

Engineering and Construction Expertise Transfusion: The U.S. Army Corps of Engineers’ Knowledge Management Program

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Abstract

Knowledge Management (KM) is the collection and transfusion of an organization’s critical information, skills, experience, and identity, held by senior individuals, to successor generations for action. A great deal of the technical expertise in the U.S. Army Corps of Engineers (USACE) has been departing through retirement of the most experienced employees over several years and continues to do so today. Without robust technical competency an organization as large as USACE cannot continue to perform design and construction functions effectively. This research study defines KM, reviews best practices from industry and assesses how USACE is performing at the working level. The research data obtained identified key needs and subsequent recommendations for additional efforts or improvements to existing initiatives. Data was collected through interviews of eight managers at a USACE District Office to make assessments and determine steps to be taken to ensure critical expertise is retained and mission execution continues effectively. This study found that at the working level the current KM program is primarily based on mentoring and informal communities of practice, and not in top down information systems based approaches. USACE would benefit greatly from reconciling different approaches, eliminating redundant items, and a coordinated approach at all levels of leadership to champion processes that work.

Keywords

Knowledge management, US Army Corp of Engineers, Project Management

1. Background

The technical expertise in the U.S. Army Corps of Engineers (USACE) have been departing through retirement of the most experienced employees over the last five years and continues to do so today. Without robust technical competency an organization as large as USACE cannot continue to function in its role effectively. Will USACE continue to be able to produce comprehensive design packages, procure and deliver high quality one of a kind facilities? Will USACE end up like other Federal Agencies that

have engineering organizations that cannot actually prepare design documents for a complete facility? These organizations can only specify requirements and then critique the work of the engineers and designers who struggle to meet the needs of clients whose primary objective is risk avoidance. Is USACE destined to become a hollow engineering and construction organization that lacks real design and construction management expertise? A Government Accountability Office (GAO) report dated April 30, 2008 titled “Older Workers” states the following:

“Like the nation’s workforce as a whole, the federal workforce is aging and ever larger proportions are nearing retirement eligibility. When they retire, these older, experienced workers may leave behind critical gaps in leadership, skills, and institutional knowledge. At the same time, the rate of growth for the pool of younger workers is declining, and by 2025 overall labor force growth is expected to be only one-fifth of what it is today and much less than the projected growth in the number of retirees.” (GAO, 2008, p. 1)

While the USACE was not specifically called out by GAO, anecdotal evidence suggests that we have been and continue to be in the same situation as the other agencies audited. The “USACE Human Capital Strategic Plan 2012 – 2017” identifies the same situation as GAO, highlighting an impending increase in retirement of talented employees which creates the need to ensure knowledge transfer is promoted. (USACE CEHR, 2012).

Research into this situation from Europe reveals similar issues. The Journal of European Industrial Training and many publications of the Institution of Engineering and Technology discuss the challenges faced in the United Kingdom and the European Union. Similar to the United States, as of the mid 2000’s a significant portion, as much as 20%, of Europe’s engineers and scientists were within five years of their retirement age. (McQuade et al., 2007) Europe and the United States are experiencing the reality that the younger workforce is not large enough to maintain the current size of the industry. While innovations in the tools engineers use will certainly make up some of the shortfall in workforce, the tools alone will not satisfy the expertise and experience gap. (Farr et al., 2004; Dychtwald, et al., 2004). The concept of Knowledge Management (KM) is most often used to define solutions for the issues highlighted above. A review of literature on KM yields various definitions from different industries and trades. For this study KM must be defined in terms of a method to preserve the knowledge of the senior experts before they depart an engineering and construction organization. The critical knowledge is a combination of intelligence and wisdom or in simpler words information and experience. In the E&C industry the experts know how to get things done because they have tried, failed and succeeded countless times. Preserving their knowledge means passing it on to the successors so that the organization continues to grow, building on the foundation laid by the predecessors.

It is now almost five years after the GAO report discussed above. What do workforces look like today? Did the projections of the report come true? What measures were taken in the area of knowledge management (KM), and what worked or did not work? Were temporary measures taken that have only delayed the inevitable? This research study will seek to investigate these and other questions in an effort to develop and propose solutions for USACE.

2. Aim, Objectives and Key Questions

The aim of this research is to define effective knowledge management strategies for USACE, and provide recommendations for program improvements and enhancements. This study will seek out best practices from within and outside of the engineering and construction industry worldwide, assess how USACE is

performing at the functional level and present guidelines in the form of tailored practices for implementation. Three primary objectives of this research study are:

1. Define KM and evaluate best practices applicable to USACE.
2. Analyze the demographics of the USACE workforce as it relates to technical expertise and assess the current USACE knowledge management program.
3. Develop guidelines for a USACE specific KM Program through the identification of new or improved practices for retaining the knowledge of retiring employees.

This study answers the following key questions:

1. Can USACE retain the technical expertise of retiring employees through a knowledge management program if the workforce continues to shrink and work continues to be outsourced?
2. What culture, roles and processes are needed to implement a successful KM program?
3. What common components and practices do successful KM programs share and how many of them exist within USACE?
4. If the KM program is lacking key components or is not implementing specific aspects effectively what steps can be taken to include or improve them?

3. Research Design

This study effort used a case study method with data collected through interviews of managers at a USACE District Office. The case study evaluated the USACE KM program in comparison to industry, identified positives and minuses and in turn prepared recommendations for more effective current and future programs. Accomplishing the study objectives required an assessment of the implementation effectiveness of KM at the working level within the Corps. Mission execution within USACE occurs at the District office level, where engineering, construction and operations personnel deliver facilities to the military and the nation. A targeted KM assessment had to be conducted based on data from the District office. Literature review identified a number of Headquarters (HQ) level goals, plans and procedures to implement an effective KM program throughout USACE. Collecting demographic data from a District office enabled a review of specific conditions against those identified in the high level planning documents prepared by HQ. Data from interviews of District office (Mobile district) managers best determined current culture, practices, software, and other activities that define the current KM program and its level of implementation.

3.1. Demographic Data

To perform a targeted assessment of the KM program the study used quantitative demographic data on the USACE workforce by sampling the Engineering Division of a District Office. Mobile District is a larger sized organization as far as the Corps is concerned, so the assumption was that it is a good case study for the rest of the Corps. Mobile performs civil works, military construction and support for other federal agencies, so it covers the full range of Corps Missions. The Division has four Branches and ten sections within them that constitute the full range of engineering services for the built environment.

3.2. Interviews

The organizational structure of the Corps places responsibility for knowledge management and succession planning primarily on middle and upper level managers. Assessing the current program and how to improve was done by learning from this group of individuals. The literature review only provided HQ sponsored academic approach to KM. Discussion with the practitioners was found to be very effective in understanding the implementation side. Interviews were qualitative and conducted in two phases the first being unstructured general guide format with two managers to refine the scope of the research. The second phase was semi-structured with standardized, open-end questions. Analysis of the qualitative data

for trends and commonalities established what KM practices are in use, how they are functioning and where shortcomings exist. The interview process took place in person with detailed notes taken to transcribe the discussion. The initial interviews with the first two managers covered only the following general topics for discussion. The interview was limited to approximately fifteen minutes with the intent of spending about five minutes on each the following: (1) The Definition of KM; (2) USACE KM Program; and (3) KM Challenges. Follow on interviews with the remaining managers used the standardized questions below. Time for the interviews was limited to thirty minutes with an additional ten minutes of flexible time for follow on discussion or questions.

1. Describe the size/function of the organization you manage?
2. How many people in your department are either recently retired (within 2 years) or are within 5 years of retirement?
3. Can you gauge the level of awareness of HQ, and division level KM initiatives like COPs, SharePoint Sites, WBDG, Technical Excellence Network (TEN), Dr. Checks, Rehired Annuitant Programs, Mentoring or other KM tools?
4. What are some successful ways your department implements KM?
5. What are the greatest challenges to KM in your department?
6. What do you envision your department will look like from a demographic and experience perspective in 5-10 years?

3.3. Details about interviewees

USACE Districts are organized into Divisions, Branches and Sections that can range widely in number of employees. A Section might have 8-12 employees reporting to a first line manager. Often 2-4 sections make up a Branch, and 3-5 Branches make up a Division. Division and Branch level managers were the primary subjects of interviews for this research effort. In most cases these middle and high level managers are primarily responsible for workforce management and consequently, KM. Because Mobile District as well as most other Districts are in the midst of retirements of the most experienced and knowledgeable managers, one recent retired Division Chief was also interviewed for an additional perspective on KM. The subjects included lifetime employees of USACE as well as individuals who worked in industry before joining Federal service. Collectively these individuals have each worked twenty or more years for USACE and represent over one hundred years of experience and technical knowledge.

3.4 Data Analysis

Both quantitative and qualitative data analysis were performed to meet study objectives and answer the key questions. Quantitatively compiling the demographic data according to technical sections defined the percentages of employees within certain ranges of retirement. In addition to the time until retirement, this data also demonstrated the years of experience or specific skillsets that will be lost upon those retirements. Interview responses were compiled by question and analyzed using descriptive statistics. Extracting key terms, themes or activities prevalent in multiple responses was to assess the current KM program and identify areas for improvement. The final step in analysis was to use the interview data to qualitatively identify unique factors for developing guidelines and recommendations for USACE.

4. Results and Discussion

4.1. Demographics and Quantitative Data

The first two structured interview questions were asked to obtain introductory information and quantitative data related to workforce demographics and retirements. Demographically the Managers interviewed supervise organizations as small as 5 employees to as large as 161. The organizations defined in Table 4.1 below correspond to each of the managers interviewed. Some of the managers interviewed were Division Chiefs that supervised Branch Chiefs who were also interviewed. These columns take this

into account and do not double count workers under a Division Chief that are supervised by one of the Branch Chiefs interviewed. For example while a Division Chief may have answered that 161 people work in the organization, 80 of them are included under one of the Branch Chief’s organization. The total number of staff supervised by the managers interviewed is approximately 351 people. The staff in these organizations is primarily made up of engineers and scientists with additional technicians, budget analysts and administrative support personnel.

Table 4.1: Sample Demographics

TABLE 4.1 Current Demographics	Org 1	Org 2	Org 3	Org 4	Org 5	Org 6	Org 7	Org 8	SUM	Avg. Rate ¹
Number of People Supervised	21	30	18	5	108	42	80	47	351	
Number of Recent Retirees	2	5	5	1	12	3	10	5	43	12%
Percentage	10%	17%	28%	20%	11%	7%	13%	11%		
Number eligible or within 5 years	10	8	5	3	40	10	25	2	103	29%
Percentage	48%	27%	28%	60%	37%	24%	31%	4%		
1. Weighted average of all organizations										

The weighted average rate of recent retirees was approximately 12% of the total size of the organizations covered by the managers interviewed. The individual organizational rates range from 10% to 28% in the smallest organization. The percentage of employees eligible or within 5 years of retirement on average across all organizations whose managers were interviewed is 29%. The individual organizations percentage of “near retirement” individuals ranged from 4% in one of the mid-sized organizations to 60% in the smallest organization. Based on these percentages it is apparent that the surge of baby boomer generation retirements is still a significant factor at the District Office studied. Industry estimates found during literature review suggested that as much as 20% of the workforce would be ready to retire in a relatively short span of time in the mid 2000’s. The peak appears to be lagging this timeline for the District studied, but in general the estimate appears to be highly applicable to USACE according to this research. Within the next five years the data indicates that if retirees are replaced with entry level employees and the organization sustains in size the workforce will be younger.

The last four questions in the structured interviews sought to obtain qualitative data on the state of the USACE KM program, learn how KM is being implemented, define the most significant challenges and consider what the future workforce will look like. Since it is clear that the workforce will be younger and generally less experienced, assessing the KM efforts of the District are critical to determining whether the necessary expertise will be available to remain an effective engineering organization.

4.2. Awareness of USACE HQ KM Program

The third interview question concerned awareness of the various HQ initiatives on KM at the working level. The findings of this study may be disappointing to HQ and emblematic of a common frustration that the working level staff feels towards HQ. The data presented below in Figure 4.1 includes seven HQ initiatives related to USACE KM, an eight category for “other” responses and a ninth category to capture one comment that was noted in every interview. All (100%) of the managers pointed out that utilization was low on more than half of the HQ initiated programs. While not a specific category of KM initiative the response was so prevalent it was included in the Figure 4.1. In Figure 4.1 percentages are calculated out of a total 8 potential positive answers for each x-axis category. One manager’s comments summarized

the general trend seen in all the interviews regarding utilization that ‘awareness is there but utilization and active participation is lacking.’ The responses were not all negative however. Greater than 60% of those managers interviewed reported a general awareness within their organization of CoPs (75%), QMS and other SharePoint collaborative sites (63%), the Rehired Annuitant Program (88%) and some form of mentoring (75%). Dr. Checks was cited by 50% of the managers and “other” initiatives were cited by 25% of the managers. No managers (0%) cited any significant awareness or utilization of the WBDG or the TEN (Technical Excellence Network) sites discussed in the literature review. Raising awareness and utilization of these repositories must become a first step in enhancing the organization’s KM program.

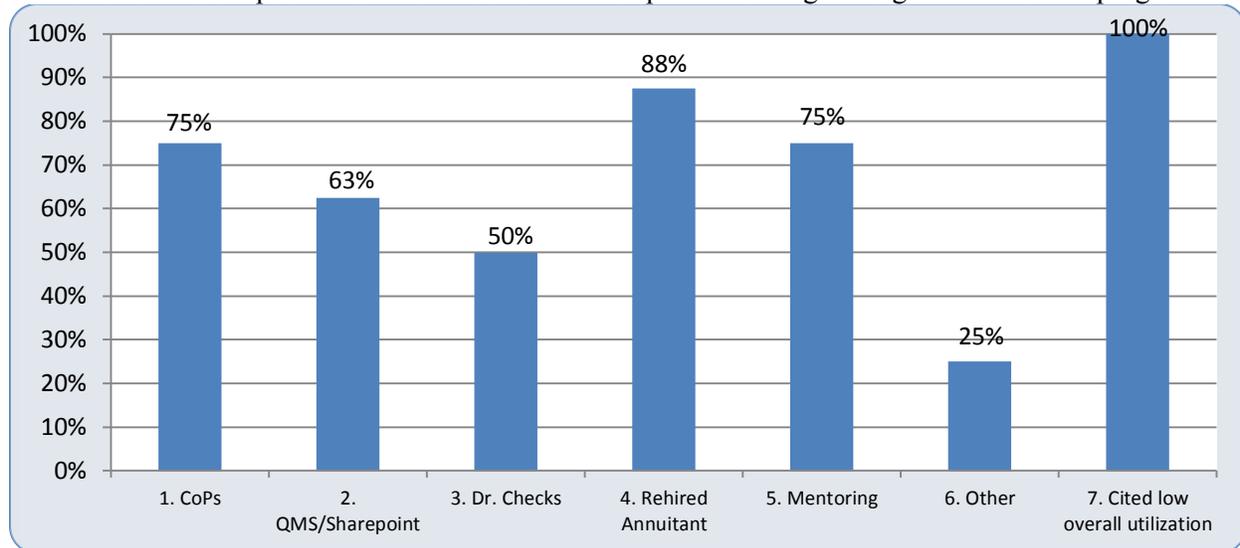


Figure 4.1: Awareness of USACE KM Initiatives

One of the interesting “other” responses was an initiative discussed by the recently retired manager. Prior to retirement his organization conducted a workforce review to assess strengths and gaps in competency so that personnel and training actions could be properly targeted. Workforce assessments were a fundamental aspect of the USACE Strategic Human Capital Management Plan and are another key first step towards improved KM. Overall, the data suggests that where awareness exists it is within the efforts that involve more direct personal interaction. CoPs, SharePoint, Rehired Annuitants and Mentoring are driven by social and personnel actions. These efforts include more local interaction and are initiated at the working level by project teams or first line managers. The data indicates that while many industry best practices for KM exist within USACE, awareness and utilization of IS based approaches are at best secondary at this time. In the future if the trend of shrinking workforce continues these approached will become more important to the organization.

4.3. Successful KM at the District Level

The fourth interview question sought to collect effective KM approaches actually being used in practice at the working level. Figure 4.2 highlights the six most common categories of methods noted by the managers. As shown in Figure 4.2, all (100%) of the managers interviewed noted some form of mentoring as a successful means to effect knowledge sharing and transfer. About half (50%) of the managers identified CoPs/Social Networks as being successfully utilized and a strong percentage (75%) of managers cited online repositories and collaborative workspaces. Often linked by the interviewees and closely related to these three items are the need for champions or leaders to promote and manage them, and 63% of managers noted that individuals serving this type of role are an effective means to implement KM. A relatively lower number (38%) of the managers cited lessons learned programs as an effective KM process being used. This is potentially one of the greatest areas for improvement in an organization as

large as USACE. With the number of already existing IS based KM initiatives by USACE - WBDG, TEN, Dr. Checks and QMS for example - the addition of a lessons learned database, accessible across Districts would be an excellent process for enhancing the KM program. At least three managers cited HR processes that enabling hiring of college students on a part time basis that transition in to interns and finally journeyman staff after a set program of 4-6 years. This program enables a work unit to hire the replacement for a senior team member before retirement and possibly have about five years of overlap and development.

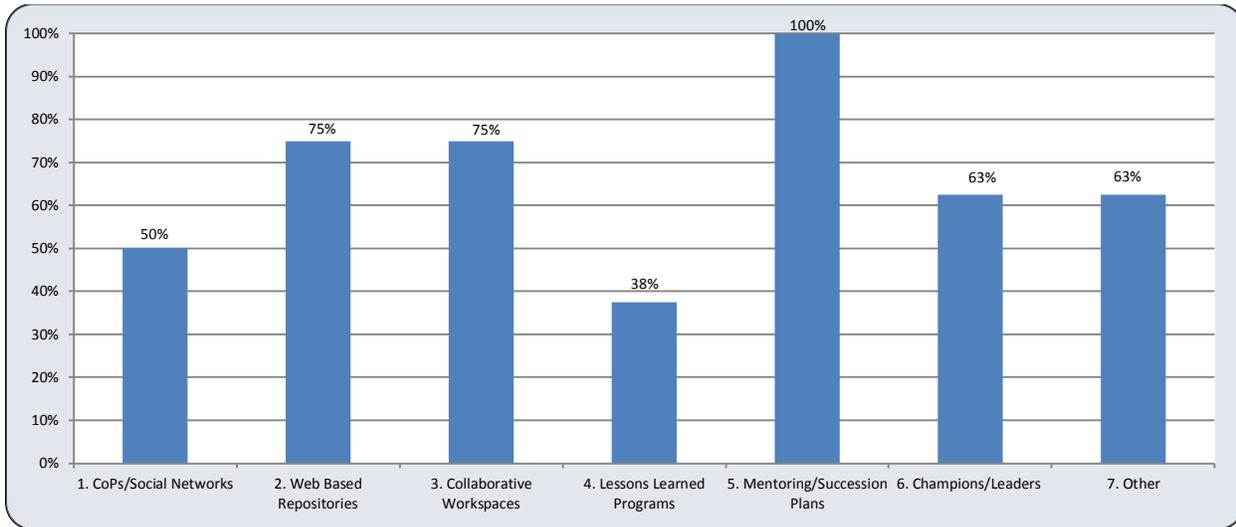


Figure 4.2: Successful KM Methods

Most of the managers cited one or more “other” means by which their work units had implemented KM. At least two managers cited HR based efforts where young workers receive on the job experience through position rotations or temporary assignments to project locations/teams. Additionally one manager cited inter-agency reviews where design products are reviewed by members of other districts that perform the same basic function. All of these “other” responses provide the organization opportunities to create informal CoPs, share lessons learned and perform informal mentoring. Interestingly, none (0%) of the managers mentioned several of the methods found in literature review to be used by industry – weblogs/wiki’s/forums, knowledge maps and phased retirements. The responses to this question further reinforce that the primary way USACE is implementing KM at the working level is with personal interaction and web-based or online tools secondary. This may be a function of the generational differences between the younger workers and the baby boomers. The boomers may not be as apt to develop, implement and sustain an online program when personal interaction is possible. If specialty disciplines are going to be harder to maintain in each District office, the need to collaborate and share information between organizations will make online tools critical. The data collected here further suggests that USACE needs improvement in the areas of IS tools.

4.4. KM Challenges

The fifth structured interview question gave managers the opportunity to identify the challenges they see at the working level. Managers raised two key themes shortage of people (75%) and insufficient time (63%) as the most significant challenges to implementing KM as shown in Figure 4.3.

Seven out of the eight managers (88%) interviewed provided one or more “other” type of challenge. Some of the more interesting responses were:

- Inconsistent amount or lack of unique and challenging design work.

- Top down approaches from HQ that is managed by many non-technical personnel.
- Two responses that noted the younger generations are more likely to change jobs and climb the management ladder.

The first two items speak to the overall organizational challenges USACE faces due to a variable workload and organizational culture. The third item is an acknowledgment of a new reality in the workforce that USACE must deal with along with other public and private organizations.

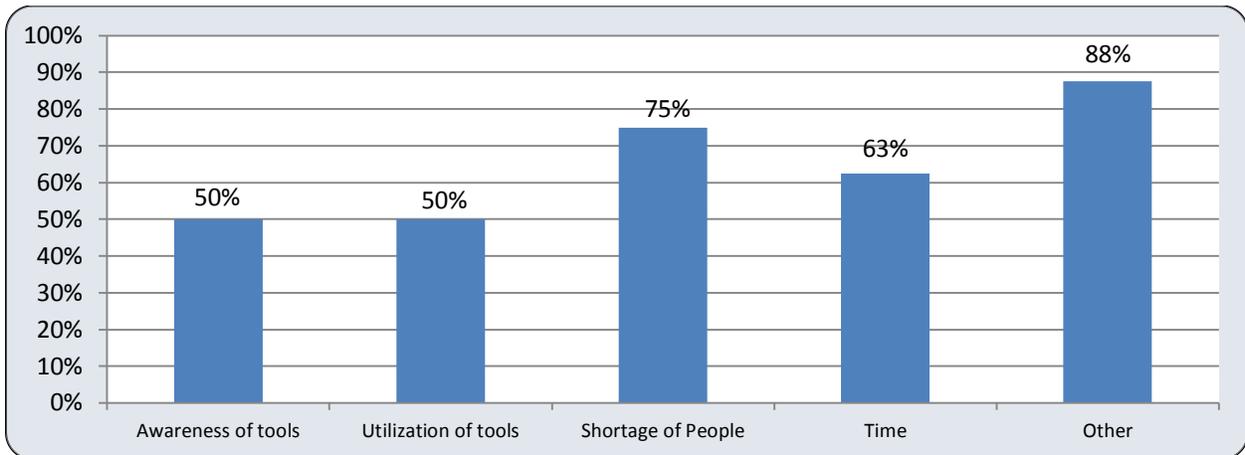


Figure 4.3 KM Challenges

Half of the managers interviewed cited awareness of opportunities and utilization of KM tools and initiatives as a significant challenge to implementation in their organization. This may look like a contradiction based on the numerous instances of low awareness or utilization noted in responses to the third question. Alternatively it could be an indication that low awareness and utilization of some of the HQ KM initiatives is not considered a significant challenge because the managers do not have high confidence in them to be effective. One manager’s comment that the HQ initiatives seem to be a series of “top-down approaches” from individuals that are not technically proficient at the working level would indicate that the alternative situation is more likely. To improve awareness and utilization or change the negative perspective of certain initiatives being “top down approaches” a more coordinated approach to KM is needed. USACE must ensure that all levels of management understand the tools available and how they fit into the implementation plan. Finally, while the literature review indicated that technical organizations might struggle with resistance to sharing or hoarding of knowledge, no managers interviewed noted these as significant challenges in their organizations. The data here shows that culturally, while the working level staff may not yet embrace IS based KM initiatives, the attitude and intent for a robust KM program is there. Knowing that teams and work units are willing and able to share information and work to pass on the technical proficiency and expertise of the organization is a fundamental requirement that does exist.

4.5. Future Outlook

The last interview question asked managers to contemplate what their organizations would look like in terms of size and experience in five to ten years. At this point much of the baby boomer generation will be retired and the results of KM programs and initiatives in place today will be displayed in the workforce. Figure 4.4 shows the percentage of responses for each of the different possible future states of workforce size and experience. Most managers indicated that their organizations would sustain in size (63%) and increase in experience (75%). Only 1 manager believed his organization would reduce in size, and two saw growth occurring. Two managers anticipated less overall experience in their organizations in the future. One of the managers did not give a certain answer on the question regarding experience

indicating that there is too much uncertainty in the workforce today due to people’s mobility. Another manager indicated that in one area (civil works projects) experience will decrease, and in another (military construction) it will increase. Overall these numbers suggests that at the working level managers believe they are effectively implementing KM through mentoring/ job experience, online repositories and collaborative workspaces. These findings are interesting considering all of the data collected and discussed in this chapter. It appears the HQ program for KM is not being implemented effectively nor is it well targeted or managed based on the number of initiatives that are not utilized significantly. To be clear the data does not indicate that effective KM is not occurring, it simply may not be following the means envisioned by HQ USACE. These points clearly illustrate that a review of the USACE KM program is needed and it must not be a “top-down” only approach.

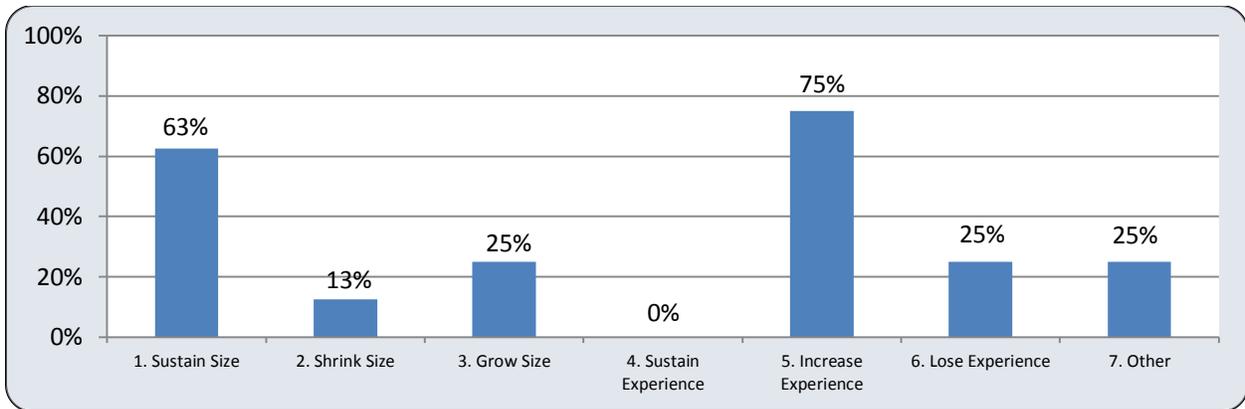


Figure 4.4 Future Workforce Size and Experience

4.6. Opportunities

The two questions that revealed perhaps the most significant data involve the manager’s examples of effective KM and the challenges. The responses to these questions demonstrated that at the working level USACE has a mentoring based KM program that is effective, but could benefit from improvements in the implementation and utilization of lessons learned repositories, CoPs and collaborative workspaces. These three areas appear to lack champions or leadership in the form of individuals at various levels of the organization from HQ down to the first and second line supervisor who are responsible for promoting and identifying opportunities where teams and individuals can utilize tools that already exist.

5. Main Findings, Conclusions and Recommendations

Interviews with managers of engineering branches and divisions within a USACE District Office highlighted a significant gap between organization-wide strategic KM initiatives and implementation of the program at the working level. At the headquarters level USACE has initiated a number of programs, but most of these are not viewed by managers as accomplishing success due primarily to lack of awareness and utilization. At the working level of the organization USACE implements KM with a mentoring focused program that achieves moderate success. While managerial outlook for the future is generally positive in terms of the expertise of the workforce there is untapped capability that could provide a substantive improvement towards accomplishing organizational KM goals. The reasons for lack of utilization and awareness are varied, but not unfamiliar – lack of time, lack of personnel, shrinking workload and limited budgets. The lack of awareness of certain key KM initiatives from the senior management of the organization is troubling as so much investment has been put into them. Simply

creating a collaborative workspace or compiling information in one accessible place does not mean the staff will embrace and utilize them.

The first question asked in this study was whether or not USACE can retain the technical expertise of retiring employees through a knowledge management program in the face of shrinking workload and outsourcing. Managers identified that shrinking workload leads to a shrinking workforce, and that this is one of the greatest challenges noted in assessing their KM program. One manager believes that his organization is about as lean as it can get while still maintaining a full range of capabilities. The reduction in unique projects is hurting the specialty disciplines most and this is where a successful KM program can be effective in retaining expertise. The second question was about the culture, roles and processes needed to implement a successful KM program. This study demonstrates that USACE has a culture that is highly conducive to KM, hoarding and resistance to KM were not noted to be challenges by any of the managers interviewed. That said it is clear that a lack of emphasis and plan of execution exists at intermediate levels of management between Headquarters and the working level. The result is that many KM initiatives from the top down are not being utilized. The research in this study reveals that without all levels of leadership and management championing the KM initiatives they will not be effective. The third question asked was about common components and practices of successful KM programs. Organizations with strong KM programs employ various methods that are based on both human resources and information systems processes. USACE is successfully employing HR based approaches with the co-op/intern/journeyman hiring program. USACE is successful on a more limited scale in the areas of Mentoring, CoPs, Repositories and Collaborative Workspaces. This study shows that formation of geographically distributed CoPs through initial and recurring personal interaction can be enhanced and nurtured through the use of IS tools such as collaborative workspaces, forums and online repositories. The last question asked what additions or improvements are needed in the KM program. Based on current utilization the prospect for many USACE KM initiatives is not great. Conversely as younger generations move into journeyman and leadership roles the likelihood exists that some if not many of the IS based approaches will see increased utilization. The key will be the steps USACE takes going forward to increase awareness and cultivate an understanding of the benefits of its KM initiatives. Developing implementation plans for IS based approaches and adding a lessons learned database are two key areas for improvement found by this study.

The USACE would benefit greatly from reconciling its approaches, eliminating redundant items, championing processes that work with leaders from all levels of management. Leadership can begin by implementing a coordinated approach to publicizing the benefits of information systems based initiatives using real examples of effective utilization. These leaders or champions must help create social networks and communities of practice that will use the systems provided. If mentoring is what works best for USACE then organizations have to find ways to link mentors and mentees of all the various specialized disciplines across geographic boundaries of the organization. If unique skills are only found in certain Districts or Centers, or in such small numbers within a District then USACE must link these individuals and help nurture CoPs that will eventually sustain themselves, bring in new members and enhance capabilities. Some members will be casual, looking for the answers to unique questions on one or two projects, while others will get engaged and at some point become contributors and active participants. SharePoint sites create a possible framework or platform for such a community to use as a data repository, lessons learned database, discussion forum, and collaborative workspace. When IS based approaches are combined with personal interaction, wider informal mentoring can happen across organizational and geographic boundaries. Strengthening this aspect of the USACE KM program is the greatest opportunity for meeting organizational goals.

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