks and activities.
2. Define each task and activity.
3. Develop a knowledge transfer plan.

Set aside some quiet time to work through the steps. You may find it helpful to talk to coworkers and your manager as you answer the questions. Sometimes experienced employees don't realize how much they know. Others can help uncover the pieces.

STEP 1: IDENTIFYING CRITICAL TASKS AND ACTIVITIES

There are probably some aspects of your work that only you know how to do. In this step you are developing a list of those tasks and activities. It isn't necessary to go into detail. Let the questions below stimulate your thinking:

- What are you known for? What are you the “go to” person for?
- What do only you know how to do?
- If you left your position today, what wouldn't get done because no one else knows how to do it or what to do?
- When you return from a vacation, what work is usually waiting for you because no one else knows how to do it?
- When you have to be away from work, what do you worry about (what work isn't getting done or what work isn't being done well)?
- What does your office rely on you for?

List the tasks and activities below, using as many blanks as necessary.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

9. _____
10. _____

Examples:

- 1. Customer complaints are not addressed. (Addressing customer complaints)**
- 2. New initiatives lay on your desk until you return. (Developing new business processes)**
- 3. Special requests are not processed. (Processing special request forms)**
- 4. Computer glitches are not fixed. (Solving computer glitches)**
- 5. G&C requests wait until you return.**
- 6. You are the only person who can expedite purchase orders.**
- 7. You are the only person who knows all the vendors [Vendor Knowledge]**
- 8. You are the “go to person” to mediate internal disputes [Dispute Resolution]**

STEP 2: DEFINE EACH TASK AND ACTIVITY

Complete this worksheet on **each** task or activity identified in Step 1. You will be identifying in more detail the essence of the knowledge and experience required to complete each task or activity. It is not necessary to inventory all your knowledge and experience. You are simply defining the particular task/activity in more detail. What information or experience do you need to have in order to carry out this responsibility or task? Focus especially on things only you know and that others need to learn.

Consider these areas to get you started:

- Knowing key contacts (customers, universities, other state agency contacts, federal government contacts, people who can walk a G&C request through the process, business contacts, etc.)
- Having strong relationships with key customers or coworkers
- Knowing logistics or locations (training rooms, field offices, etc.)
- Knowing past history (court cases, customer requests, business decisions, etc.)
- Knowing locations of critical files or information

- Knowing how to carry out a task or responsibility

There are many other areas. Think through the steps necessary to complete the task and work to uncover the parts that are critical to your success. What do you know that others need to learn from you in order to be able to serve your customers as well as you do?

Example

Task or Activity (from step 1): Special requests are not processed
List the critical knowledge, experience, or skill needed for this task: <ol style="list-style-type: none"> 1. Knowing how to enter special requests into the computer system 2. Knowing how to assign special requests, based on each person's experience 3. Knowing which information to ask customers for when they make a special request 4. Knowing the history of a customer's special requests, and being able to judge what their true need is

See next page for blank form.

Critical knowledge and experience worksheet

Task or Activity from step #1:

STEP 3: DEVELOPING A KNOWLEDGE TRANSFER PLAN

Fill in the matrix below. Start by inserting all the critical tasks and activities you identified in Step 1. Answer the questions in the chart for each area. Use the detail you developed in Step 2 to help you think about the questions.

Complete the matrix with your manager. When working closely in an area, it is sometimes hard to judge the importance and impact of the tasks on the organization. He or she will help you confirm your perception of the current importance, availability and impact on the organization.

For the tasks identified as critical, work with your manager to develop a strategy for addressing that area.

Example

Critical Tasks From Step 1 in the worksheet.	Importance Low-Medium-High Gauge the importance of the task identified	Availability Is this knowledge and expertise currently available from anyone else in our work area? Yes, No, or Don't Know [if yes, who?]	Impact Low-Medium-High [If the task is important and there is no one else who possesses the knowledge, impact is high.]	Resources What resources [files, people, web sites, references, etc.] exist to help others learn this task?	Strategy How do you plan to address this knowledge gap? Who will learn it? How and when?
Special requests aren't processed	High	No. Jane knows how to enter data, but the rest only I do.	High	Jane for database. My special request files for format of info needed.	Outline step-by-step process of handling special requests. Me – 7-31-09 Creating a matrix of each person's expertise to help with assignment of special requests. Me – 7-31-09

See next page for blank transfer plan form.

Knowledge Transfer Plan Worksheet

Critical Tasks From Step 1 in the worksheet	Importance Low-Medium-High Gauge the importance of the task identified	Availability Is this knowledge and expertise currently available from anyone else in our work area? Yes, No, or Don't Know [if yes, who?]	Impact Low-Medium-High [If the task is important and there is no one else who possesses the knowledge, impact is high.]	Resources What resources [files, people, web sites, references, etc.] exist to help others learn this task?	Strategy How do you plan to address this knowledge gap? Who will learn it? How and when?

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OVERVIEW OF KNOWLEDGE MANAGEMENT/TRANSFER STRATEGIES

There are many ways for an organization to identify, store, and transfer knowledge. Some strategies will work better in one organization than another. Some may not be appropriate for specific types of content. The challenge is to identify and develop complementary ways to further knowledge management and transfer in an organization.

Knowledge Management A systematic approach to finding, understanding and using knowledge to achieve organizational objectives.				
Identifying & Collecting Knowledge		Storing Knowledge		Transferring Knowledge
6. Best Practices 7. Documenting Processes 8. Expert Interviews 9. Knowledge Audit 10. Knowledge Maps & Inventories	+	2. Document Repositories and Management Systems Databases	+	11. After Action Reviews 12. Communities of Practice 13. Co-op/Internships 14. Job Aids 15. Knowledge Fairs 16. Learning Games 17. Mentoring 18. On-the-Job Training 19. Storytelling 20. Training

After Action Reviews: These debriefings are a way to identify, analyze, and capture experiences, what worked well and what needs improvement, so others can learn from those experiences. For maximum impact, after action reviews should be done either immediately following an event or on a regular basis, with results shared quickly among those who would benefit from the knowledge gained.

Best Practices: The identification and use of processes and/or practices that result in excellent products or services. Best practices, sometimes called preferred practices, often generate ideas for improvements in other organizations or work units.

Co-op/Internships: Formal arrangements are established for an experienced person to pass along knowledge and skills to a novice. In New Hampshire State government, the Co-op/Intern Educational Placement Program serves as a recruiting tool for agencies. The program helps agencies meet their short-term staffing needs in critical skill areas. It also serves as a mechanism for students to obtain practical on-the-job experience and academic credit as part of their educational experience.

Communities of Practice: Groups of individuals who share knowledge about a common work practice over a period of time, though they are not part of a formally constituted work team. Communities of practice generally cut across traditional organizational

boundaries. They enable individuals to acquire new knowledge faster. They may also be called Communities of Interest if the people share an interest in something but do not necessarily perform the work on a daily basis.

Documenting Processes: Developing a written or electronic record of a specific work process that includes the business case for the process, steps in the process, key dates, relationship to other processes that come before and after, key players and contact information, any required references and legal citations, back-up procedures, and copies of forms, software, data sets, and file names associated with the process.

Document Repositories: Collections of documents that can be viewed, retrieved, and interpreted by humans and automated software systems (e.g. statistical software packages). Document repositories add navigation and categorization services to stored information. Key word search capability is often provided to facilitate information retrieval.

Expert Interviews: Sessions where one or more people who are considered experts in a particular subject, program, policy, or process, etc. meet with others to share knowledge. Expert interviews can be used in many ways, including capturing knowledge of those scheduled to leave an organization, conducting lessons learned debriefings, and identifying job competencies.

Job Aids: These are tools that help people perform tasks accurately. They include things such as checklists, flow diagrams, reference tables, decision tree diagrams, etc. that provide specific, concrete information to the user and serve as a quick reference guide to performing a task. Job aids are not the actual tools used to perform tasks, such as computers, measuring tools, or telephones.

Knowledge Audits: Knowledge audits help an organization identify its knowledge assets, including what knowledge is needed and available. They provide information on how knowledge assets are produced and shared, and where there is a need for internal transfer of knowledge.

Knowledge Fairs: These events showcase information about an organization or a topic. They can be used internally, to provide a forum for sharing information, or externally, to educate customers or other stakeholders about important information.

Knowledge Maps and Inventories: These catalog information/knowledge available in an organization and where it is located. They point to information but do not contain it. An example is an Experts or Resource Directory that lists people with expert knowledge who can be contacted by others in need of that knowledge.

Learning Games: These structured learning activities are used to make learning fun and more effective, provide a review of material that has already been presented in order to strengthen learning, and evaluate how much learning has occurred.

Mentoring: In mentoring, an experienced, skilled person (mentor) is paired with a lesser skilled or experienced person (protégé), with the goal of developing or strengthening competencies of the protégé.

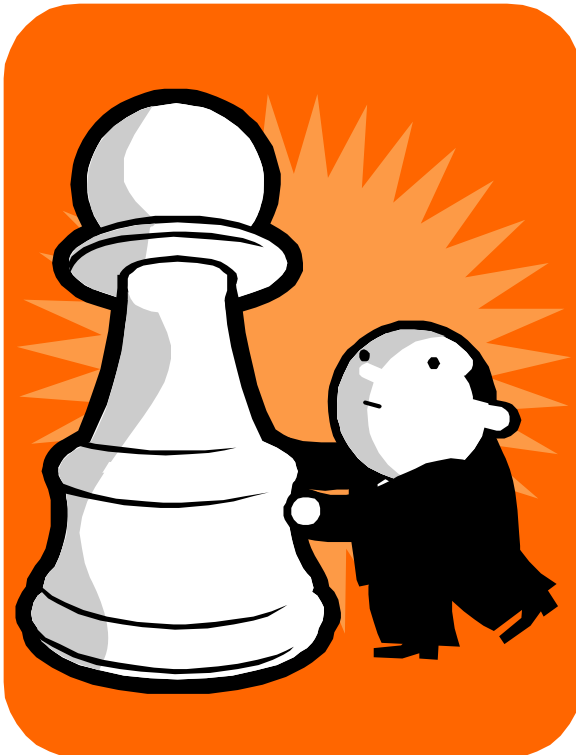
On-the-Job Training: Most organizations use some form of on-the-job training where an experienced employee teaches a new person how to perform job tasks. If this happens at random or with no consistent written materials or processes, it is called unstructured OJT. A system of structured OJT differs in that specific training processes are written; training materials and guides exist and are used consistently by all those who train; training is scheduled; records are kept of training sessions; and "trainers" are given training on how to do OJT, how to give feedback, and several other factors.

Storytelling: This involves the construction of fictional examples or the telling of real organizational stories to illustrate a point and effectively transfer knowledge. An organizational story is a detailed narrative of management actions, employee interactions, or other intra-organizational events that are communicated informally within the organization. When used well, storytelling is a powerful transformational tool in organizations.

Training: Training encompasses a large variety of activities designed to facilitate learning (of knowledge, skills, and abilities or competencies) by those being trained. Methodologies can include: classroom instruction, simulations, role-plays, computer or web-based instruction, small and large group exercises, and more. It can be instructor-led or self-directed in nature.

Note: Pages 71 through 95 of this model provide a description of the strategies listed on pages 67 through 69. Each strategy contains a definition, benefits, when to use the strategy, how to use the strategy, and obstacles you may encounter when using the strategy.

Knowledge Management & Transfer Strategies



- **Strategy**
- **Definitions**
- **Benefits**
- **When to Use**
- **How to Use**
- **Obstacles**

After Action Reviews	
Definition	An After Action Review (AAR) is a discussion of a project or an activity that allows individuals involved to better learn what was done right and what could be done better the next time.
Benefits	AARs identify and capture the things that went well and the things that could be improved so that team or work group members are aware of and can use the broader team/group's learning in their future projects or work activities. Results can also be shared with future teams or other work groups so they can learn from the experiences of others. AARs are excellent for making tacit knowledge explicit during the life of a project or activity. AARs are a useful tool for developing employees by providing constructive, directly actionable feedback in a non-threatening way. They give employees an opportunity to share their views and ideas.
When to Use	The sessions should be done as soon as possible after the completion of the project or activities. They could also be done at any strategic point during a project. AARs simply need to have a beginning and an end, an identifiable purpose and some basis on which actions can be assessed.
How to Use	<p>There are three types of AARs. Although the fundamentals are similar and depending upon the event, an AAR can be Formal, Informal or Personal. All involve the exchange of observations and ideas. Both Formal and Informal AARs should be appropriately documented so lessons learned may be shared across functional and geographic boundaries, and so that implementation of improvements can be measured.</p> <ul style="list-style-type: none"> • Formal AAR. A formal AAR is more structured, requires planning and takes longer to conduct. The formal AAR usually occurs immediately or soon after an event is completed. It may also occur while the event is in-progress. A neutral third party should facilitate a formal AAR. • Informal AAR. Informal AARs are less structured, require much less preparation and planning and can be conducted anywhere, anytime, for any event, by anyone. Examples: following a meeting or conference call; or as part of a safety briefing. Managers or other interested parties may facilitate their own informal AARs. <p>The amount of planning and preparation required for an AAR will vary based on the type of AAR conducted; however, the process for both informal and formal AARs has four steps:</p> <p>Planning:</p> <ul style="list-style-type: none"> • Schedule the AAR • Select a facilitator

	<ul style="list-style-type: none"> • Notify participants • Select AAR site • Assemble AAR materials • Establish the AAR agenda <p>Preparation:</p> <ul style="list-style-type: none"> • Review the expected outcomes for the project or event • Identify key processes • Prepare the AAR site • Rehearse as required <p>Conduct:</p> <ul style="list-style-type: none"> • Seek maximum participation • Maintain focus on AAR objectives • Review key points learned • Record the AAR <p>Follow up:</p> <ul style="list-style-type: none"> • Distribute the record of the AAR to all participants • Publish lessons learned in an easily accessible location • Prioritize actions • Develop action plan to fix the problem (revise procedures; develop a new process, etc.) <ul style="list-style-type: none"> • Personal AARs are a simple matter of personal reflection. For example, take a few minutes to reflect on something you did yesterday such as a client consultation, dealing with a complaint or making a specific telephone call. Ask yourself the four AAR questions below. What does that tell you about what you could do differently tomorrow? <ul style="list-style-type: none"> <input type="checkbox"/> What did I set out to do? <input type="checkbox"/> What did I actually do? <input type="checkbox"/> What did I do well? <input type="checkbox"/> What can I improve? <p>An AAR is both an art and science. What makes AARs so powerful is that they can be applied across a wide spectrum of events from two individuals conducting a 5-minute AAR at the end of a short meeting to a longer AAR held by a team at the end of a large project. Individuals involved may absorb lessons learned on the spot and they can be documented in a format that can be shared with a wider audience. A</p>
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	properly conducted AAR can also have a powerful influence on the climate of the organization. It is a part of the communication process that educates and motivates people and focuses them on organizational priorities to improve procedures across the organization.
Obstacles	<p>Mutual trust must be obtained so that people will speak freely. The climate must be one of trust, openness and commitment to learning. AARs are not critiques and should not be treated or interpreted as a performance evaluation.</p> <p>Resources</p> <p>HQDA Training Circular 25-20, A Leader's Guide to After-Action Reviews</p> <p>Rock Island District, U.S. Army Corps of Engineers; Fiscal Year 2003 Annual Report</p> <p>Introduction to After Action Reviews, David Gurteen, 2000.</p>

Best Practices	
<i>Definition</i>	"Best practices" are ways of doing business, processes, methods, strategies, etc. that yield superior results. They have been implemented and honed over time to a point where they are viewed as exemplary and should or could be adopted by others. A formal "benchmarking" process is often used to identify best practices. A full description of this technique is beyond the scope of this document; however, there are many books and other resources on the subject.
<i>Benefits</i>	Identifying and sharing best practices is an important way to incorporate the knowledge of some into the work of many. Organizational structures tend to promote "silo" thinking where particular locations, divisions, or functions focus on maximizing their own accomplishments and rewards, keeping information to themselves and thereby sub-optimizing the whole organization. The mechanisms are lacking for sharing of information and learning. Identifying and sharing best practices helps build relationships and common perspectives among people who don't work side by side. Best practices can also spark innovative ideas and generate suggestions for improving processes, even if a practice can't be used in its entirety. The process of identifying them can also benefit employee morale. By highlighting or showcasing people's work, employees get organization-wide recognition for their work.
<i>When to Use</i>	The technique of identifying and sharing best practices can be done at any time. It can be especially important when looking for ways to improve results of important or significant processes. In today's environment of tight budgets and rapid change, identifying ways to improve effectiveness and efficiency are crucial.
<i>How to Use</i>	<p>There are many approaches to identifying and sharing best practices, ranging from a formal organization-wide initiative with staff assigned to researching, documenting, and creating a database to more informal ways such as talking at the water cooler (sometimes the most effective approach!).</p> <p>One "in between" approach involves management identifying the results they want to improve, determining the parameters of a process that should be studied, and then chartering a team to conduct the study. A sample of people involved in the process should:</p> <ul style="list-style-type: none"> • Thoroughly review and document the current process. • Identify organization(s) that have exemplary practices or processes

	<p>that produce high results.</p> <ul style="list-style-type: none"> • Explore the "best practices." • Generate possible ways to improve their process. • Recommend or select changes to be implemented. • Arrange for implementation of the changes. • Evaluate the results of the changes. <p>Another approach some organizations use is to encourage employees to learn from others within the organization through annual or periodic best practices or benchmarking conferences.</p> <p>Some organizations recognize teams that have been particularly successful in accomplishing their objectives. Their process and results are often showcased at internal conferences or through knowledge fairs.</p>
<i>Obstacles</i>	<p>Sometimes employees are reluctant to share their methods with others. Information can be seen as a source of power and some people hoard it. A more likely reason for not sharing is reluctance to say that something is the "best way." The "not-invented-here" syndrome could negatively affect the adoption of a method created by a different workgroup.</p> <p>Documenting and storing descriptions of best practices can be a challenge. If storage is to be in written form, a database or other shared file system, the practice needs to be described in enough detail for all to understand. Often, written descriptions are the starting point for transfer, with employees using site visits and other forms of communication to learn. Keeping best practice information current is important. Since organizations are constantly finding ways to improve processes and products, a "best practice" could become obsolete.</p>

Communities of Practice	
Definition	A Community of Practice (COP) is a group of individuals sharing a common working practice over a period of time, though not a part of a formally constituted work team. They generally cut across traditional organizational boundaries and enable individuals to acquire new knowledge faster. COPs can be structured depending on the needs of the membership.
Benefits	Communities of practice provide a mechanism for sharing knowledge throughout one organization or across several organizations. They lead to an improved network of organizational contacts, supply opportunities for peer-group recognition, and support continuous learning, all of which reinforce knowledge transfer and contribute to better results. They are valuable for sharing tacit (implicit) knowledge.
When to Use	Communities of practice can be used virtually anywhere within an organization: within one organizational unit or across organizational boundaries, with a small or large group of people, in one geographical location or multiple locations, etc. They can also be used to bring together people from multiple agencies, organized around a profession, shared roles, or common issues. They create value when there is tacit information that, if shared, leads to better results for individuals and the organization. They are also valuable in situations where knowledge is being constantly gained and where sharing this knowledge is beneficial to the accomplishment of the organization's goals.
How to Use	There are different kinds of COP. Some develop best practices, some create guidelines, and others meet to share common concerns, problems, and solutions. They can connect in different ways: face-to-face, in small or large meetings, or electronically. An organization or group of practitioners needs to decide which kind of community is best for it by determining what knowledge people need to share, how closely connected the community is, and how closely knowledge needs to be linked with people's everyday jobs. The supporting organization(s) needs to be willing to make resources available to the community. These resources include supporting employees' ability to participate at COP events as well as providing logistical and other support. Public and private entities that have created communities of practice say they work best when they set their own agenda and focus on developing members' capabilities. Management should not dictate. Smaller, more informal COPs will likely have fewer constrictions and less need for support. Following are guidelines to consider in forming a COP:

	<p>A. Determine the community's purpose. Link the community's purpose to the profession or organization's goals and objectives. Communities can be formed as:</p> <ol style="list-style-type: none"> 1. Helping communities that provide a forum for members to help each other solve everyday work problems. 2. Best practice communities to develop and disseminate best practices, guidelines, and procedures for member use. 3. Knowledge stewarding communities to organize, manage, and steward a body of knowledge from which community members can draw. 4. Innovation communities for creating breakthrough ideas, knowledge, and practices. <p>B. Clarify roles and responsibilities. Roles can include the following, especially for larger, more formal COPs:</p> <ol style="list-style-type: none"> 1. Functional Sponsors: sponsors need to believe in the value of knowledge sharing. They encourage community growth and commitment of agency resources, act as champion for the community within the organization, and work with community leaders to resolve issues. 2. Core Group: a subset of the community, consisting of knowledgeable and experienced community members (subject matter experts) to assist with start-up of the group and to provide ongoing organizational support. 3. Community Leaders: active members of the community who help to focus the community, plan and schedule meetings and events, represent the community within the organization, manage day-to-day activities, etc. 4. Members: membership should be voluntary. Members will continue to be actively engaged to the extent the community meets their needs, but the expectation must be set that members participate in community discussions, activities, and work. 5. Facilitator to guide the community's process: facilitators provide process expertise, assist with the use of process tools, and help to create and maintain a collaborative environment.
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	<p>6. Logistics Coordinator: coordinates calendars, schedules meetings and events, coordinates facilities, and arranges for equipment.</p> <p>Other roles to consider include functional support staff and a project historian. Functional support staffs help to arrange for databases to store and share community knowledge and establish mechanisms for on-line sharing of information through such tools as chat rooms or discussion lists. The project historian documents project decisions and events for reuse by the agency.</p> <p>C. Identify community members. Membership is voluntary but it is recommended that individuals who could learn from each other and have a stake in the community's success be identified and cultivated. Employees, who are seen as experts or as trusted information sources, add value to the community and efforts should be made to recruit them.</p> <p>D. Develop mechanisms for communication and collaboration. There can be a combination of face-to-face meetings and events, instant messaging or chat rooms, shared databases, videoconferencing, etc.</p> <p>E. Hold an initial community workshop to engage member interest and stimulate continued involvement. At this meeting, the community's purpose should be clarified as follows:</p> <ul style="list-style-type: none"> • Work should begin on building member relationships. • Ground rules should be decided and roles explained. • Methods for creating, capturing, and sharing knowledge should be discussed. • Consensus should be reached on the highest priority knowledge needs. <p>F. Check community progress to identify and resolve any barriers that impede the community's success. This is often a function of the community leader and core group.</p>
Obstacles	<p>To be successful, COPs require support from the organization(s). However, if management closely controls their agendas and methods of operation, they are seldom successful. This is more of an issue for communities of practice within organizations.</p> <p>Resources</p>

	<p>Wenger, Etienne C, and William M. Snyder, "Communities of Practice: The Organizational Frontier," Harvard Business Review, January-February 2000, p. 139-145.</p> <p>NAVSEA Community of Practice Practitioner's Guide, U.S. Department of the Navy, Version 1.0a, May 2001. 2001</p>
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Co-op Internships	
Definition	<p>Co-op/Internships are formal arrangements where a person gains practical experience or knowledge by working for a prescribed period of time under the supervision of more experienced workers.</p> <p>Co-ops/Interns typically have basic skill sets or competencies, such as analytical skills, but lack the specialized competencies necessary for the job. In some situations, specialized education may be required.</p>
Benefits	<p>Co-op/Internships provide a structured means for passing on specific knowledge and skills required for success in a particular job or profession. Because they take place at an actual job site, they provide ready access to people who are experienced in the job and to hands-on learning opportunities. It also serves as a mechanism for students to obtain practical on-the-job experience and academic credit as part of their educational experience.</p>
When to Use	<p>The Co-op/Intern Educational Placement Program serves as a recruiting tool for agencies that cannot find potential employees with appropriate skills in order to fill their vacant positions. The program helps agencies meet their short-term staffing needs in critical skill areas. State agencies may use the following criteria in their selection process:</p> <ul style="list-style-type: none"> • The students' area of study and their special skills or abilities should be utilized in the co-op/intern position. • The students' interest in working for State Government upon completion of their course of study should be considered. • Recommendations of the campus co-op/intern coordinator.
How to Use	Contact the NH Division of Personnel.
Obstacles	<p>Funds for the payment of student salaries must come from the agency's budget and be coordinated with the division of personnel. Work Study Programs that are non-paid programs can be coordinated between the agency and the learning institution.</p>

Expert Interviews	
Definition	Expert interviews are sessions where one or more people who are considered experts in a particular subject, program, process, policy, etc., meet with others to share their knowledge. The format of the sessions can range from an informal one-on-one meeting to a larger group session with a panel of experts. Sessions can be audio or videotaped or even transcribed if the subject is highly technical. The experts can come from within an organization or from the outside.
Benefits	Expert interviews are a way of making tacit knowledge more explicit. A person can describe not only what was done but why, providing context and explaining the judgment behind the action. <i>Interviews are often easier for the experts than having them write down all the details and nuances.</i> Learners can ask questions and probe more deeply to ensure understanding.
When to Use	Expert interviews can be used in many situations. The best place to begin is with people who have unique knowledge developed over a period of time. The next step might be to identify mission critical processes or programs where only one or two staff has a high level of technical knowledge.
How to Use	<p>This process is probably most effective when someone facilitates the experience, setting the stage with participants, facilitating the exchange of any information prior to the interview, and handling scheduling or other logistics.</p> <p>Identify the people and knowledge you want to start with, both the experts and the learners. Discuss with the experts the reasons for the interviews, who will be involved, and what you would like to focus on. If the learner needs to prepare for the session, the expert can identify how to do this and what resource materials would be helpful. It is also essential to ask the learners what they think they would like to know from the experts. If they have specific questions, provide these to the expert in advance so he or she can be prepared.</p> <p>If the session is more formal, with larger numbers of experts and learners, a facilitator can help keep the session focused and on time. If the interview is a one-on-one meeting, a facilitator is probably not needed. If audio or videotaping, arrangements should be made in advance and equipment tested to ensure both experts and learners can be heard on tape.</p>
Obstacles	Making time for these sessions is probably the biggest challenge for both the experts and the learners. If the session is more formal with a large

	group of learners, some may be intimidated and need coaching.
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Job Aids	
Definition	<p>A job aid can take many forms, but basically it is a document that has information or instruction on how to perform a task. It guides the user to do the task correctly and is used while performing the task, when the person needs to know the procedure.</p> <p>A job aid can be as simple as a sticker on an answering machine that describes how to access messages. Types of job aids include:</p> <ul style="list-style-type: none"> • Step-by-step narratives or worksheets sequencing a process. • Checklists, which might show items to be considered when planning or evaluating. • Flow charts, leading the user through a process and assisting the user to make decisions and complete tasks based on a set of conditions. • Reference resources, such as a parts catalog or telephone listing.
Benefits	<p>Job aids are usually inexpensive to create and easy to revise. Using job aids can eliminate the need for employees to memorize tedious or complex processes and procedures. When a job aid is easy to access, it can help increase productivity and reduce error rates.</p>
When to Use	<p>Consult with knowledgeable users to identify what job aids to develop. Create job aids that include only the steps or information required by the user. Keep the information and language simple, using short words and sentences. Don't include background information or other information extraneous to actual performance of the task; put that in another location. Use graphics or drawings, when appropriate, to more clearly demonstrate detail.</p> <p>Use bold or italicized text to highlight important points. Use colors to code different procedures or parts of a process. Make sure the job aid can be easily accessed and is sturdy. A laminated wall chart hung near where a task is performed can be consulted more quickly than a piece of paper stored in a file.</p>
How to Use	<p>Job aids are most appropriate for tasks that an employee does not perform frequently, or for complex tasks. Tasks with many steps that are difficult to remember, or tasks that, if not performed correctly cause high costs, can benefit from having readily accessible job aids. Also, if a task</p>

	<p>changes frequently, a job aid would save time and reduce the chance for errors.</p> <p>Job aids can be a good supplement to classroom training. Users can learn tasks in a classroom but will likely need something to rely on when on the job.</p>
<i>Obstacles</i>	<p>Job aids need to be written clearly and concisely, with nothing left to interpretation. They also need to be updated and kept current. Finding the time to create job aids can be a challenge; however, creation of good job aids produces benefits over the long term.</p> <p>Resources</p> <p>Russell, Susan, "Create Effective Job Aids," American Society for Training & Development Info-Line, Issue 9711, November 1997.</p> <p>Willmore, Joe, "Job Aids Basics," American Society for Training & Development Training Basics Series, 2006.</p>

Knowledge Fairs	
<i>Definition</i>	The Knowledge Fair is an event designed to showcase information about an organization or a topic. It can be organized in many ways using speakers, demonstrations, or more commonly, booths displaying information of interest to the attendees.
<i>Benefits</i>	<p>A large amount of information can be made available and attendees can focus specifically on what they are interested in learning. Attendees can interact directly with the presenters, getting immediate answers to their specific questions. They also can establish contacts for further exploration of topics if needed.</p> <p>Attendees often network with one another and booth developers' often strengthen their teamwork. Knowledge fairs also provide opportunities to draw attention to best practices and recognize employee and team achievements.</p>
<i>When to Use</i>	Consider a knowledge fair when there is a lot of information to share with a lot of people and participants need a broader perspective, as well as an opportunity to interact on a one-on-one basis on specific topics. A knowledge fair is an alternative to traditional presentations when more interactive experiences are desirable
<i>Obstacles</i>	Depending on the scope and size of the event, it can require a large amount of staff time for creating booths, putting information together to display, and for organization and logistics. The costs for space, materials, and resources can be high. The potential exists for participants to become overwhelmed with information.

Learning Games	
Definition	<p>A game is a type of structured learning activity used to make learning fun. It can provide a review of material that has been presented to strengthen the learning or evaluate how much learning has occurred. Games can also be used to:</p> <ul style="list-style-type: none"> • Help people prepare for learning by testing current levels of knowledge. • Apply a newly learned skill. • Learn as they play the game. • Practice what has been presented to reinforce the learning.
Benefits	<p>Games improve knowledge transfer by:</p> <ul style="list-style-type: none"> • Increasing participation among all involved. • Improving the learning process by creating an environment where people's creativity and intelligence are engaged. • De-stressing learning by making it fun. • Addressing the different ways in which people best learn. • Adding variety to a training program, which helps to keep people actively involved.
When to Use	<p>Games are usually used in conjunction with other learning methodologies, such as presentations and discussions. Using learning games depends on the learning you are trying to convey and whether games will help you meet your learning objectives. Games used at the beginning of a program can measure existing knowledge and build immediate interest in the training material. Games used during a program can help people discover the learning themselves (strengthens recall and commitment), practice using new knowledge or skills, or reinforce initial learning. Games used near the end of a program can test knowledge gained and people's ability to apply it in their work settings</p>
How to Use	<p>For games to be effective, they must:</p> <ol style="list-style-type: none"> 1. Be related to the workplace by providing knowledge, reinforcing attitudes, and initiating action that is important to job success. 2. Teach people how to think, access information, react, understand, and create value for themselves and their organizations. 3. Be enjoyable and engaging without being overly simplistic or silly. 4. Allow for collaboration between learners. 5. Be challenging yet attainable. 6. Permit time for reflection, feedback, dialog, and integration. In other words, games should be debriefed. <p>Examples of games:</p>

	<ul style="list-style-type: none"> • Quizzes • Scavenger hunts • Quiz show games, including those modeled on television game shows such as Jeopardy or Family Feud • "Name that" games • Sports-related games • 20 questions
<i>Obstacles</i>	<p>There are two major obstacles to learning games:</p> <ol style="list-style-type: none"> 1. When games are used as an end in themselves and not a means towards an end, they waste time and can hamper learning. 2. Using too many games can destroy learning effectiveness. <p>Resources</p> <p>Meier, Dave, The Accelerated Learning Handbook: A Creative Guide to Designing and Delivering Faster, More Effective Training Programs, McGraw-Hill, New York, 2000.</p> <p>Scannell, E. E. & Newstrom, J. W., The Complete Games Trainers Play, McGraw-Hill, 1995</p>

Mentoring	
Definition	<p>Mentoring is a process by which the mentor and protégé work together to discover and develop the protégé's knowledge, skills, and abilities, usually in a particular area. The mentor acts as a teacher, coach and advisor, offering knowledge, wisdom, insight, or perspective that is especially useful to the protégé's personal and professional development.</p> <p>In addition to formal mentoring programs, mentoring also occurs in organizations on an informal basis – through a supervisor's daily contact with staff; through interactions with peers; and, through observation of someone who has succeeded in an area where we wish to excel. In some instances, we are the mentor, helping to guide others, and in some we are the protégé, learning from those around us. So, in addition to formal mentoring programs, there are ample opportunities in the workplace to mentor and be mentored on an informal basis.</p>
Benefits	<p>The organizational benefits of mentoring extend to the protégé, the mentor, and the organization itself.</p> <p>The benefits to the protégé are numerous: mentoring contributes to a protégé's personal growth, professional maturity, career development, and leadership/managerial skills.</p> <p>The benefits to the mentor are just as significant. Being a mentor can contribute to the mentor's own personal and professional growth. As the mentor coaches and guides the protégé, he or she stays focused on the skills, characteristics, and styles that are valued by the organization and needed to succeed. Being a mentor also identifies you as someone of professional distinction who can serve as an example and role model for others. A mentor can also learn from the protégés knowledge and questions.</p>
When to Use	<p>Mentoring can be effective when:</p> <ul style="list-style-type: none"> • There is a need for deliberate, systematic knowledge transfer • You want to create and reinforce a positive organizational culture • When there is a need for methods of providing job specific knowledge and insight for those positions requiring experience, judgment, discretion and “soft skills” in order to be effective • You want to create opportunities to shape the workforce of the future in an intentional, deliberate way to meet the agency's

	<p>strategic goals and objectives</p> <ul style="list-style-type: none"> • You want to provide structured learning for employees assuming new or expanded responsibilities • You need identification of talent and development of organizational leadership
<i>How to Use</i>	<p>Mentor Responsibilities:</p> <ul style="list-style-type: none"> • Serve as guide and facilitator of growth • Share critical knowledge and experience • Set expectations for success • Offer wise counsel • Provide information and resources • Identify role requirements, organizational imperatives, professional demands • Correct mistakes, demonstrate techniques • Assist in mapping career plan • Provide challenge and validation • Build self-confidence, self-esteem, strengthen motivation • Listen to personal and professional challenges • Offer guidance, give feedback and cheer accomplishments • Discuss and facilitate opportunities for new experiences and skill building tasks associated with the mentoring relationship • Meet with primary protégé to discuss progress • Meet with other mentors discussing all protégés progress <p>Protégés Responsibilities</p> <p>The mentoring relationship requires commitment and shared responsibility for the person being mentored also. The partner should discuss mutual roles and responsibilities at the beginning of the relationship and review them periodically as necessary.</p> <ul style="list-style-type: none"> • Establish and clearly define personal employment goals • Take and follow through on directions given • Accept and appreciate mentoring assistance • Listen and learn – experiences shared • Express appreciation • Be assertive – ask good questions • Ask for help/advice when needed • Share credit for a job well done with other team members • Respect the mentor's time and agency responsibilities • Effort and hard work – strive for excellence • Take the initiative • Commitment • Critically self-evaluate • Disclose frustrations and concerns • Honesty

	<ul style="list-style-type: none"> • Help others <p>Mentoring is an effective planning strategy that benefits the organization in numerous ways. Mentoring programs can be valuable tools in recruitment, retention, knowledge transfer, and workforce development. Mentoring can also contribute to the promotion of diversity in an organization.</p> <p>In summary, mentoring programs offer a relatively low-cost opportunity to serve the needs of the protégé, the mentor, and the organization as a whole. Many studies have supported the benefits of mentoring programs.</p> <ul style="list-style-type: none"> •
Obstacles	<p>Resources such as staff, oversight and record keeping can involve substantial time.</p> <p>Not every seasoned employee is capable of being a mentor.</p> <p>Resources</p> <ul style="list-style-type: none"> • Anonymous, "How to be an Effective Mentor," For Achievers Only, June 1998, p. 8-9. • Barbian, Jeff. "The Road Best Traveled," Training, May 2002, p. 38 - 42. • Bell, Chip R. Managers as Mentors: Building Partnerships for Learning. San Francisco: Berrett-Koehler Publishers, Inc., 1998. • Daugherty, Duane. "Wanted: A Mentor to Advance Your Career," Supervisory Management, January 1995, p. 4-5. • Kaye, Beverly, and Jacobson, Betsy. "Reframing Mentoring," Training & Development, August 1996, p. 44-47. • Kizilos, Peter. "Take My Mentor, Please!" Training, April 1990, p. 49-54. • "Mentoring: Facilitator's Guide and Participant's Workbook," developed by Brainstorm Dynamics, Inc. • Murray, Margo. Beyond the Myths and Magic of Mentoring: How to Facilitate an Effective Mentoring Process, San Francisco: Jossey-Bass Inc., 2001. • Peters, Helen. "Peer Coaching for Executives," Training & Development, March 1996, p. 30-41. • Shea, Gordon F. Mentoring, Menlo Park, CA: Crisp Publications, Inc., 2002. <p>The Public Management Institute (PMI) Guide Part 3 - Mentor Guide</p>

On-the-Job Training (OJT)

Definition	On-the-job training is any kind of instruction that takes place at the actual job site and involves learning tasks, skills, or procedures in a hands-on manner. It can be informal, such as when a person asks a co-worker to show how to perform a task, or part of a more formal structured OJT system. If part of a structured system, there are usually prescribed procedures for training that specify the tasks and skills to be learned and the sequence of activities to build on knowledge already acquired. There are also administrative processes requiring both trainer (sometimes called a coach) and trainee to certify that a particular task or skill has been mastered. Structured OJT is usually more effective than informal; however, informal can also be valuable.
Benefits	On-the-job training can be very effective because someone skilled in performing the tasks does the training (the coach). With training done on the actual job site, it may not reduce productivity as much as taking a person off site to a classroom setting. The cost is usually the coach's and employee's time. If a more structured approach is being taken, there are costs associated with training coaches and developing checklists and other materials. However, those costs can be amortized over time and over the number of trainees who use them.
When to Use	Consider the following when deciding whether to use structured OJT: <ul style="list-style-type: none"> • When equipment and/or materials needed to perform the job are not replicable in a classroom environment. • When instruction needs to take place in small chunks so that taking the person away from the job site is not an efficient use of time. • When the number of people needing instruction is too small to efficiently organize a classroom session. • When showing someone how to do something using real work is the most effective way of teaching.
How to Use	One-on-one training should not be presented in a vacuum, but as part of an overall training program that might include some classroom instruction, job aids (e.g., check lists –See Job Aids), manuals, and demonstrations. A. Preparation <ul style="list-style-type: none"> • Analyze the job to figure out the best way to teach • Make a list of the tasks and associated knowledge and skills

	<ul style="list-style-type: none"> • Break the job tasks into steps and note the key factors that relate to each step <p>B. Present the process</p> <ul style="list-style-type: none"> • Put the employee at ease • Find out what the employee already knows about the job • Tell the employee the importance of the job or task and how it fits into the larger picture of what the employee does • Show the employee how to perform the task and describe what you are doing • Stress the key points and use appropriate job aids • Completely instruct one point at a time, at a rate slow enough for the employee to understand <p>C. Test the performance</p> <ul style="list-style-type: none"> • Have the employee perform the job while you observe • Have the employee show you how he or she does each step of the job and describe what is being done • Ask questions and offer advice • Continue until you are satisfied that the employee knows the job or task [s] <p>D. Follow up</p> <ul style="list-style-type: none"> • Tell the employee who to go to for help • Check on the employee as often as you feel necessary • Encourage questions • Have employee perform independently with normal supervision
Obstacles	<p>Sometimes informal OJT can be a problem if the training objectives are not clearly stated and understood. If the training is presented in an off-the-cuff manner, it might not be taken seriously enough. Also if the person doing the training is not adequately prepared, the training could be confusing and the time wasted.</p> <p>Resources</p> <p>Levine, Charles I., “On-the –Job Training”, American Society of Training and Development Info-line, Issue #9708, August 1997.</p>

Storytelling

Definition	<p>Storytelling uses anecdotal examples to illustrate a point and effectively transfer knowledge. There are two types:</p> <ul style="list-style-type: none"> • Organizational stories (business anecdotes) are narratives of management or employee actions, employee interactions, or other intra-organizational events that are communicated within the organization, either formally or informally. • Future scenarios create a future vision for the enterprise that describes how life will be different once a particular initiative, change, etc. is fully implemented. They provide a qualitative way of describing the value of the initiative even before it starts.
Benefits	<ul style="list-style-type: none"> • Stories capture context, which gives them meaning and makes them powerful. • We are used to stories. They are natural, easy, entertaining, and energizing. • Stories help us make sense of things. They can help us understand complexity and assist us in seeing our organizations and ourselves in a different light. • Stories are easy to remember. People will remember a story more easily than a recitation of facts. • Stories are non-adversarial and non-hierarchical. • Stories engage our feelings and our minds and are, therefore, more powerful than using logic alone. They complement abstract analysis. • Stories help listeners see similarities with their own backgrounds, contexts, fields of experience, etc., and, therefore, help them to see the relevancy of their own situations. • Stories can be a powerful transformational tool. Stories of transformation were coined "springboard stories" by Stephen Denning.
When to Use	<p>Stories are seldom used alone, but rather they are combined with other approaches such as quantitative analysis, best practices, knowledge audits, etc. They impart meaning and context to ideas, facts, and other kinds of knowledge derived from other knowledge management tools. Stories can be used to support decision making, aid communications, engage buy-in, or market an idea or approach. If being used to illustrate the value of a way of thinking, or explaining an idea, they are best used at</p>

	the outset, to engage the listener and generate buy-in.
<i>How to Use</i>	<p>In using storytelling, the message, plot, and characters must be considered. Determine what underlying message is to be conveyed (examples: importance of organizational goals, impact on an individual of a change effort, end-benefits associated with a change effort, how a process works, and so on). How does the story illustrate the underlying message (plot)? Who was involved in the story (characters)?</p> <p>Think about the audience for the story. To whom is the story aimed? What will each audience listening to the story do with the story's message? What message will be told to each audience? How do we tell each desired story?</p> <p>Four different structures for using stories have been developed (from The Springboard, by Stephen Denning):</p> <ul style="list-style-type: none"> • Open with the springboard story, and then draw out its implications. • Tell a succession of stories. The telling of multiple stories can help enhance the chances that the audience will co-create the follow-up. Two examples: You want to describe the benefits of a proposed change effort. Tell a story that only partly serves your purpose, and then extrapolate with an anecdote (e.g., a future scenario) that describes how the story will play out when the change effort is fully in place. Or, tell a series of related stories that, taken together, illustrate various ways in which the change effort is leading to payoffs for colleagues. • Accentuate the problem. Start with describing the nature of a problem, tell the story, and draw out the implications. • Simply tell the story. This is useful when time is very limited and you want to plant a seed. <p>The story should:</p> <ul style="list-style-type: none"> • Be relatively brief and have only enough detail for the audience to understand it. Too much detail and the listener gets caught up in the explicit story and not its message. • Be intelligible to a specific audience so it hooks them. It must be relevant to them. • Be inherently interesting, maybe because the problem presented is difficult, the "old" way of resolving the problem won't work, there is tension between characters in the story, there are unexpected events, or an element of strangeness exists. • Embody the idea you are trying to convey and provide an easy mental leap from the "facts" of the story to its underlying message. • Have a positive ending, to avoid people being caught up in a negative, skeptical frame of mind. • Have an implicit change message, especially if the audience is

	<p>skeptical or resistant, since the audience can then discover the change message on their own and, therefore, make it their own idea.</p> <ul style="list-style-type: none"> • Feature a protagonist with which the audience can identify. • Deal with a specific individual or organization. • Have a protagonist who is typical of the organization and its main business. <p>True stories are generally more powerful than invented stories, and can serve as jumping off points for future scenario stories. Stories should be tested on individuals or small groups before being tried on large groups or in high-risk settings.</p> <p>The stories must be simple, brief, and concise. They should represent the perspective of one or two people in a situation typical of the organization's business, so that the explicit story is familiar to the audience. Similarly, the story should be plausible; it must ring true for the listener. It needs to be alive and exciting, not vague and abstract. By containing a strange or incongruous aspect, the listener can be helped to visualize a new way of thinking or behaving. Stories, therefore, should be used to help listeners extrapolate from the narrative to their own situations.</p> <p>Finally, storytellers must believe in the story (own it) and tell it with conviction. Otherwise, the audience will not accept it.</p>
<i>Obstacles</i>	<p>Stories are only as good as the underlying idea being conveyed. Since stories are usually orally presented, the person telling the story must have good presentation skills.</p> <p>Resources</p> <p>Denning, Stephen, <i>The Springboard: How Storytelling Ignites Action in Knowledge-Era Organizations</i>, Butterworth-Heinemann, Woburn, MA, 2001.</p> <p>Poage, James L., "Designing Performance Measures to Tell a Story: Applying Knowledge Management Principles," presented to the Federal CIO Council, Knowledge Management Working Group, November 1, 2000.</p>

Training	
<i>Definition</i>	Training encompasses a large variety of activities designed to facilitate learning (of knowledge, skills, and abilities or competencies) by those being trained. Methodologies can include: classroom instruction, simulations, role-plays, computer or web-based instruction, small and large group exercises, and more. It can be instructor-led or self-directed in nature.
<i>Benefits</i>	Training provides the ability to address multiple participants at one time in a structured environment. Training can provide the transmission of consistent information allowing employees to come away with the same skills/knowledge. Training may be conducted in a self-paced environment or through distance learning. (If instructor-led, participants may benefit through other attendees experiences or expertise.)
<i>When to Use</i>	Train multiple participants at the same time with the same information. Information/skills can be replicated (practiced) on the job.
<i>How to Use</i>	
<i>Obstacles</i>	Several obstacles may include time spent away from job, cost, travel, etc. Participants may not have opportunity to ask questions or achieve a high-level of confidence in skills learned, or no real work related (on the job) practice.



Addendum #1

Using a Knowledge Loss Risk Assessment [Metrics] to Identify Positions Key to Organizational Goals and Objectives

Note: This format is for organizations or individuals seeking a metrics [numerical] format for decision making. Some organizations or individuals may not find this format necessary or helpful.

Management must identify positions that are key to its business goals and objectives. A key position is not necessarily determined by the location of the position on an organizational chart, **but rather by its influence on the organization's performance**. The same jobs can exist in different offices and not have the same levels of importance.

Sometimes a particular type of job plays a key role within an organization. There may be several positions in that role (e.g., Correctional Officers), but they are not all "key positions." In such cases, a combination of position attributes *and* critical employee knowledge and skills is the deciding criterion that makes a position "key." This is the difference between a "key role" and a "key position".

Once key positions are identified, employees who possess knowledge that is both crucial and unique to those positions should be identified. The manager should make extensive

efforts to retain those employees' knowledge through application of appropriate knowledge practices identified earlier in this model.

A. Tips for Identifying Key Positions: Below is a list of criteria to assist in identifying key positions.

- Mission critical tasks are activities, if left undone, will result in an adverse effect on the accomplishment of organizational and unit goals and objectives.
- Unique expertise is crucial knowledge or expertise that is inherent to the position. If possessed by the incumbent, this places that person in a technical leadership position
- Organizational fit describes the position's area of responsibility and its importance to the overall organizational structure.
- Strategic location is determined on a job-by-job basis. In one location a position may be "key", but in another, it may not.
- Decision-making responsibilities are assessed based on the position's role as a part of the decision-making process, or how it frees others to make critical decisions.

The above list of criteria is adapted from the State of [New York's Succession Planning Criteria for a Key Position](#) program.

Once key positions and employees have been identified, assessments of their criticality should be conducted to assist management in focusing on the most significant knowledge issues. Guidelines for conducting a Knowledge Loss Risk Assessment are described below:

B. Position Risk Factor: Apply a rating scale of 1 - 5 (as identified below) to the position being assessed to estimate the level of difficulty involved in replacing the incumbent in the position. The value assigned is the "position risk factor" and helps management assess the overall attrition risk. The following lists of evaluative criterion were adapted from the [Tennessee Valley Authority's \(TVA\) Knowledge Retention](#) Program:

- 5 – Critical and unique knowledge or skills. This is mission-critical knowledge, agency- or unit-specific knowledge that is undocumented and requires three to five years of experience to bring skills to journey level. No skilled replacement is available to move into the position.
- 4 – Critical knowledge and skills. The knowledge and skills are mission-critical. Limited duplication exists in other positions/units or divisions, and only limited documentation exists

to guide employee moving into this position. It requires two to four years of focused training and experience.

- 3 – Important organizational knowledge and skills. Documentation exists for the knowledge and skills and/or other personnel on site possess the knowledge/skills necessary to be successful in these positions. Applicants can generally be trained in one to two years.
- 2 – Procedural or Non-Mission-Critical knowledge and skills. Clear, up-to-date procedures exist. Training programs in place are current and effective. Training can be completed in less than one year.
- 1 – Common knowledge and skills. External hires possessing the knowledge/skills are readily available and require little additional training.

C. Retirement/Departure Factor: Apply a rating scale of 1 - 5 (as described below) to estimate the timing and probability of the incumbent retiring or leaving the key position.

Attrition data can be gathered at least two ways at present: A manager's survey of employee population to get an estimate of probable retirement dates, or manager's awareness of the career paths of their staff (are some employees looking to advance their careers by moving on to another job, or might some be less than happy in their current job?)

- 5 – Projected attrition date within one year
- 4 – Projected attrition date within one to two years
- 3 – Projected attrition date within two to three years
- 2 – Projected attrition date within three to five years
- 1 – Projected attrition date is more than five years

The two parts to this exercise will give managers a starting point in taking charge of retaining critical knowledge and preventing its loss in their work unit. The focus should be on positions that really are critical, where knowledge loss would present the greatest threat to the success of the work unit

Once the critical knowledge has been identified, it can be prioritized according to the level of importance and effort required to replace it if lost.

The projected attrition dates add the dimension of urgency to the situation. Managers can make an assessment as to how quickly they must apply a solution to stop the leakage of intellectual capital from their unit and the organization.

The total attrition factor will help managers determine the level of urgency, the amount of effort that might be required, and the options available to mitigate the impending knowledge loss. To calculate the overall attrition risk factor for the position, a simple calculation is done:

$$\text{Position Risk Factor (PRF)} \times \text{Retirement/Departure Factor (RDF)} \\ = \text{Total Attrition Factor (TAF)}$$

To further give value to the Total Attrition Factor, a weighting scale is described below:

- 20 – 25: High Priority and Immediate Action Needed

Action plan with due dates should be developed to include the method of knowledge transfer and specific training required.

- 16 – 19: Priority with Candidate Development Planning Needed

Planning should include method and timing of replacement, recruitment efforts and the method by which knowledge will be transferred.

- 10 – 15: High Importance

Assess how position will be filled in the future.

- 1 – 9: Important

Recognize the functions of the position and determine the transfer timing and methods.

Once a Total Attrition Factor has been assigned, a manager can then create a report revealing all the ‘hot spots’ for the work unit relative to loss of critical knowledge.

From such a report, a plan can be devised for controlling or mitigating the adverse effects of impending loss of hard-to-replace knowledge. See the Risk Assessment Work Sheet on the next page.

Risk Assessment Worksheet -Sample

Dept. Name	Job Title	Incumbent	Anticipated Retirement Date	Source: Employee, Estimated Date or Other	Retirement Factor	Position Risk Factor	Total Attrition Factor	Risk Level
DOT/Eng.	Senior Design Engineer	John Doe	4/1/09	Employee	5	X 5 =	25	A
DOT/Eng.	Admin. Asst. to Director	Linda Sue	6/10/14	Survey	2	X 3 =	6	D

Score Rating & Risk Level Legend:

A	20 – 25 = High Priority, immediate action needed
B	16 – 19 = Priority; staffing plans should be established
C	10 – 15 = High Importance; look ahead to how the position will be filled or the work accomplished
D	1 - 9 = Important; intermediate succession planning triggered

Adapted from the TVA's Knowledge Retention Program.

Resources

- Commonwealth of Kentucky, Personnel Cabinet, Governmental Services Center
- North Carolina State, Office of State Personnel, Workforce Development
- New York State, Department of Civil Services, Governor's Office of Employee Relations, Workforce and Succession Planning – Tools & Resources.
<http://www.cs.state.ny.us/successionplanning/resources/index>
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- Hartz, Cynthia, et.al., Measurement for Knowledge Management, American Productivity and Quality Center Organization, February 2001.
- Knowledge management Working Group of the Federal Chief Information Officers Council. Managing Knowledge @ Work: An Overview of Knowledge management, August 2001.
- Levine, Charles I., "On-the-Job Training," American Society for Training & Development Info-Line, Issue 9708, August 1997.
- Meier, Dave, The Accelerated Learning Handbook: A Creative Guide to Designing and Delivering Faster, More Effective Training Programs, McGraw-Hill, New York, 2000.
- O'Dell, Carla S., et.al., If Only We Knew What We Know: The Transfer of Internal Knowledge and Best Practice, The Free Press, New York, 1998.
- Plunkett, Patrick T., Managing Knowledge @ Work: An Overview of Knowledge Management, Knowledge management Working Group of the Federal Chief Information Officers Council, August 2001. r
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<<http://www.km.gov/documents/measures/measures.ppt>>
- Russell, Susan, "Create Effective Job Aids," American Society for Training & Development Info-line, Issue 9711, November 1997. Governmental Services Center

- Wenger, Etienne C, and William M. Snyder, "Communities of Practice: The Organizational Frontier," Harvard Business Review, January? February 2000, p. 139/145.
- <http://www.km.gov/> (Website of the Federal Chief Information Officers Council, Knowledge management Working Group, containing lots of useful resources.)

Appendix D

Homepage from SDC (Swiss Agency for Development and Cooperation)
Knowledge Management Tools, plus pages for selected tools

(taken from Swiss Agency for Development and Cooperation (SDC) (2009). "SDC
Knowledge Management Tools" [http://www.sdc-
leamingandnetworking.ch/en/Home/SDC KM Tools](http://www.sdc-leamingandnetworking.ch/en/Home/SDC_KM_Tools))

See also [http://www.sdc-leamingandnetworking.ch/media/SDC-KM-
Toolkit/Vademecum_englisch%5B1%5D.pdf](http://www.sdc-leamingandnetworking.ch/media/SDC-KM-Toolkit/Vademecum_englisch%5B1%5D.pdf) for a small pocket guide with two-
page descriptions of 22 tools based on this website.

Learning and Networking

You are here: » [Home](#) » **SOC KM Tools**

SOC Knowledge Management Tools

The aim of this page is to help people in getting familiar with a variety of methods and tools for planning and reflection of their own activities, for drawing lessons and for sharing insights and applying them. It features a selection of more than 20 **methods and tools for knowledge sharing and learning**, from basic to more advanced tools, applicable at personal, team and organisational level.

See the table below for the different tools and methods. The links lead you to a short individual description as well as links to additional documents.

For the SOC KM toolkit in [German](#), [French](#), [English](#) and [Spanish](#) see the publications section below.



KM IOOL.S

Individual Descriptions of the Tools

Tool	Group Size	Moment P: Preparation A: Action R: Reflection	Level B: Basic I: Intermediate A: Advanced
After Action Review	T		R B
Balanced Scorecard		O A	A
Brainstorming	T	P A R	B
Briefing und Debriefing		P A R	B
Collegial Coaching	T	P	B
Community of Practice	T	O A	A
Exit Interviews	T	O	R
Experience Capitalization		O	R
Experience Documentation	T	O	R
Good Practice	T	O A R	
Group Facilitation	T	A	

Knowledge Fair		O	P	A		A
Knowledge Map	T	O	P	A		
Knowledge Network	T	O	P	A		
Lessons Learnt	T	O			R	B
Mentoring		O	P	A		
Open Space	T	O	P	A		A
Peer Assist / Peer Review	T	O	P	A	R	A
Ritual Dissent	T		P	A	R	
Storytelling	T	O		A	R	
SWOT	T		P	A	R	B
Visualisation	T		P	A		B
World Cafe		O	P	A		A
Yellow Pages	T	O	P	A	R	A

Descriptions of selected methods are also available in the form of the following publications- download them with the links below or order print versions at wlp@deza.admin.ch.

- **Vademecum** - a handy, small pocket guide with a short 2-page description of 22 tools. Available in four languages as download ([english/french/german/spanish](#)) and print version.
- **Flyer** - A4 format, 7 pages, 2-4 methods on one page, only in web format. ([english/french/german/spanish](#))
- **Comprehensive Brochure** - Full text version, 126 pages, with additional explanations. Available as download and in print. Only in [English](#).

In addition to these KM tools you find here some underlying concepts linked to learning processes in organisations:

- **Capacity Development:** a key concept in SOC for working with strategic partners and developing their capacities in order to contribute to social and structural change in partner countries.
- **Scaling-up and Replication:** Learning from efforts and building on successes: Scaling-up and replication are key strategic elements to ensure sustainability of investment through working on different societal levels and/or in different, comparable contexts.

[Click here](#) for links to learning and knowledge-sharing toolkits of other organisations we consider useful.

Learning and Networking

You are here: » [Home](#) » [SOC KM Tools](#) » **Community of Practice**



Communities of Practice (CoP)

A CoP is a network of people with a common interest or problem in a specific area of competence and who are willing to work together for a given time to learn, develop and share that knowledge.

Six essential aspects of a successful CoP

- Strong **community** – a group of (more or less) active members with a lively interest for the CoP and its topics and who give it priority. Member pool is often fluctuating not stable.
- Clear and well-defined **domain** -there is a specific thematic orientation; the domain is relevant and meaningful to members.
- Link to own **practice**- members are active in the given domain. Shared experiences, concepts and strategies spring from and are being tested against the individual reality of practice.
- Personal **motivation** – membership is voluntary and based on personal interest.
- **Mandate**- the involved organization(s) defines and is interested in the given thematic focus and has an interest in a concrete outcome. Commitment of members is supported by providing necessary working time and resources.
- **Informal structure** – goes beyond organizational boxes and lines, often combining horizontal and diagonal links. It makes a link between units within and/or between the organization(s).

Networks and Communities of Practice (CoPs) are both specific forms of cooperation. Whereas networks represent

interests, agendas and resources of organizations, CoPs are more driven by individuals and their personal priorities. CoPs are involving a sense of common identity and purpose, a sense of belonging; networks are more topic- and interest-oriented forms.

CoPs may develop into networks and vice versa. The CoP & Network dynamism represents the formalization or institutionalization of an "informal" initiative. The Network & CoP dynamism represents the need to leave organizational logics and procedures in order e.g. to be creative and innovative.

Important

- Ensure that key stakeholders are members; balance giving and taking.
- Strive for most practical and tangible outputs/outcomes; disseminate them widely.
- Carefully select how to "be connected" – balance and combine face to face meetings with other means.
- Combine informality with a basic set of rules for communication and collaboration.
- Ensure ownership within – cultivate and support the roles of manager, expert, facilitator. Adjust to changes in the environment.

More Information

- [Comprehensive Text about Communities of Practice \(CoP\)](#)
- [Experiences within SOC](#)
- [Community of Practice in brief \(business card size\)](#)
- [Calendar sheet as pdf file](#)

In addition to the SOC Knowledge Management Toolkit

Find more information about communities of practice:

- [What is a community of practice?](#)
- [Concepts on communities of practice](#)
- [Questions and answers](#)
- [Readings](#)
- [Examples](#)

Learning and Networking

Learning and Networking

You are here: » [Home](#) » [SOC KM Tools](#) » **Knowledge Map**



Knowledge Map

A knowledge map is a tool for presenting what knowledge resides where (e.g. people, media, organizational units or sources of knowledge outside the organisation) and for demonstrating the patterns of knowledge flow (access, distribution, learning). Knowledge mapping is the first step in creating an inventory of knowledge (i.e. the knowledge base) and developing/improving the processes of knowledge sharing. Its principal purpose and clearest benefit is to show people in an organization or within a network/supply chain very fast where to go when they need expertise. It also helps to understand what knowledge is essential or at risk to be lost and thus needs to be reused or "secured". Based on knowledge maps organizations can go about developing new models for improving knowledge sharing and knowledge flow and the fulfillment of their mission and goals. Knowledge maps can also help in organizing research activities and analyzing the related flow and impact of knowledge. The most common way of presenting a knowledge map is a simple graph with typically 60- 100 nodes representing knowledge repositories/sources and connections representing the flow of knowledge (in a physical or mental sense).

How to go about a Knowledge Map

1. In a series of interviews ask people to provide information about the (structure of) knowledge in the concerned domain (what is linked to each other, how)
2. Let them rate the importance for the company, the difficulty to replace it, whether it is acquired mainly from study or practice and the proportion of staff in the knowledge area who would also know about it.

3. Plot the results on a knowledge map.
 4. Analyze the knowledge map and integrate the results in a knowledge management strategy, keeping in mind that a knowledge map is a momentary snapshot and might change.
-

Experience with Knowledge Map

"We have been using Knowledge Mapping in Bolivia during my time in the CooF to map outstanding capacities of our partner organisations and their staff in fields relevant for development cooperation (www.cosude.org.bo ; gesti6n de conocimientos). The idea behind this mapping was to foster the access to skilled and experienced people within the SOC network. The CooF thus got a less central position in the knowledge sharing, but more the role of a knowledge broker. The knowledge map has also been used to identify lessons learned presented on the SOC Website."

Willi Graf, Senior Advisor NRM Division (2007)

More information

- [Comprehensive Text about Knowledge Map](#)
 - [Experience within SOC](#)
 - [Knowledge Map in brief \(business card size\)](#)
 - [Calendar sheet as pdf](#)
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Learning and Networking

Learning and Networking

You are here: » [Home](#) » [SDC KM Tools](#) » **Lessons Learnt**



Lessons Learnt

The formulation of lessons is the collection, validation, consolidation and finally documentation of experiences, developments, hints, mistakes and risks found during a project. Drawing lessons learnt makes sense at the end of any project, activity and work phase. Doing so not only gives credit to the efforts made it also leads to a valuable selection of information that can be useful in the planning and preparation of new endeavours. The analysis of a series of lessons learnt in a sequence of projects can yield ideas for improving the project management in an organization in general. Lessons learnt are drawn first and foremost at an individual level. In a team these (often diametrically different) individual lessons can be consolidated into lessons learnt of the team. Likewise lessons learnt of various teams can be consolidated and made useful for the whole organization.

How to go about it

1. Clarify a) for what area lessons learnt are to be drawn, b) who (else) could have an interest in these lessons.
2. Delineate the system boundaries (project, area of activity, action-learning).
3. Then formulate guiding questions corresponding to the above.
4. Collect (individual) answers to these questions and any other spontaneous idea.
5. Consolidate individual lessons into shared lessons (team, organization).
6. Describe the lessons learnt (and the surrounding setting) in an attractive and well-structured way
7. Make lessons learnt accessible to all interested persons.

Experience with Lessons Learnt

"The more one has been involved in an exercise, the more you feel like learning lessons. In my view, learning lessons is a natural human reflex. The amazing thing is to share in a team, what (often different) lessons we have learnt based on a common experience and to learn common lessons."

Geri Siegfried, Head of Controlling Division (2007)

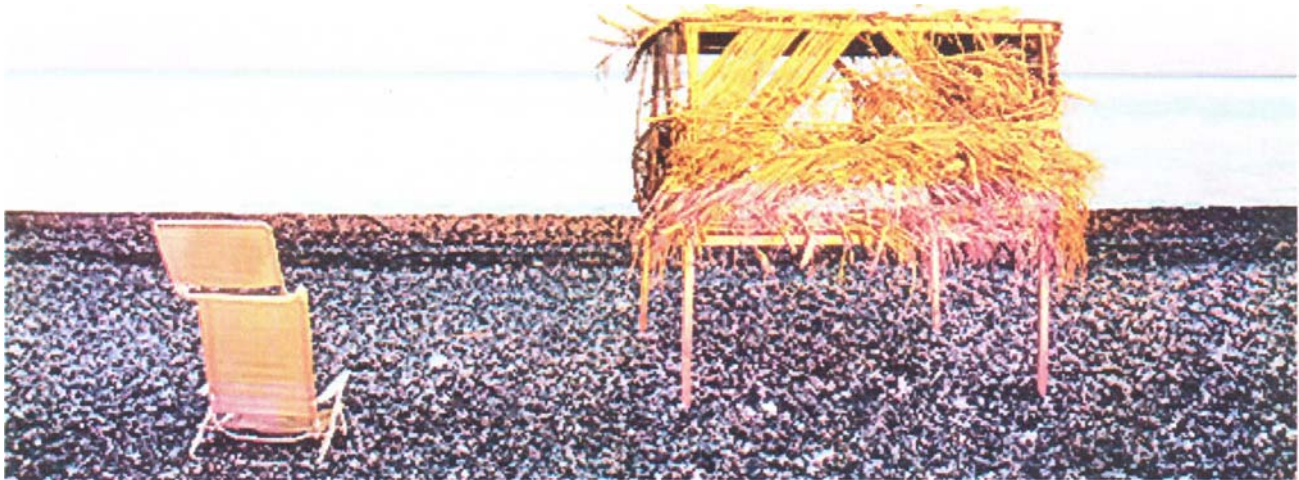
More Information

- [Experiences within SOC](#)
 - [Lessons Learnt in brief \(business card size\)](#)
 - [Calendar sheet as pdf file](#)
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Learning and Networking

Learning and Networking

You are here: » [Home](#) » [SOC KM Tools](#) » **Yellow Pages**



Yellow Pages

An organisational "yellow pages" is a tool to help people to find others in their organisation who have the knowledge and expertise they need for a particular task or project. It is like a staff directory including details about knowledge, skills, experience and interests. The "yellow pages" is electronic rather than paper-based, so that users can efficiently search information. "Yellow pages" are particularly beneficial in organisations that are over a certain size or that are spread around in different locations, and so people don't have the opportunity to get to know each other well. "Yellow pages" are helping organisations to 'know what they know'. They allow to find people and to get access to their tacit knowledge. A "yellow pages" is not necessarily aimed at those embarking on a major project or piece of work; often the greatest value comes from a multitude of simple ten-minute conversations in which people ask each other for a quick word of advice or a steer in the right direction.

How to go about it?

1. Be clear about your aims: What purpose will the yellow pages serve?
2. Create ownership with the people contributing to, and using, the system.
3. Balance formal with informal information. Personal information and a photograph help in building contacts.
4. Include name, job title, team, job description, current projects, professional qualifications, CV, areas of knowledge and expertise, areas of interest, key contacts (internal and external), membership of knowledge networks or CoPs, contact information.

5. Organise entries for ease of loading and retrieval.
 6. Keep it up-to-date.
 7. Encouraging use- make marketing efforts to create peoples curiosity.
-

Experience with Yellow Pages

"As with any working tool, be it even the Internet: Yellow Pages require an invitation to participate, an introduction, some sort of assistance to enter."

Manuel Flury, Head Knowledge Management SeNice (2007)

Additional information ...

- [Comprehensive text on Yellow Pages](#)
 - [Yellow Pages in brief \(credit card size\)](#)
 - [Calendar sheet as pdf file](#)
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Learning and Networking