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Developing a Formal Navy Knowledge Management Process

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DEVELOPING A FORMAL NAVY

KNOWLEDGE MANAGEMENT PROCESS

by

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ABSTRACT

Organization tacit and explicit knowledge are required for high performance, and it is imperative for such knowledge to be managed to ensure that it flows rapidly, reliably and energetically. The Navy N1 organization has yet to develop a formal process for knowledge management (KM). This places N1 in a position of competitive disadvantage, particularly as thousands of people change jobs every day, often taking their hard earned job knowledge out the door with them and leaving their replacements with the need to learn such knowledge anew. Building upon initial efforts to engage with industry and conceptualize a Navy KM strategy, the research described in this study employs a combination of Congruence Model analysis, Knowledge Flow Theory, and qualitative methods to outline an approach for embedding a formal Navy KM process. This work involves surveying best tools and practices in the industry, government and nonprofit sectors, augmented by in depth field research to examine two specific Navy organizations in detail. Results are highly promising, and they serve to illuminate a path toward improving Navy knowledge flows as well as continued research along these lines.

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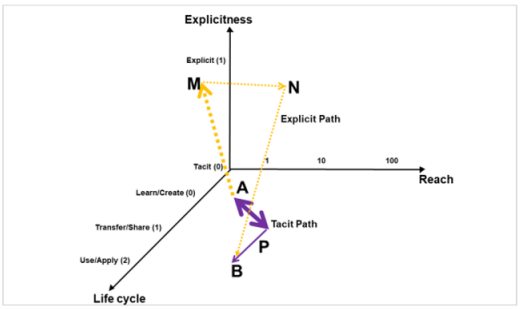
Recruiting: Knowledge Management for OPNAV N1

Naval Postgraduate School

Background

- OPNAV N1 is the primary source of people and know-how in the Navy
- Recruiting begins the process of Navy talent acquisition & development
- OPNAV N1 & Recruiting lack integrated knowledge management (KM) processes
- A competitive disadvantage results

Knowledge Is Power!



State of the Art KM – Visualization & Measurement

Our Approach

- Focus initially upon Recruiting
- Understand its knowledge stocks & flows in detail
- Leverage Industry best tools & practices
- Identify challenges & opportunities
- Apply state of the art KM
- Generalize up from Recruiting to N1

Key Results

- Impressive Recruiting leadership & organization
- Recruiting knowledge does not flow well
- 67 Recruiting challenges & 4 major pathologies
- Recommendations for NTAGs, NRC & N1
- Path to improve Recruiting knowledge flows
- Path to integrate embedded KM in Recruiting & N1
- Executive Summary & detailed technical report

Impactful Results

Future Research Opportunities

- Opportunity to assist NTAGs, NRC & N1
- Help to address challenges & treat pathologies
- Conceptualize & integrate embedded KM
- Reconceptualize Navy knowledge engineering
- Leverage Recruiting as Navy exemplar
- Map Navy knowledge ecosystem

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EXECUTIVE SUMMARY: DEVELOPING A FORMAL NAVY KNOWLEDGE MANAGEMENT PROCESS

Drs Mark E Nissen and Shelley P Gallup

Naval Postgraduate School

March 2021

Background

Organization tacit and explicit knowledge are required for high performance, and it is imperative for such knowledge to be managed to ensure that it flows rapidly, reliably and energetically. The Navy N1 organization has yet to develop a formal process for knowledge management (KM), however. This places N1 in a position of competitive disadvantage, particularly as thousands of people change jobs every day, often taking their hard earned job knowledge out the door with them and leaving their replacements with the need to learn such knowledge anew each time.

Building upon initial efforts to engage with industry and conceptualize a Navy KM strategy, the research described in this study employs a combination of Congruence Model analysis, Knowledge Flow Theory, and qualitative methods to outline an approach for embedding a formal Navy KM process. Through our discussion of the Congruence Model, we see how this approach to organization design (OD; see Galbraith, 1977)) leverages Contingency Theory (CT; see Thompson, 1967) to examine organizations for fit, which represents a powerful tool for analyzing N1 and its KM efforts. Likewise, through our discussion of Knowledge Flow Theory, we see how to visualize, analyze and measure dynamic knowledge, which represents another, complementary tool for analyzing N1 and its knowledge and workflows. Then through discussion of our research method, we see how qualitative analysis enables in depth understanding of specific N1 organizations and processes, which adds a third, complementary, analytic power tool.

This work involves surveying best tools and practices in the industry, government and nonprofit sectors, through which we identify, classify and describe over a dozen KM organizations, 17 preconditions for success and failure, 60 knowledge flow principles and

leadership mandates, over 100 tools and 15 common and emerging techniques for effective KM. From this we find that positioning of KM in the organization matters in terms of scope and efficacy, with the greatest results corresponding with comparatively high placement of KM in the organization. In the case of Navy organizations such as carrier strike groups (CSGs), this equates to placement on the Commander's Staff. We find also that a few preconditions for success (esp. senior management commitment, realistic expectations, appropriate people participating full time) and failure (esp. reliance on external expertise, narrow technical focus, too many improvement projects) are particularly important for KM efficacy.

Additionally, the set of knowledge flow principles form a theoretic basis for understanding and evaluating dynamic knowledge in the organization, and the complementary set of leadership mandates provide practical guidance for organization leadership. Further, from the 100+ tools examined, many are relatively common, familiar and understood (e.g., groupware, decision support, document sharing), whereas a number of others represent contemporary and emerging capabilities (e.g., artificial intelligence and machine learning (AIML) driven search, knowledge taxonomies and ontologies, extended reality). Likewise, the KM techniques reflect both common (e.g., training & education, mentoring & coaching, communities of practice) and emerging (e.g., crowd sourcing & peer assist, simulation & enactment, KM & C2 integration) techniques. Together, this background work equips us well to analyze Navy knowledge flows.

Recruiting KM

Given the large size and scope of the N1 organization, we focus our field research initially upon the important Recruiting organization. Recruiting begins the essential process of Navy talent acquisition and development. It also involves considerable knowledge work; encounters substantial knowledge flow challenges; and provides excellent visibility into how state of the art KM can be applied, in conjunction with Industry best tools and practices, within the N1 organization.

This fieldwork centers on understanding Recruiting in depth, which we accomplish through archival research, conversations with leadership, and focus group interviews with line recruiters. Indeed, we identify 42 recruiters from two different commands for surveys and interviews; and through our iterative, 11 step analytic process,

we identify numerous challenges and knowledge flow pathologies afflicting these commands. Through further conversations with Leadership, we develop a detailed set of recommendations for the recruiting commands, which we generalize into a smaller set appropriate for higher level organizations, including the Naval Recruiting Command (NRC) and N1.

Major Pathologies and Recommendations

Four major pathologies emerge as highly prominent:

1) Knowledge clumping and hemorrhaging
2) Information diaspora and disorganization
3) Nonintegration of work and tools
4) Nonintegration of KM

Each pathology can be addressed by corresponding recommendations:

1) Redesign NORU[1]; motivate teamwork; and capture expertise.
2) Develop a single, searchable, authoritative and intuitive knowledge and information site; maintained by NRC; taught by NORU; and utilized by NTAGs.
3) Provide SalesForce implementation support and training; utilize NORU, I-Site, RTIs and Help Desks to assist recruiters; and question any tools that do not support work directly.
4) Leverage the return on investment in KM; address both tacit (esp. people's experience) and explicit (esp. documented procedures) knowledge; assign knowledge engineers to help organize and lead the KM implementation effort initially; strive to have every recruiter become a knowledge manager eventually.

These recommendations offer excellent potential to treat the knowledge flow pathologies outlined above for Recruiting, and they provide insight into establishing a KM capability for the N1 organization. Armed with myriad powerful KM tools and techniques, along with the analytic approach to identify how, when and where to leverage them, we can help recruiting leaders to improve knowledge and workflows in their organizations, and we can help N1 leaders to integrate KM into their organizations. These represent topics for further research.

[1] Navy Recruiting Orientation Unit

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I. INTRODUCTION

A. KNOWLEDGE POWER

More than 450 years after the aphorism *scientia potentia est*[2] was attributed to Sir Francis Bacon, it remains axiomatic to say that knowledge is power: knowledge enables action; action drives performance; and performance supports both mission success and competitive advantage (Nissen, 2014). Indeed, organization knowledge is at least as important for mission success and competitive advantage as the traditional economic inputs including land, labor and capital (Grant, 1996; Spender, 1996), and knowledge can overcome organization deficits in terms of technology.

Recall, for instance, the colorful era of wooden sailing ships with fixed rows of cannons along their sides. The outcomes of naval battles in this era were predictable generally on the basis of: a) number of ships in a fleet, and b) number and size of cannons onboard ship. The countries whose land, labor, capital and technology could produce fleets and cannons in greater numbers than those of adversaries fared well consistently in battles at sea.

However, such battles were fought commonly through broadside cannon exchanges between ships from opposing fleets sailing past one another in long, straight lines. "Crossing the T" (i.e., sailing perpendicular to the line of ships from an opposing fleet) represented a *tactic* (i.e., a set of actions based upon knowledge) that conferred competitive advantage even to a smaller fleet of lesser equipped ships (e.g., consider the Battle of Trafalgar).

Because ships of the day had difficulty shooting forward or aft, the "crossing" fleet faced comparatively little cannon fire. Further, because cannons were relatively inaccurate in those days, the "crossing" fleet also had a long line of opposing ships to target lengthwise, whereas the fleet shooting broadside had comparatively small targets as ships pitched, rolled and sailed on the high seas. Here tactical knowledge conferred competitive advantage even to fleets lacking the materiel advantage based upon traditional resources of land, labor, capital and technology. In our current era of

[2] Latin for "knowledge is power"

networked sensors and weapons (Alberts & Hayes, 2003), knowledge remains a key competitive resource in military combat.

B. US NAVY KNOWLEDGE MANAGEMENT

High power knowledge does not just appear automatically when and where it's needed. Rather, an organization must possess the capabilities and processes required: a) to amplify knowledge to high power levels, and b) for such powerful knowledge to flow—rapidly, reliably and energetically—from where, when and how it is to where, when and how it needs to be. Like land, labor, capital and technology, knowledge needs to be managed, hence the popular term *knowledge management* (KM). This represents a fundamental KM principle (Nissen, 2006)

The US Navy is no exception to this principle. Organization tacit and explicit knowledge are required for high performance, and it is imperative for such knowledge to be managed to ensure that it flows rapidly, reliably and energetically. The Navy has been employing KM on its carrier strikes groups (CSGs), expeditionary strike groups (ESGs) and other organizations (e.g., numbered fleets) for years (C3F, 2020). In many cases KM plays a central and prominent role by a relatively senior officer (e.g., on the CSG Staff), whereas in others the role is diminished (e.g., within N6 [Technology] organization) or relegated simply to a collateral duty performed at much lower levels.

The Navy N1 (Personnel) organization has yet to develop a formal process for KM. This places the Navy in a position of competitive disadvantage, especially as thousands of naval personnel change jobs every day, often taking their hard earned job knowledge out the door with them and leaving their replacements with the need to learn the same knowledge anew.

Building upon initial efforts to engage with industry and conceptualize a Navy KM strategy, the research described in this study employs a combination of Congruence Model analysis, Knowledge Flow Theory, and qualitative methods to outline an approach for developing a formal Navy KM process. This work involves surveying best tools and practices in the industry, government and nonprofit sectors, augmented by in depth field research to examine two specific Navy organizations in detail. Results are highly

promising, and they serve to illuminate a path toward improving Navy knowledge flows as well as continued research along these lines.

The balance of this report begins with important background regarding the Congruence Model, Knowledge Flow Theory, and KM in practice. It continues then with an overview of our research method; followed in turn by key findings, results and recommendations. The report closes with high level conclusions and suggestions for further research.

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II. BACKGROUND

A. EMBEDDED KNOWLEDGE MANAGEMENT, WORK AND RELATIONSHIPS

We begin this section by addressing Embedded KM (EKM), with a particular emphasis on knowledge, work and distinction in the context of dynamic open systems. We then review organization design and the Congruence Model, which is used for analysis; after which we summarize Knowledge Flow Theory. We move in turn to discuss KM in practice, which gleans best organizations, tools and practices from the private, public and nonprofit sectors.

We start by getting at a meaning of EKM and its connections to work through knowledge. This discussion is necessary, as in interviews with corporations, military and government it has become clear that the term *Knowledge Management* has been ambiguous from the start, with many definitions of knowledge (philosophical discussions going back to ancient times) being conflated with "management." What exactly is being managed? And is knowledge itself manageable?

Operationalizing the term *knowledge* to be "information that enables action" (e.g., see Nissen, 2014) is a fundamental premise, as it connects the role of tacit and explicit knowledge to become connected to the needs of work. Work is what gets accomplished and can be considered as the meaning of an organization entity.

Unfortunately, as KM gained power within the academic literature and professional practice over the years, the creation of means to use knowledge in an actionable form was co-opted broadly across many organizations, by people who were mostly dedicated to building platforms that are information management focused. During a presentation of Figure 1 to corporate KM leaders, for instance, I asked the questions: "What is the *work* being made possible through your KM system?" What is the *intention* for these investments, or at a more minimalist level, the intention of the worker within the organization requiring a need for actionable information?

This is a rich topic with many different views. For example Freeman (2007) reviews the history of intentionality from philosophical meanings to its neurobiology. His views of intention support the further writings of Philip Herbst (1993) in defining

what happens where intention is part of a triad of action, the "fundamental principal" he names as creating a distinction. Indeed, knowledge enables action, the fundamental aspect of which centers on distinction to meet the aims and needs of the organization.

At the cognitive level, there can be discussion about choice in creating distinctions. For instance, actions that are routine and based on well understood information, the results of which are passed to another level of work, are different from actions where choice depends on the individual's understanding of context and needs of others. In the latter case, there is a response to outcomes, but the results of work do not necessarily produce an anticipated expectation. Indeed, ambiguity can emerge and require additional (re)work.

In Figure 1 we take from the "universe of potential" the "drawing of a distinction." Distinction has many philosophical and cognitive definitions. Here we use distinction as the "fundamental act" (Philip Herbst, 1993) and a task that is either routine or will require additional description or information to make it understood. A mental comparison resolves this act as expected, within the work task needs of the worker. Where this expectation is different or requires additional information, an intention to do *something* to create alignment creates in turn a need for action.

The question becomes, "what means are available to meet intentions?" Means could be additional resources or processes, and enabling knowledge flows are engaged in order to complete the action. When small perturbations of the workflow occur and are corrected through minor alterations enabled by tacit or explicit knowledge, this is called first order learning (Umpleby, 2004). Learning of any order involves dynamic knowledge. When the work system moves out of control and requires more effective efforts to bring it back to alignment, this is known as second order learning. See Robertson (1999) for a more complete explanation of George Spencer-Brown (Laws of Form) for additional information.

The point of this discussion is that distinction, work, change and maintenance of control must be included in an open system view of organization dynamics, held together through the implementation of a knowledge system. As we discuss organization design and the Congruence Model subsequently, we maintain a dynamic, open system perspective.

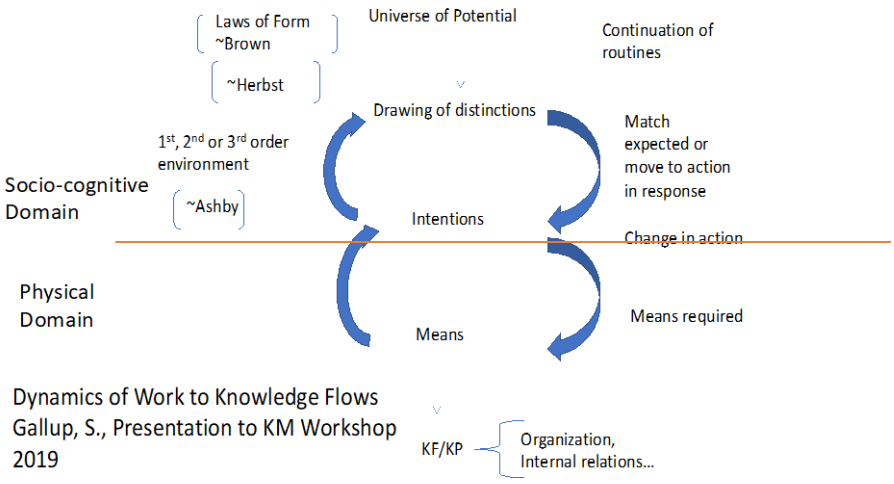

Figure 1 Distinctions, Intentions and Knowledge Means

B. THE CONGRUENCE MODEL

The Congruence Model (CM) represents an organization design (OD) approach—all of which center on Contingency Theory—developed 40 years ago (Nadler & Tushman, 1980) to help guide leaders and managers to identify performance gaps. Like other OD approaches (e.g., see Nissen & Burton, 2011), CM centers on the concept *fit*, which Donaldson (2001) characterizes as matching the design of an organization with its key factors that affect performance. Thus, the ideal organization design is contingent upon good fit with its key factors. In this section, we first provide a brief overview of OD for background. Then we discuss congruence models more specifically before centering on the specific model employed in this study.

1. OD Overview

Various OD approaches consider different organization design factors. For instance, organization *environment* is a fundamental contingency factor (Burns & Stalker, 1966), with alternate environmental characteristics (e.g., *complexity, change*) related contingently with different organization structures (e.g., *Functional, Decentralized*, see

Duncan, 1979). Among others, *organization technology* has been studied extensively as a powerful contingency factor also (Woodward, 1965), with alternate technologic characteristics (e.g., *task variability, problem analyzability*) related contingently with different organization forms (e.g., *Craft, Engineering;* see Perrow, 1970).

In addition to exogenous contingency factors along these lines (e.g., including environmental shocks, technologic shifts and regulatory changes; see Eldredge & Gould, 1972; Gersick, 1991; Romanelli & Tushman, 1994), organization forms are and should be designed and changed to fit endogenous contingency contexts as well, such as strategic choice (Child, 1972; Hambrick, 1983; Govindarajan, 1986), cultural change (Deshpande & Webster, 1989) and management intervention (Covin & Slevin, 1989; Doty et al., 1993). Fit with endogenous contingencies is just as important as with their exogenous counterparts (Burton et al., 2006; Levinthal, 1997).

Particularly through the early phases of OD research, the concept *organization fit* has been treated in a unidimensional manner for the most part; that is, the early concept has been limited largely to describing fit between a specific organization structure (e.g., Functional or Divisional) and a single contingency factor (e.g., *organization environment* or *strategy*). However, scholars have identified an array of multiple contingency factors (e.g., *age, environment, size, strategy, technology*), which are often conflicting (Gresov et al., 1989). As such they must be addressed, *simultaneously*, as a multicontingency set (Gresov & Drazin, 1997) through holistic, coherent organization designs (Meyer et al., 1993) comprised of internally congruent elements (Whittington & Pettigrew, 2003).

Further, building recently upon such research, Burton and colleagues (2006) identify a coherent set of 14 contingency factors (e.g., *goal, strategy, environment*) that an organization must address in an integrated manner, and they explain how the specific contingency set facing a given organization can be expected to *change through time*; that is, the contingency context of organization design is not static. Contingencies—and hence the corresponding organization designs required for fit—are dynamic. However, most OD research maintains a static focus (Burton et al., 2002; Zajac et al., 2000), and many scholars reject this view of fit as static equilibrium (Donaldson, 2001; Sinha & Van de Ven, 2005).

Not only must management attempt to match the best fitting organization form to the particular contingency set that obtains at any given point in time (i.e., seeking the best static fit at each time period; see Burton et al., 2006), it must also attempt to forecast the contingency sets likely to obtain at future times, identify the corresponding best future organization designs, and maneuver the organization over time (i.e., seeking to obtain the best dynamic fit across time periods). Hence *time* emerges as a central concept, one that was not addressed well by research (Burton et al., 2002; Zajac et al., 2000) until Nissen and Burton (2011) introduced and integrated the dynamic concepts *stability, maneuverability* and *opportunity loss*. We return to this dynamic view of organization when we discuss Knowledge Flow Theory below.

2. Congruence Models

As with OD as outlined above, numerous variations on CM have been developed and employed over the years. Drawing from Nadler and Tushman (1980), for instance, the specific factors addressed through CM include *work, culture, structure* and *people*, which are characterized as interacting closely together to transform organization inputs (e.g., environment, resources, history) into outputs (e.g., at the individual, group and organization levels) when examined as a system. Figure 2 summarizes this model.

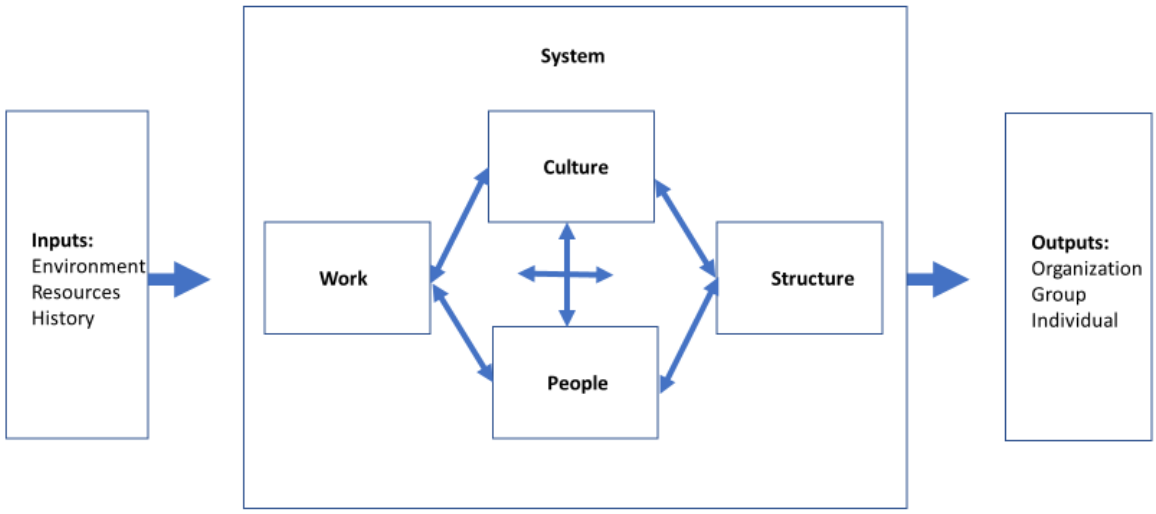

Figure 2 Nadler-Tushman Congruence Model

This is very similar to the Leavitt Diamond (Leavitt, 1965), which characterizes interactions between *process, organization, people* and *technology*, and which underlies our KM approach. To translate between models, three concepts from each are largely interchangeable: *work* and *process*, *structure* and *organization*, *people* and *people*. The focus of the former upon *culture* differs distinctly from the latter's focus upon *technology*. We return to the Leavitt Diamond when we discuss Knowledge Flow Theory below.

Other variations of CM (e.g., MindTools, 2020) differ slightly, as the basic model is employed by a variety of consultants and like professional service providers. The alternate model leveraged in this study (Mercer Delta, 1998) inserts *strategy* as a mediating input, and it emphasizes *informal organization* instead of *culture* and *formal organization* instead of *structure*. Figure 3 delineates this alternate model.

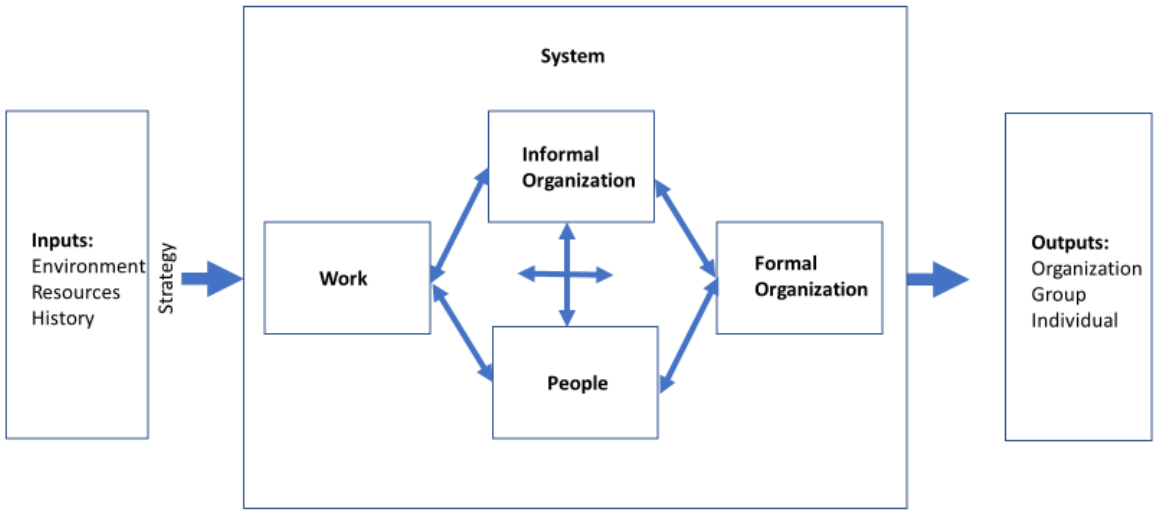

Figure 3 Alternate Model

The congruence model is fundamentally a means to view the organization as a system of interrelated parts. The systems view provides the researcher a scaffold on which to study each part independently and then in concert with other parts. As parts come together to do the work of the organization there is either a fit or a misfit between them. Organizations with close fit are higher performing organizations, and where there is misfit the model helps identify the causes and potential measures to address problem areas. Finally, the model become prescriptive in terms of feasibility along each of the transformation vectors, in Figure 4.

This is an open system model: information comes from the external environment; work is done with that information; and outputs are created that feed back into input. There are three primary parts to this model: input, transformation and output.

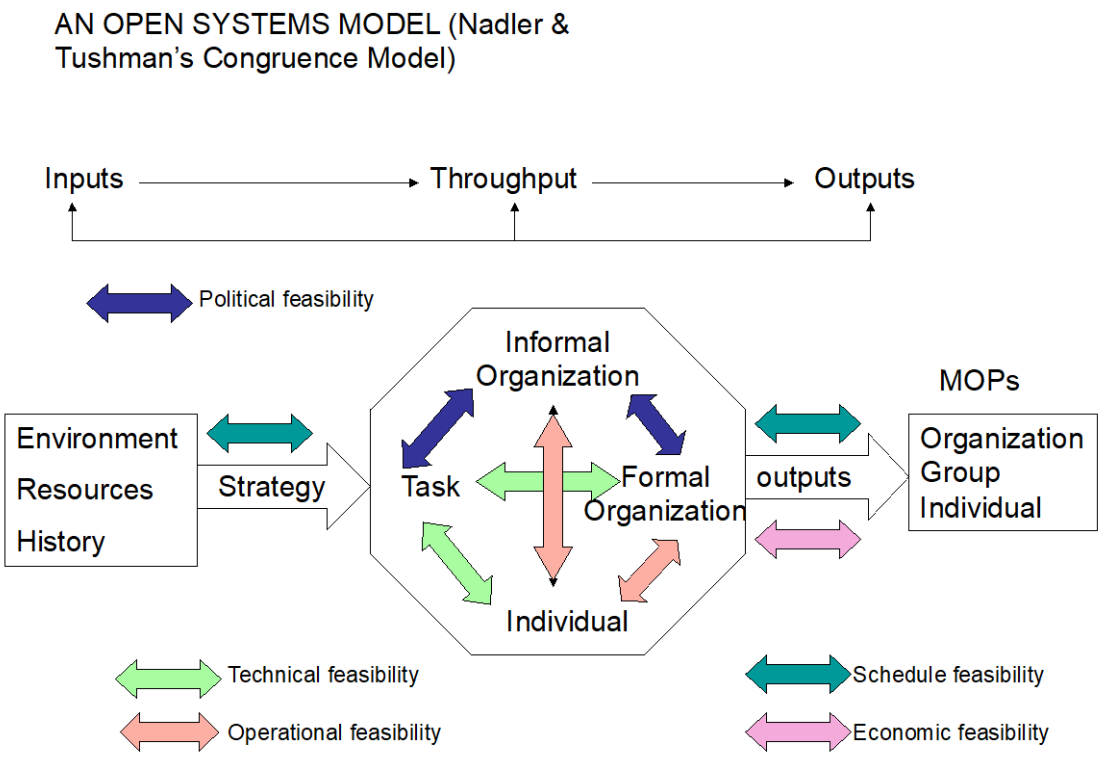

Figure 4 Congruence and Feasibility

Briefly, input includes the environment (e.g., organization demands, constraints, opportunities), resources (e.g., human, technology, funding, information, intangibles such as operational urgency) and history (e.g., what was done in the past is knowledge and momentum for what is occurring in the present). These inputs are shaped by an organization strategy as they are processed for the next part of the model.

Transformation occurs in the center of the model depicted in our figure. Transformation uses the inputs, through strategy, to create the system's outputs. This is where most of the work is accomplished. In this particular depiction of the model, the arrows are labelled as having "feasibility." In this study, the feasibility of what is happening is postponed until we have determined the current state. Instead we will seek to understand the interactions and coordination that happens around a "task." The task represents the work to be done, and one will notice that in doing this work, it can include

people, a formal organization, an informal organization and the means (usually technical) that enable the work.

Breaking this down just a bit further, “people” (individual in this model) is the label for human capital, their training, cultural biases, motivations, expertise and so forth. Work represents the inherent tasks that are to be done in the organization, often by a charter or instruction. The formal organization is arranged according to the instructions, policies, standardized work flow and the like that enable individuals to perform tasks. The informal organization is emerging arrangements that include structures, processes and individual relationships. Quite often informal organization can exist within the formal organization where policies and instructions are out of date and people find more efficient ways to do the work.

The point of the model is to understand the concept of fit and misfit within the organization. The consultants from above note, “the organization’s performance rests upon the alignment of each of the components—the work, people, structure and operating environment” (Mercer Delta, 1998). For example, imagine the organization requires work done to data in order to process it for output, but the technical means to do this are antiquated or simply problematic in some way. This would represent a misfit of the alignment between the work, people who do the work, and the formal processes requiring it be done within the deficient technical system.

Figure 4 takes the concept of fit at the each of the transform points and connects it to others in a logical fashion that now becomes “feasibility.” In other words, each of the factors in the transform needs to interact with one or more other factors in a way that either exists at the time, could exist in the future, or should exist at some point. Knowledge management and knowledge flow must now be incorporated in a vector across which knowledge must be part of the transformation.

As an example, take the feasibility vector between individual and task, named “technical feasibility.” The individual can be of many types: new to the job, highly experienced, understanding of the formal needs of the organization to finish the job, or feel embedded in a system where he or she is afforded little understanding of the part. There can therefore be a lack of fit between the individual and task, but technical means to overcome the lack of fit exist.

Here we are concerned with the role of knowledge in assisting with the intertwining of individual understanding of the work and how such understanding fits within the larger transformation of work. The corresponding knowledge flow vector could be tacit (e.g., slow speed but high energy), explicit (e.g., high speed but low energy) or even non-existent, depending upon the organization specifics. Each of the other vectors can be described similarly.

At this point the Congruence Model can become prescriptive and quantitative via this eight step process:

1) Identify the symptoms of poor performance.
2) Specify the input—what is critical to the core mission?
3) Identify the output—does it meet the strategic needs for the system?
4) Identify the problems—pinpoint specific gaps.
5) Describe the organizational components—begin to focus on causes of problems.
6) Assess the congruence.
7) Generate hypotheses about problem causes.
8) Identify action steps for improved performance.

C. KNOWLEDGE FLOW THEORY

Nissen (2005) describes the concept *knowledge flow* in terms of dynamic knowledge and indicates that it subsumes similar concepts such as *knowledge conversion, transfer, sharing, integration, reuse* and others that depict changes, movements and applications of knowledge over time. Knowledge Flow Theory (Nissen, 2006; 2014) describes the dynamics of knowledge flows phenomenologically, and it includes multidimensional, analytic and graphic techniques for understanding, interpreting, measuring and comparing a diversity of flows. Drawing directly from Nissen (2007), we organize this brief overview of Knowledge Flow Theory (KFT) into five parts: 1) knowledge uniqueness, 2) knowledge flows, 3) knowledge visualization, 4) knowledge patterns, and 5) knowledge measurement. Interested readers are directed to Nissen (2014) for details.

1. Knowledge Uniqueness

In this characterization, *knowledge* is conceptually distinct from *information, data* and *signals*: knowledge enables effective action (e.g., decisions, behaviors, work); information provides meaning and context for action (e.g., decision criteria, behavior

stimuli, work settings); data answer context-specific questions (e.g., How much profit is expected by selecting Alternative A? Who says that we should honor our commitments to the workers? How many industrial accidents have occurred so far this year?); and signals transmit detectable events across physical space (e.g., light patterns from pages in a book, sound waves from voices in a room, voltage differences across cables in a computer network).

Many scholars (e.g., Davenport and Prusak, 1998; Nissen et al., 2000; von Krogh et al., 2000) conceptualize a hierarchy of knowledge, information and data. As illustrated in Figure 5, each level of the hierarchy builds upon the one below. (Each is also fed from the one above.) For example, data are required to produce information, but information involves more than just data (e.g., need to have the data in context). Similarly, information is required to produce knowledge, but knowledge involves more than just information (e.g., it enables action). We operationalize the irregular shape of this hierarchy using two dimensions—*abundance* and *actionability*—to differentiate among the three constructs.

Briefly, data lie at the bottom level, with information in the middle and knowledge at the top. The broad base of the triangle reflects the abundance of data, with exponentially less information available than data and even fewer chunks[3] of knowledge in any particular domain. Thus, the width of the shape at each level reflects decreasing abundance in the progress from data to knowledge. The height of the shape at each level reflects actionability (i.e., the ability to take appropriate action, such as informed decisions, appropriate behaviors or productive work). Converse to their abundance, data are not particularly powerful for supporting action, and information is more powerful than data, but knowledge supports action directly, hence its position at the top of the shape.

[3] *Chunk* (C) is a longstanding technical term, derived from psychology and used in the artificial intelligence literature, which describes a unit of knowledge that has become familiarized and can be recognized in one's field of expertise (Simon, 1996). A recognized expert in some domain is estimated to have command of roughly 100,000 knowledge chunks in that domain and to require at least ten years to acquire such knowledge. We use chunk as a proxy for the mass or amount of knowledge possessed or moved.

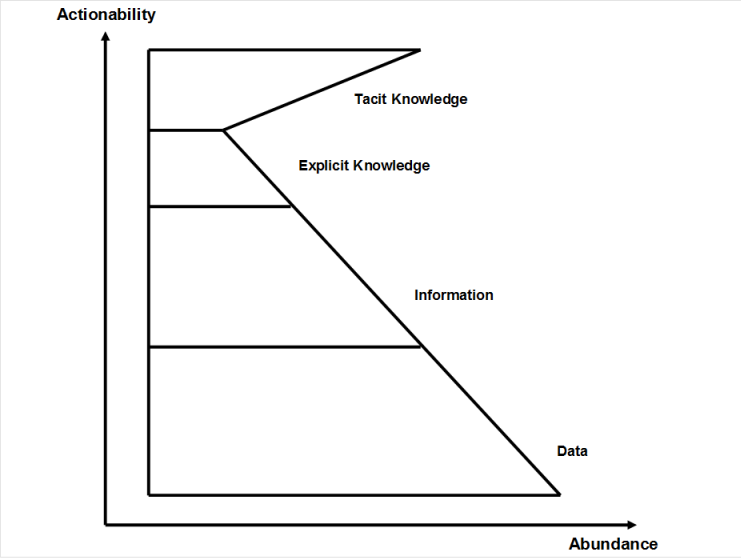

Figure 5 Knowledge Hierarchy (adapted from Nissen, 2014)

Notice that we position tacit knowledge "above" its explicit counterpart in this figure. Tacit knowledge is characterized widely as being very rich in terms of enabling action, whereas explicit knowledge represents often a diluted formalization of its tacit counterpart, with many properties and behaviors that are similar to those of information (Nissen, 2005). Further, unlike explicit knowledge, which must by definition be formalized, articulated or otherwise made explicit (e.g., via books, graphs, charts, software), and hence is somewhat limited in abundance, tacit knowledge accumulates naturally (e.g., through direct experiences and observations of people) and is quite abundant. This is the basis for the irregular shape depicted in the figure.

2. Knowledge Flows

In terms of knowledge flows (e.g., movements of knowledge across people, organizations, places and times; from where, when and how it is to where, when and how it needs to be), the two connected knowledge hierarchies depicted in Figure 6 illustrate some key concepts. On the left side, we see a knowledge producer's hierarchy, and on the right side, we see a knowledge consumer's hierarchy. Both of these knowledge hierarchies conform to the characterization above (e.g., abundance vs. actionability, layers building upon one another, distinct concepts, irregular shape). The producer hierarchy includes a vector arrow pointed downward (i.e., from knowledge, through

information, to data; each level feeds the one below), and the consumer hierarchy includes an arrow pointed upward (e.g., each level builds upon the one below). This depicts the relative direction of knowledge as it flows from producer to consumer.

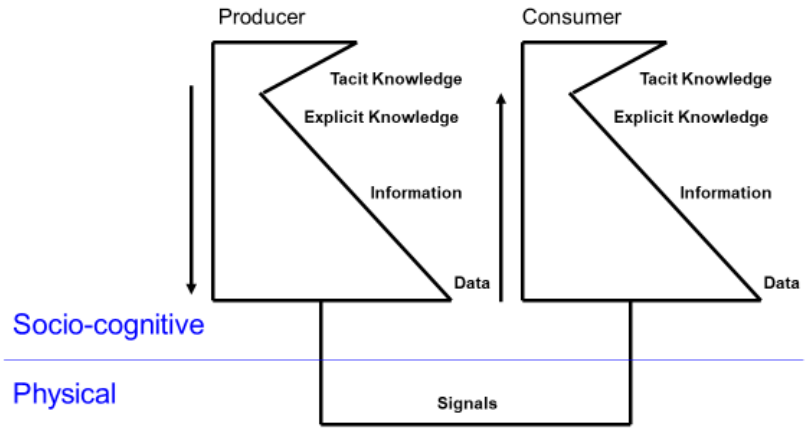

Figure 6 Knowledge Flows (adapted from Nissen, 2014)

Specifically, following Tuomi (1999), the producer utilizes existing knowledge to create information, which is used in turn to produce data, which are transmitted via signals across some physical space. Then, following von Krogh et al. (2000), the consumer interprets the data from signals, develops information through incorporation of meaning and context, and finally develops actionable knowledge through some learning mechanism. Of course, the directionality of arrows can reverse (i.e., a "producer" can become a "consumer," and vice versa), and multiple knowledge hierarchies can participate simultaneously, but this provides a phenomenological description of how knowledge flows. Notice that only signals are involved with flows across physical space; following Alberts and Hayes (2003), flows of data, information and knowledge take place in the socio-cognitive domain.

3. Knowledge Visualization

Figure 7 depicts a multidimensional space to visualize dynamic knowledge. Because knowledge is inherently intangible, invisible and resistant to quantification, understanding its dynamics through graphic representation remains a challenge. Alternatively, multidimensional representation and visualization is straightforward and commonplace in Physics, so we borrow some of its fundamental concepts and techniques, and we begin to adapt them for our purpose in the knowledge domain.

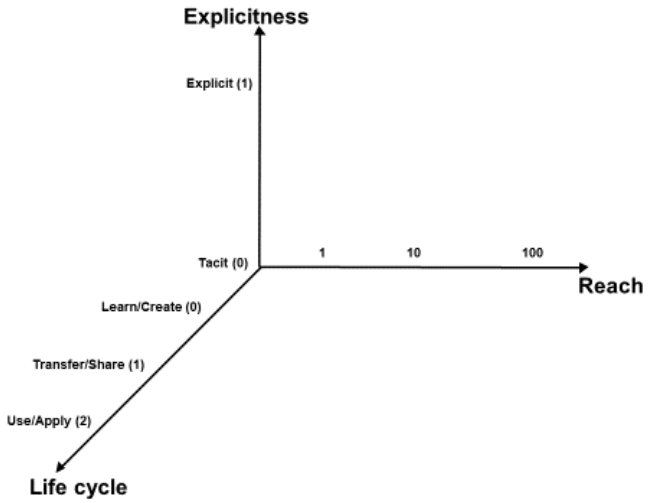

Figure 7 Basic Knowledge Flow Space (adapted from Nissen, 2014)

We are far from the first to borrow and adapt such concepts and techniques from other disciplines. Economics research, for instance, has borrowed concepts from Physics (e.g., *equilibrium, elasticity, differential*) for many years, and the Econophysics field (Gangopadhyay, 2013; Ghosh, 2013) employs both concepts and techniques from Physics (e.g., vectors, systems of dynamic equations, simulation) directly for use in addressing complex (esp. dynamic) economic problems. Hence our approach has abundant and relevant precedent, one that we continue to exploit for knowledge measurement below.

Briefly, the vertical axis represents the dimension *explicitness*, which characterizes the degree to which knowledge has been articulated in explicit form. This dimension draws from the Spiral Model (Nonaka, 1994) and includes a ratio scale

between tacit and explicit knowledge. The horizontal axis represents the dimension *reach*, which characterizes the level of social aggregation associated with knowledge flows. This dimension draws from the Spiral Model also and is operationalized by the number of people associated with any particular chunk of knowledge. The third axis represents the dimension *life cycle*, which characterizes the kind of activity associated with knowledge flows. This dimension represents an extension to the Spiral Model (Nissen, 2002) and includes several ordinal categories of life cycle activity (e.g., create, share, apply). Together, these axes combine to form a three dimensional space.

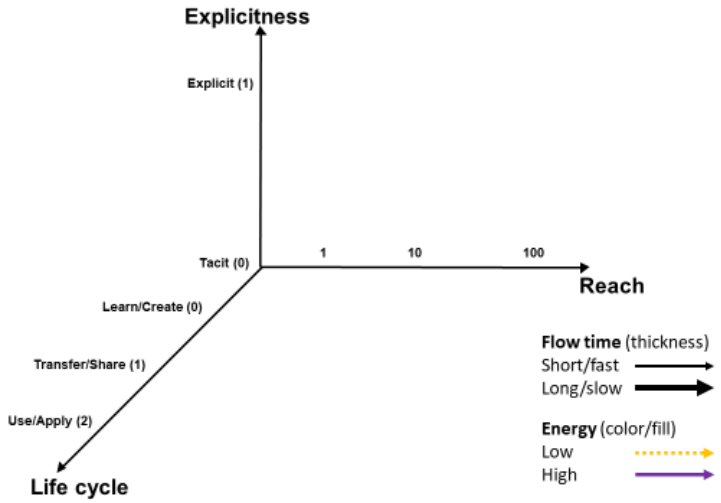

Figure 8 Extended Knowledge Flow Space (adapted from Nissen, 2014)

To represent important knowledge dynamics, through Figure 8 we continue to extend the Spiral Model by integrating the dimension *flow time,* which pertains to the length of time required for knowledge to move from one coordinate point in this three dimensional space to another, and *energy*, which depicts the performance level of action enabled by a particular knowledge chunk. Because visualization in five dimensions does not come naturally to most people, we use arrows of different thickness (e.g., thick for slow flows, thin for fast flows) when delineating knowledge flowing at different speeds,

and we use different color patterns (e.g., dotted-orange for low energy flows, solid-purple for high energy flows) to represent the energy dimension.

4. Knowledge Patterns

A wide variety of knowledge patterns emerge from the multidimensional visualization space from above. In Figure 9, for instance, we illustrate a basic knowledge sharing problem. Someone at Point A learns how to do something important. Notice that the corresponding knowledge is tacit (e.g., experience based): The person at Point A knows how to perform the knowledge enabled action, but he or she has not written it down or articulated it into explicit form otherwise. Nonetheless, we want this knowledge to flow organization wide so that everyone is able to apply it *at the same efficacy level* (i.e., energy level) as the person at Point A.

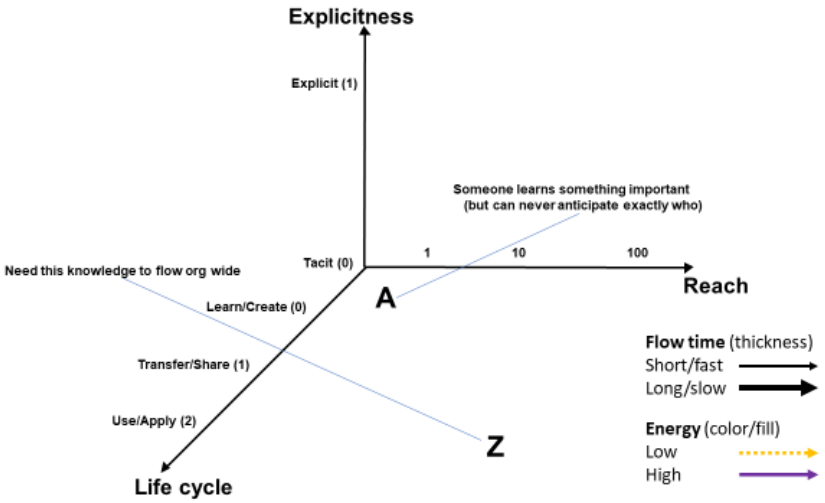

Figure 9 Basic Knowledge Sharing Problem

The shortest distance between two points is a straight line, hence we would like for such knowledge to flow quickly and energetically from the one individual to all 100 of his or her colleagues. Unfortunately, the organization does not possess a process for tacit knowledge to flow both quickly and energetically. (Few, if any, organizations do.)

Indeed, much of the rich, experience based tacit knowledge in an organization can take weeks, months or even years to learn.

We illustrate this effect in Figure 10, which includes a thin, solid-purple vector extending from Point A toward Z. This delineates the kind of rapid, energetic flow that would be ideal. Because such ideal flow is infeasible, however, it cannot extend directly to Point Z, so we annotate the figure with a RIDGE blocking the ideal flow. This indicates that the corresponding knowledge must flow either over or around the RIDGE in order to reach Z.

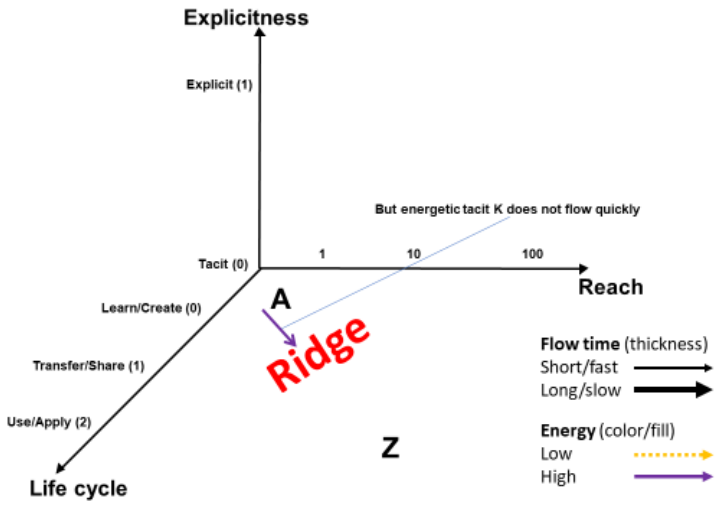

Figure 10 RIDGE Blocking Ideal Knowledge Flow

These two flows are depicted in Figure 11. The organization possesses two, archetypical knowledge flow processes, to which we refer as 1) the Jump Shot, and 2) the River. The Jump Shot is delineated by a dotted-orange line that rises up out of the tacit plane, whereas the River flow moves back and forth within this plane. With the former flow, the person at Point A expends both time and effort to articulate his or her knowledge in explicit form (e.g., written document, training material, SOP/TTP), who can then share it very quickly across the organization via network. Once shared as such, all 100 people in the organization are able to access and apply the new knowledge. This explicit knowledge flow pattern is exceedingly common in the modern organization.

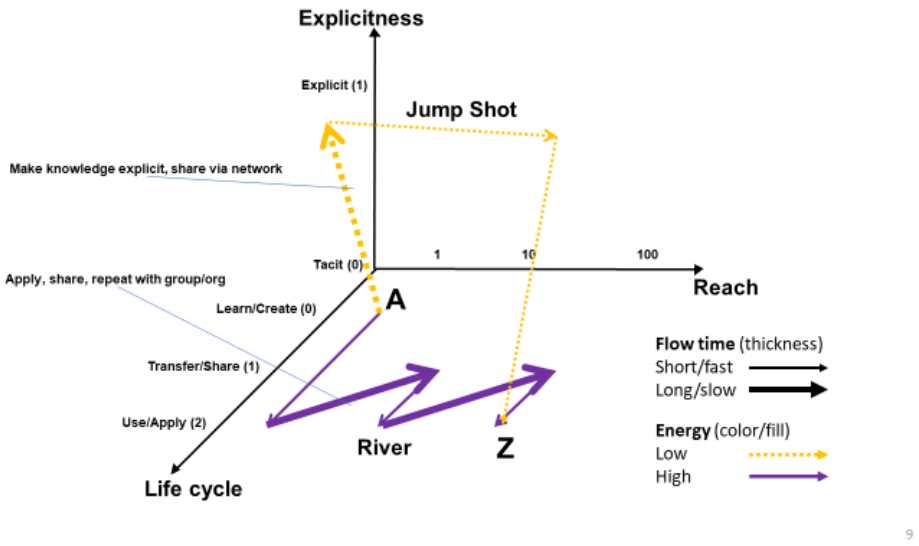

Figure 11 Archetypical Knowledge Flow Processes

The problem is, once articulated, explicit knowledge rarely flows at the same energy level as the corresponding tacit knowledge used to articulate it. Reading a book, for instance, about how to fly an airplane is not the same as direct experience flying airplanes. Simply reading a document, as another instance, about leading people rarely equips a leadership novice to be an effective leader without considerable experience and practice. Even the best training course on computer network defense, as a third instance, is rarely adequate for a novice computer security person to defend a complex network well without working defensively with that network. Thus, the Jump Shot archetype is known well for knowledge flowing very quickly and broadly through the organization, but it is known also for such knowledge to be comparatively attenuated in terms of energy.

Alternatively, with the latter flow, the person at Point A applies his or her knowledge directly and then shares it with a group of (say ten) people using tacit knowledge flow techniques (e.g., demonstration, mentoring, coaching, observation, OJT). Once all ten people in this group are able to apply the knowledge *at roughly the same efficacy level* as the knowledge creator, each of them shares it in turn with another group

of ten—in something of an evangelic or viral model—using the same kinds of tacit knowledge flow techniques. Over considerable time, all 100 people in the organization are able to apply the knowledge at roughly the same energy level. This latter energy level—and hence the efficacy level of performance—is generally much higher than that achieved through the Jump Shot.

Nonetheless, despite the high energy knowledge flow, the River has its own limitations. In particular, tacit knowledge flows comparatively very slowly and narrowly. It can take weeks, months or even years for someone to teach others to perform some knowledge enabled actions proficiently, and the kinds of tacit knowledge flow techniques noted above (e.g., demonstration, mentoring, coaching, observation, OJT) limit the number of people that knowledge can be shared with at any point in time. Effective mentoring, for instance, is limited to only one, two or perhaps a few people at a time. Thus, the River archetype is known well for knowledge flowing very slowly and narrowly through the organization, but it is known also for such knowledge to be comparatively very energetic.

This does not imply that one archetype is necessarily "better" than another. Rather, it explains that the two archetypes differ qualitatively and exhibit unique dynamic properties and behaviors. When circumstances necessitate rapid and broad knowledge flows, and when such flows do not require high energy, the Jump Shot represents the superior approach. Alternatively, when high energy flows are critical, and when the organization can wait for it to flow slowly from individuals through small groups, the River represents the better choice. With this as background, we have the ability to examine knowledge flows and needs within any operational organization and to determine—analytically—which approach to employ.

5. Knowledge Measurement

Finally, we summarize and extend recent information systems (IS) research (Nissen, 2017) that enables the visualization and measurement of dynamic knowledge. Such recent research builds upon our understanding of dynamic physical systems to outline a simple set of equations that characterize the dynamics of motion in physical space and time (e.g., including constructs *force, work, friction, energy, time, power*). This recent work then draws from Measurement Theory (Krantz, Luce, Suppes & Tversky,

1971) and leverages KFT to develop an analogic set of equations to characterize the dynamics of knowledge as it flows through the organization (e.g., including constructs *knowledge force, knowledge work, knowledge friction, knowledge energy, flow time, knowledge power*). We link the dynamic knowledge measurement system that emerges with the visualization techniques from above to illustrate how such system is consistent with theoretic predictions.

This is done with full understanding and upfront admission regarding the limitations of analogic reasoning: In no way do we assert that the dynamics of knowledge follow or mirror the dynamics of physical systems precisely. Every analogy breaks down when stretched too far, and even some of the most basic physical concepts may have little meaning in terms of dynamic knowledge. Notwithstanding such limitations, however, we gain considerable insight from the deep understanding and mathematic representation of dynamic physical systems, which are adapted analogically to enable the measurement of dynamic knowledge.

a. Physical System

To recapitulate the approach, which is described in detail through research by Nissen (2017), a simple physical system is represented mathematically through the basic Newtonian equations summarized in Table 1. Such equations can be found in any introductory Physics textbook, yet they enable quantitative measurement, analysis, prediction and simulation of dynamic physical systems. Here we interrelate *force* (mass x acceleration; expressed in Newtons), *work* (force x distance; expressed in Joules) and *power* (work / time; expressed in Watts). We include three variations of Equation (3) to interrelate *time, distance* and *acceleration.*

We note also (beyond the table) how *work* and *energy* are exchangeable and expressed in the same units (Joules): energy is required to perform work, and work performance involves the expenditure of energy. We leverage such exchangeability below through analogic reasoning for knowledge systems.

We note further how friction affects many physical systems by opposing motion and acceleration. An ordinary shopping cart, for instance, requires greater effort (i.e., more force) to push along a store aisle with a rough floor than a

smooth one: the greater friction associated with the rough floor opposes motion and acceleration of the cart, hence it requires more force to push.

Table 1 Physical System Equations

Construct	Description	Equation
Force (F)	Effort required to accelerate mass	(1) F = m x a
Work (W)	Force applied through distance	(2) W = F x d
Time (t)	Time for a mass to move its distance	(3a) $t = \sqrt{(2d/a)}$
Distance (d)	Distance that a mass moves	(3b) $d = ½ at^2$
Acceleration (a)	Change in velocity	(3c) $a = 2d/t^2$
Power (P)	Work done per unit time	(4) P = W / t

Considering friction in support of our analogic reasoning, a simple, linear, negative relationship between *force*—including that required to overcome friction (F_{Fr})—and floor *smoothness* (fs) is delineated in Figure 12. Here force can be measured in Newtons, and smoothness is expressed on a [0,1] continuum between rough (fs=0) and smooth (fs=1) endpoints.

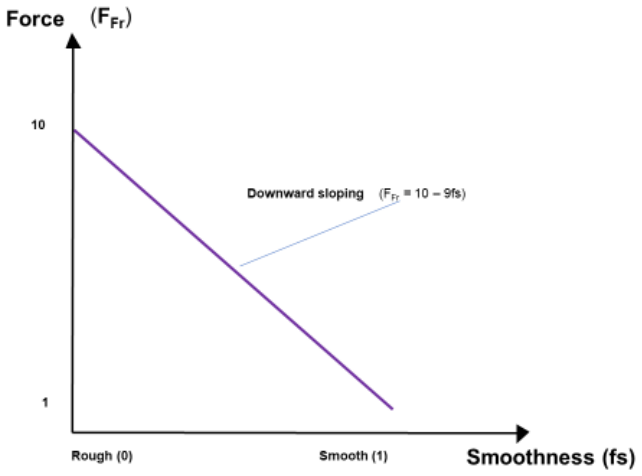

Figure 12 Force and Smoothness

Specifically as depicted in the figure, a rough floor is characterized here as requiring ten times the force to push a shopping cart as that needed on a smooth floor (F_{Fr} = 10 - 9fs). This downward sloping relationship between force and

smoothness is representative, with specific slopes, intercepts and functions highly likely to differ across various carts, stores, aisles and floors. Nonetheless, the relationship makes intuitive sense and is consistent with many physical observations and measurements.

For illustration, say that some researchers go into a store and take three measurements: They observe a cart laden with 10 kg of groceries that takes 20 s to be pushed to the end of a 10 m aisle. The researchers use a scale to weigh the groceries, a stop watch to time the cart, and a tape measure to gauge the aisle length. This simple system of equations enables one to calculate all of the other parameters.

Using Equation (1) to find the force: The mass (10 kg) is known; and acceleration is calculated from Equation (3c), knowing distance (10 m) and time (20 s), at 0.05 m/s^2. Hence the corresponding force is 0.5 N. From Equation (2), work and energy are 5 J, and from Equation (4), the average power exhibited is 0.25 W. Thus, the researchers are able to discover much about this system from only three measurements. Figure 13 delineates velocity (v), acceleration (a) and distance (d) over the first five seconds of movement down the aisle.

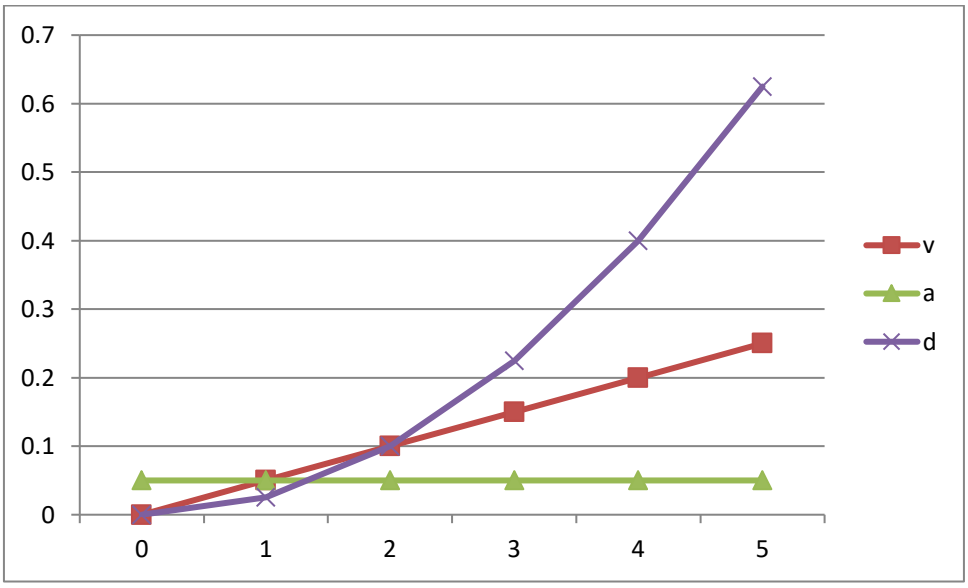

Figure 13 Physical System Dynamics

Moreover, now that this system of equations has been parameterized with measured and calculated values, one can understand and predict myriad changes and variations to the system without having to observe and measure it again physically. Say, for several instances, that researchers want to know what would happen if someone were to double or halve the mass of groceries on the cart (i.e., 20 kg, 5 kg), if the aisle were to double or halve in length (i.e., 20 m, 5 m), or if the cart were pushed to the end in double or half the time (i.e., 40 s, 10 s). Calculating such changes is straightforward with our parameterized system of equations: different values are substituted simply, and additional measurements in the field are not required.

b. Basic Knowledge System

In this section we recapitulate development of a basic knowledge system via analogic reasoning with respect to the simple physical system summarized above. Details of such knowledge system are found in Nissen (2017). As summarized in Table 2, we outline an analogic knowledge system. Briefly, *knowledge force* (K-Force or KF) is analogous to physical force and represents the effort required to accelerate knowledge in an organization. From KFT, it is expressed as a function of the knowledge *chunks* (C) being accelerated and the *explicitness* (E) of such knowledge.

Table 2 Analogic Knowledge System

Construct	Description	Analogy
K-Force (KF)	Effort required to accelerate knowledge	f(C, E, **o**)
K-Work (KW)	K-Force applied through reach	KF x R
Flow Time (FT)	Time required for knowledge to flow	FT
K-Power (KP)	K-Work done per unit flow time	KW / FT

In this conceptualization, each chunk (see Simon, 1996) of knowledge can enable the performance of one atomic action (e.g., making one distinction) in the organization. As noted above in terms of knowledge visualization, *explicitness* derives from Nonaka's (1994) epistemological dimension and represents the degree to which a knowledge chunk has been articulated in explicit form. The greater the number of chunks being accelerated (analogous to physical mass), and

the more tacit the corresponding knowledge (analogous to physical friction), the greater the K-Force required. Notice also the **o** vector representing a number of other, unspecified factors (e.g., experience, communication skill, motivation, stress, organization climate, IT support), which are likely to play a role, but which have yet to be integrated explicitly or analogically.

As noted above also, *reach* (R) derives from Nonaka's (1994) ontological dimension and represents the number of people associated with the knowledge chunks from above (analogous to physical distance). Reach combines with KF to specify *knowledge work* (K-Work or KW) accomplished in the organization (analogous to physical work). Analogous to the exchange between and common units of *work* and *energy* in physical systems, we also conceptualize a correspondence between *knowledge work* and *knowledge energy* (K-Energy or KE): KE is required to perform KW, and KW performance involves the expenditure of KE.

In turn, *flow time* (FT) represents the time required for such knowledge chunks to flow from one person (e.g., an expert), group (e.g., a sales team), place (e.g., West Coast office), form (e.g., tacit) or time (e.g., night shift) to another. As a time measure, it combines with KW to specify *knowledge power* (K-Power or KP), which represents the knowledge work accomplished (and knowledge energy expended) per unit time (analogous to physical power).

Continuing to draw analogically from the dynamics of physical systems; and considering friction, which opposes motion and acceleration; a simple, linear, negative relationship between *knowledge force* (KF) and *explicitness* (E) is delineated in Figure 14. Consistent with KFT, this relationship indicates that tacit knowledge, which is notably "sticky" (Szulanski, 2000) and difficult to move through the organization, requires more effort (i.e., greater KF) to accelerate than its explicit counterpart.

Alternatively, tacit knowledge, in the context of which Polanyi (1967) explains that we know more than we can say, can enable knowledge work at higher performance levels than explicit. As noted above, to recapitulate the instance, reading a book (i.e., explicit knowledge) about how to fly an airplane is

not the same as direct experience (i.e., tacit knowledge) flying airplanes, hence it is unlikely to enable performance at the same level.

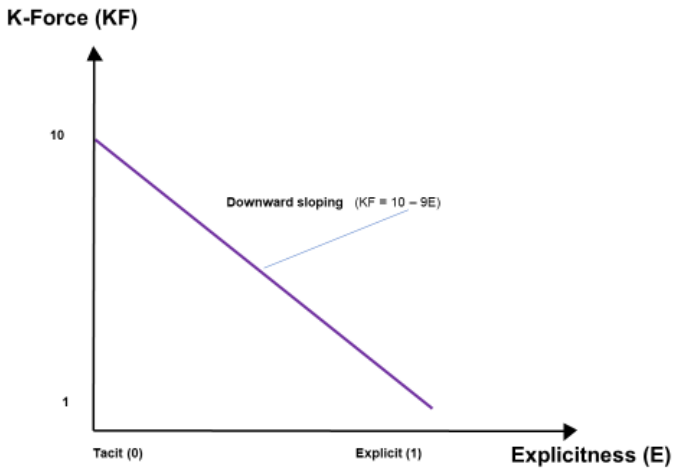

Figure 14 Knowledge Force and Explicitness

Specifically as depicted in the figure, a chunk of tacit knowledge is characterized here as requiring (analogously) ten times (10x) the K-Force needed to get a chunk of explicit knowledge flowing (KF = 10 - 9E). Space prohibits a long discussion of sensitivity analysis, but results are highly robust to differences in slope (e.g., 2x, 100x), linearity (e.g., x^2, $x^{1/2}$) and other factors. Indeed, this downward sloping relationship between K-force and explicitness is representative, with specific slopes, intercepts and functions highly likely to differ across various organizations, people, processes, technologies and kinds of knowledge. Nonetheless, the relationship makes intuitive sense and is analogous to physical friction.

Further, we can use this representative relationship to specify the set of dynamic knowledge equations summarized in Table 3. In Equation (5) we specify K-Force as a multiplicative function of knowledge chunks (C), explicitness (10 - 9E), and vector of unspecified other factors (**o**). We refer to units of K-Force as

"Nonakas" (N), acknowledging the seminal knowledge flow research done by Nonaka (1994). K-Work (and K-Energy) then follows in Equation (6) as the product of K-Force and reach (R). We refer to units of K-Work as "Polanyis" (P), for the keen insight into tacit knowledge provided by Polanyi (1967). K-Power is specified in turn through Equation (7) by dividing K-Work (or K-Energy) by flow time, the latter of which must be measured (e.g., using a stopwatch or calendar, measured in seconds). We refer to units of K-Power as "Bacons" (B), acknowledging Sir Francis Bacon, to whom many scholars attribute the aphorism, "knowledge is power."

Table 3 Knowledge System Equations

Construct	Equation
K-Force	(5) KF = C x (10 - 9E) x **o**
K-Work	(6) KW = KF x R (= KE)
Flow Time	Measure
K-Power	(7) KP = KW / FT

To reiterate from above, this analogic reasoning is not strict, and we recognize its limitations. Nonetheless, we gain insight from the deep understanding and mathematic representation of dynamic physical systems, which are adapted here to address the measurement of dynamic knowledge. Even this simple set of equations enables us to begin measuring knowledge as it flows through the organization. This represents a substantial step forward in terms of knowledge management and measurement.

c. Measurement Example

Recall from Figure 11 above how the Explicit Path delineates knowledge flowing *over* the RIDGE via the Jump Shot pattern. As illustrated in Figure 15[4], one can visualize such flow via three vectors (i.e., A-X, X-Y, Y-Z). This is the archetype associated most closely with technologic implementations, as it centers on making knowledge explicit and using technology for sharing. In contrast, the Tacit Path delineates knowledge flowing *around* the RIDGE via the River pattern.

[4] To simplify this figure, we omit the knowledge pattern names (i.e., Jump Shot and River) from the diagram, and we show the two archetypical flows extending only to a Reach of 10.

Through this same figure, one can visualize such flow via two vectors (i.e., A-W, W-Z). This is the archetype associated least closely with technologic implementations, as it centers on sharing tacit knowledge through interpersonal interaction.

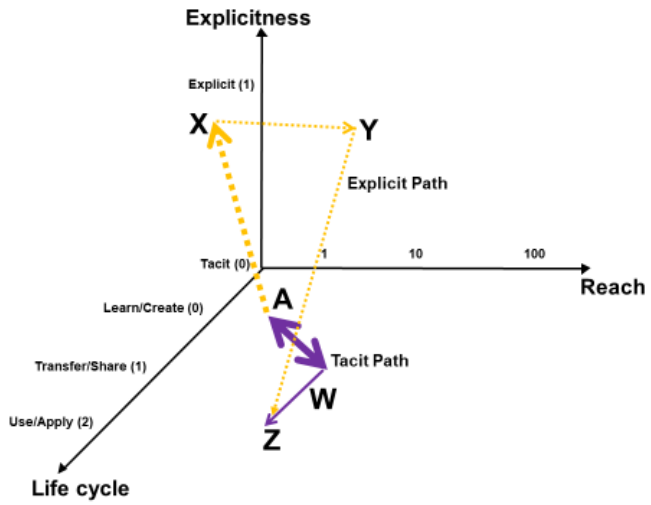

Figure 15 Archetypical Knowledge Flow Processes

Measurements corresponding to the Explicit Path for, say, 100 knowledge chunks are summarized in Table 4. Notice that we divide the measurements into three parts corresponding to each of the flow vectors. Walking across columns in the table, for the 100 chunks moving through the first flow vector (A-X), one can see explicitness is listed as a fractional value (0.5) in Column 2. This denotes that knowledge associated with the flow begins as tacit (E = 0) and ends as explicit (E = 1), as an individual worker articulates tacit knowledge into explicit form. Using Equation (5), this results in K-Force of 550 N (KF, KW and FT are expressed in thousands in the table), and with unitary reach (i.e., the individual), Equation (6) indicates K-Work (and K-Energy) of 550 P. The worker's time records indicate that just over four hours are invested in articulating the knowledge in explicit

form and making it available on the computer network, which corresponds to 15,000 s flow time.

Table 4 Explicit Path Measurement

Flow	E	KF	R	KW	FT	KP
A-X	0.5	0.55	1	0.55	15.0	
X-Y	1.0	0.10	10	1.00	0.1	
Y-Z	1.0	0.10	10	1.00	1.0	
Sum				2.55	16.1	0.16

Calculations for the other two flow vectors (X-Y, Y-Z) involve the same 100 knowledge chunks and follow the same logic and procedure. Notice that knowledge is purely explicit (E = 1) for these latter flow segments[5] and that both involve the same reach (10) across the team. In the first of these vectors (X-Y), explicit knowledge flows very quickly (100 s) and simultaneously to all ten people via computer network. In the second (Y-Z), all ten coworkers apply such explicit knowledge directly and in parallel, through actions requiring nearly 17 minutes (1000 s) to complete. K-Work (and K-Energy) is nearly double (i.e., 1000 P) for these purely explicit flows because of the greater reach (10 vs. 1). Summing K-Work (2550 P) and flow time (16,100 s) for the process as a whole, (average) K-Power of 0.16 B obtains from Equation (7).

Measurements corresponding to the Tacit Path are summarized in Table 5. They involve the same 100 knowledge chunks and follow the same logic and procedure described above. Notice that knowledge for both flow vectors (i.e., A-W, W-Z) comprising this latter process is purely tacit (E = 0). This reflects the kind of interpersonal, iterative, experiential interaction that is associated widely with tacit knowledge sharing. As such, and as above, the system of equations is used to obtain the measurement values in this table for the tacit knowledge flow path, and flow time from coworkers' time records is included.

[5] Although the A-X-Y-Z vectors complete a loop through (tacit) application at Point Z, without incorporating some kind of learning process, the corresponding knowledge remains explicit (accessible by the team at Point N). This differs from the A-W-Z flow vectors, through which knowledge persists in both tacit (the individual at Point A) and explicit (the team at Point W) form.

Table 5 Tacit Path Measurement

Flow	E	KF	R	KW	FT	KP
A-W	0.0	1.0	10	10.0	55.0	
W-Z	0.0	1.0	10	10.0	0.1	
Sum				20.0	55.1	0.36

Notice further that a relatively long time (i.e., roughly 15 hours; FT = 55,000 s) is required for this tacit knowledge to be shared (A-W). This is consistent with the "sticky" nature of such knowledge. Alternatively, once learned, application of tacit knowledge is comparatively very quick (i.e., FT = 100 s) for the group of coworkers (W-Z).

Comparing measurements for the Explicit and Tacit Path archetypes, K-Work performance through the tacit flow is nearly eight times that of its explicit counterpart (20,000 vs. 2550 P), but flow time is more than three times as long (55,100 vs. 16,100 s). The K-Power metric reveals that the Tacit Path completes the knowledge flow at over double the power level (0.36 vs. 0.16 B) of its Explicit counterpart. Thus, the Explicit Path, leveraging technologic implementations for explicit knowledge sharing, accomplishes substantially less knowledge work—at lower energy levels—in the organization, but the corresponding knowledge flows much more quickly. The opposite applies to the Tacit Path, which relies more on interpersonal interaction than technology for knowledge sharing.

D. KM IN PRACTICE

In addition to deductive inference via the Congruence Model and Knowledge Flow Theory, there is much to be learned inductively through the experience of KM practitioners and professional service providers. Although much of such knowledge has been learned through trial and error and imitation—arguably not the best learning modes—these practitioners and providers must convince their organization leaders to fund KM projects, tools and personnel. Hence they must be at least minimally effective, and in many cases they represent the state of the practice in KM. In this section we summarize the state of the practice through three perspectives: 1) organization, 2) tools and 3) techniques.

1. Organization

By "organization" we mean where the KM process fits within the organization structure and how it operates. Most of our corresponding information sources for this part of the study remain confidential, as the authors leverage many personal and professional connections to elicit such information, hence we do not include specific references to all sources (Nissen, 2020). Nonetheless, the information is useful, and it helps to provide organization perspective to KM. We begin with a focus on the US Navy and then summarize KM in industry. The discussion continues with a summary of preconditions for KM success and failure, along with important knowledge flow principles and leadership mandates.

a. Navy KM

As noted above, the US Navy has been employing KM on its carrier strike groups (CSGs), expeditionary strike groups (ESGs) and other organizations (e.g., numbered fleets) for years. In many cases KM plays a central and prominent role by a relatively senior officer (e.g., on the CSG Staff), whereas in others the role is diminished (e.g., within N6 [Technology organization]) or relegated simply to a collateral duty performed at much lower levels. As noted above also, the Navy N1 (Personnel) organization has yet to develop a formal process for KM.

A relatively recent governmentwide symposium highlights some important aspects of Navy KM (DISA, 2018). The DOD and Federal Knowledge Management Symposium, hosted by the Defense Information Systems Agency (DISA), brought together hundreds of federal, academic and private sector experts eager to discover and discuss information sharing solutions for the modern warfighter. The symposium included keynote speeches by knowledge leaders from Amazon and the Armed Forces Communications and Electronics Association (AFCEA), speakers from nearly a dozen federal agencies, and panels of experts from DOD, academia and industry, who shared KM best practices. For instance, Stewart MacLeod, with the United Kingdom Ministry of Defence, said this regarding the importance of KM:

> An effective leader allows people to manage their time doing information sharing, collaborating, and forming networks. … You can't force someone to share

knowledge—you must encourage them, make them want to share their knowledge without ridicule or favor.

This elucidates the importance of leadership in the organization and a recognition by leaders of how important knowledge and information sharing are to organization efficacy. Within the Navy CSGs, for instance, sources indicate that leadership is inconsistent regarding its emphasis and support of KM. Some CSG leaders integrate Knowledge Management Officers (KMOs) into their staffs as peers to the Assistant Chiefs of Staff (ACOSs) that advise the Admiral directly and regularly. Such KMOs enjoy and leverage great access to the Admiral, Chief of Staff (COS) and ACOSs to address and solve organization level issues that cross functional and administrative lines (esp. across N codes within the CSG). As the Admiral's KM representative, such staff level KMOs can also interact at high levels with other ships and organizations within the CSG. From a KM practices perspective, this appears to be the most powerful place for a KMO to be positioned within the organization.

In other organizations, however, KMOs do not play such a prominent role or have access to the same power levels. For example, some CSGs place KMOs within the N6 organization (e.g., N6A or N2/N6A), subordinate to the N6 ACOS on the Admiral's staff. This limits the KMO perspective more to computer, network and technology issues. Such issues are clearly important, but the KMO positioned as such has greater difficulty—and less mandate or authority—to address organization level issues that cross functional and administrative lines. Other CSGs position KMOs elsewhere (e.g., within N3 or N3/N5) with similar effects (e.g., a focus on operations but not organization level issues that cross functional and administrative lines). The same general description applies to other Navy organizations that employ KMOs (e.g., ESGs, numbered fleets, TYCOMs) at various levels.

Still other Navy organizations, especially deployed ships, relegate KM to collateral duties of comparatively low level officers. Much of this stems from limited ship manning and the absence of staffs enjoyed by CSG commanders. Being positioned even lower in such organizations, these officers—who are not

KMOs—have still narrower focus and less ability to address broader organization issues and problems. Moreover, since KM represents a collateral duty in a great many cases, it does not receive the better part of an officer's attention. Hence organization positioning and prioritization of KM represent important considerations.

At a higher level in the US Navy, KM has represented a focal activity within the Chief Information Officer (DoNCIO) organization for over 20 years (Halvorsen, 2014). Building upon prior KM strategy dating back to 2005, the DoNCIO characterizes KM thoughtfully: "… the integration of people and processes, enabled by technology, to facilitate the exchange of operationally relevant information and expertise to increase operational performance." Of course, such information and expertise exchange has been ongoing since the beginning of military warfare and does not depend upon a formal KM program.

However, to continue with the strategy, "… numerous DoN commands have benefitted from the implementation of KM processes, procedures and programs." This strategy is centralized, but its implementation is decentralized, leaving individual leaders and organizations to implement KM as they see fit. Notice also how KM at the Navy level is embedded within the CIO organization: this is very similar to our CSG example from above where the KMO is embedded within the N6 organization with limited access and perspective.

At a higher level also, the US Navy has recently created the Chief Learning Officer (CLO) role (Eckstein & Warner, 2019). The CLO writes about the importance of learning: "If we don't outthink people, we can't outfight them." In an interview, he mentions his role as CLO: "… to align the department's academic institutions, which include the United States Naval Academy, the Naval War College, Naval Postgraduate School, Marine Corps University and the soon-to-be established Naval Community College." The focus is turning education inside the department into a lifelong trajectory in the service.

Although knowledge and learning are interrelated clearly and inextricably—learning increases one's stock of knowledge, and the greater one's knowledge stock, the faster his or her learning (in that domain)—the CLO does

not appear to focus on knowledge *management*: the focus appears instead to be more on the alignment of Navy education institutions. Interestingly, the inaugural CLO decided to leave the Navy and that position after less than one year in the new job (Wheelbager, 2020).

b. Industry KM

Continuing with KM beyond the Navy, which we label "Industry KM" even though it pertains to organizations beyond "industry" (e.g., for profits, nonprofits, consulting firms, universities), we find numerous similarities and differences. Indeed, much of what the Navy has learned and attempted in terms of KM derives from industry experience (Nissen et al., 2000). In the 1990s, for instance, as the term *knowledge management* began to differentiate from *information management*, many organizations in industry augmented their executive ranks to incorporate the Chief Knowledge Officer (CKO) role, sometimes at the CIO level and other times within it.

Even informal sources describe how the CKO and CIO roles are related (Wiki, 2020):

> CIOs tend to be more focused on information technology within an organization (computer systems and the like), while CKOs have more nebulous portfolios including matters such as overseeing patent applications, internal training and documentation, knowledge sharing, and promoting innovative research.

Earl and Scott (1999) expand by noting how CKOs frequently report directly to organization CEOs and have responsibilities that cut across organization boundaries. As a result, exactly what a CKO works on can vary greatly from organization to organization. This is very similar to the KMOs described above (e.g., within a CSG).

The CKO as a formal organization role appears to be fading in terms of popularity, however, although the principal conditions for success can be present through one or more people at various organization levels. Five such conditions include (Lee, 2015): 1) A senior leadership that truly embraces the philosophy and strategy of expertise reuse within the organization. 2) A governance model that mirrors any other important strategy, objective and function that is deemed

important to the organization. 3) Resources in the form of people assigned to perform KM functions to conduct change management, to educate, to train and to support the entire organization's knowledge sharing efforts. 4) Real recognition of the value of knowledge sharing and reuse for both the individual as well as for the organization. 5) A strategy that says knowledge sharing and reuse is about making everything better: the organization's goals are met; the members see and feel the value of their contributions or reuse; and the long term returns of such a strategy far exceed the cost of implementing it.

c. Preconditions for KM Success and Failure

This echoes a similar perspective that includes preconditions for both success and failure (Nissen, 2006), which derive from the change management literature. Table 6 lists eight success preconditions, most of which are likely to be self-explanatory and intuitive. Experience to date suggests preconditions 2, 5 and 7 (i.e., Realistic expectations, Shared vision, Appropriate people participating full-time) represent the ones that are absent or insufficient most often in KM projects.

In terms of expectations (i.e., Precondition 2), KM is not a "silver bullet" and will not cure all organization ills. However, enhancing knowledge flows can enable sustainable competitive advantage, which provides a substantial source of power. Hence realistic expectations—particularly in terms of how much progress can be made and how quickly—are key to successful KM implementation.

In terms of vision (i.e., Precondition 5), not everyone views KM in the same manner or can envision equally well how organization knowledge can flow better through change. Yet all involved knowledge workers need to change their behaviors (e.g., in terms of sharing, searching, learning). A common vision can provide necessary cohesion to their disparate change activities.

In terms of staffing (i.e., Precondition 7), successful change requires thought and action, planning and doing, patience and persistence. Talented people need to be assigned to conceive, plan and implement KM projects. They need to both commit and devote themselves to such projects as well.

Table 6 Preconditions for Success (Adapted from Nissen, 2006)

1. Senior management commitment	Change of any magnitude requires commitment by senior managers. KM should be considered change of substantial magnitude.
2. Realistic expectations	Expecting too much, too fast, can deflate support for change. Change takes time to implement and refine in KM as in other areas.
3. Empowered and collaborative workers	People doing organization work are the ones who will make KM work or not. Knowledge workers need some empowerment for exploration and learning, not just exploitation and doing.
4. Strategic context of growth and expansion	Enthusiasm and optimism can pervade a change project and contribute toward its success, whereas negativity and pessimism can kill it. Setting goals for growth and expansion, through sustained competitive advantage, can facilitate KM change.
5. Shared vision	A vision of how knowledge flows can be enhanced must be conceived and shared broadly in order for empowered people to understand how to change.
6. Sound management processes	The better-organized an enterprise is to begin with, the better its chances for successful change via KM.
7. Appropriate people participating full-time	Successful change requires talented people devoting their attention and effort toward enhancing knowledge flows. Assigning slack, part-time resources is unlikely to produce successful KM change.
8. Sufficient budget	Successful change costs money and requires time. Competitive advantage enabled by knowledge is not free. The KM budget should reflect this reality.

Likewise, Table 7 lists nine failure preconditions. These represent "negative preconditions," which can affect adversely a KM project if present. As with the preconditions for success above, most such preconditions are likely to be self-explanatory and intuitive.

Experience to date suggests preconditions 10, 12 and 17 (i.e., Reliance upon external expertise, Narrow technical focus, Animosity toward staff and specialists) represent the ones that are present and sufficient most often in KM projects.

Table 7 Preconditions for Failure (Adapted from Nissen, 2006)

9. Wrong sponsor	Some characteristics of a "wrong sponsor" include: too low in management ranks, too technically focused, getting ready to retire or change jobs, and lacking credibility and leadership.
10. Reliance upon external expertise	Reliance upon external talent may be necessary to initiate a KM program, but such talent leaves the organization, often before the requisite expertise can be absorbed. This leaves the KM project without sufficient knowledge for sustainment.
11. Cost-cutting focus	People do not react well to change when they feel threatened. A focus on downsizing effectively killed the BPR movement in the Nineties.
12. Narrow technical focus	People, organizations, work processes and technologies must all change—together—for successful KM. A single-minded focus on technology is hazardous.
13. Consensus management	Collaboration without leadership is problem-prone. Tough decisions about KM alternatives are required but are unlikely to be resolved well by consensus.
14. Unsound financial condition	Many organizations attempt KM out of desperation. When management is desperate, then realistic expectations, patience and sufficient budget are unlikely.
15. Too many improvement projects under way	Successful change requires focus. If everyone in an organization changes simultaneously everything they do, then chaos is likely. Organizations are advised to focus on one or perhaps a few KM initiatives at any one time.
16. Fear and lack of optimism	This is the counterpart to the cost-cutting focus above. People associated with change need to believe they are working to improve their own work environment in addition to that of others.
17. Animosity toward staff and specialists	Many leaders and line managers view specialists with contempt and perceive change efforts as disrupting their work processes. Middle management is the place in which resistance to change is likely to be greatest on a KM project.

In terms of reliance (i.e., Precondition 10), many organizations that stand to benefit from enhanced knowledge flows lack the expertise necessary to plan and implement a successful KM project. Hiring external consultants represents a common tactic used by such organizations, but external expertise is expensive generally, and the corresponding knowledge leaves the organization often before

it can be absorbed to sustain whatever KM changes are conceived and/or implemented.

In terms of focus (i.e., Precondition 12), a narrow technical emphasis pervades most KM projects still. Successful KM projects require more than just technology. People, organizations, work processes and technologies must all change—together—in a co-evolutionary manner to enhance knowledge flows. This applies in particular to flows of tacit knowledge.

In terms of animosity (i.e., Precondition 17), most leaders and line managers remain very busy and are proud consistently of the organizations they lead and manage. Staff members and specialists are viewed often with contempt and animosity by such leaders and managers, who may perceive them as disruptive at best and as threats at worst. Middle management represents the place in which resistance to successful KM implementation is likely to be greatest.

d. Knowledge Flow Principles

The preconditions for KM success and failure stem largely from experience with KM projects in industry and beyond. Most such experience reflects trial and error learning (aka on the job training or OJT), which can be a costly, error prone and time consuming approach to organization learning.

Knowledge flow principles offer an alternate organization learning approach that can serve to greatly ameliorate cost, error and time. Inherently deductive in nature (cf. OJT, which is inductive), principles outline how a well-functioning organization should look and operate, hence they can be employed along the lines of a checklist for examination, analysis and correction of problems, even before they arise. The principles presented below derive from both theory and experience, and the key is that a particular organization need not spend the time and money acquiring such experience directly. Rather, it can learn from the experiences of others. A set of 30 knowledge flow principles is summarized here. The interested reader can refer to their source (Nissen, 2014) for details.

Principle 1. Knowledge is distinct from information in enabling competitive advantage. Hence shuttling *information* around via computers,

networks, reports and communications does not address the flow of *knowledge*, at least not directly or on the same time scale.

Principle 2. Knowledge is distributed unevenly and must flow for organization performance. Hence knowledge clumps need to be identified, and knowledge flows need to be enabled through the organization.

Principle 3. Tacit knowledge supports greater appropriability for competitive advantage than explicit knowledge. Hence organization leaders and managers may benefit from an emphasis on tacit knowledge flows.

Principle 4. Knowledge flows must balance exploration through learning with exploitation through doing. Hence understanding the kinds of knowledge that are important in an organization's particular environment is essential for promoting the most important knowledge flows.

Principle 5. Enhancing knowledge flows requires simultaneous attention to personnel, work processes, organizations and technologies. Hence the elements *people, work processes, organizations* and *technologies* operate as a cohesive system and should be addressed as an integrated design problem.

Principle 6. Knowledge enables action directly, whereas information provides meaning and context for such action. Hence understanding whether flows of data, information or knowledge are required in a particular situation depends upon what needs to be accomplished (e.g., resolving uncertainty, deriving meaning, enabling action, respectively).

Principle 7. Data, information and knowledge flows are interrelated dynamically yet distinct *mental* processes. Hence people play the critical role in flows of data, information and knowledge.

Principle 8. Flows of knowledge require supplementary flows of information, data and signals. Hence every flow (i.e., data, information and knowledge) from signal interpretation through knowledge creation, and back, requires some kind of knowledge.

Principle 9. *Explicitness* represents a very discriminatory dimension for evaluating the uniqueness of knowledge. Hence moving knowledge through tacit

versus explicit flows represents a leadership or management decision in many cases, a decision which has implications in terms of *power*.

Principle 10. Information technology supports principally flows of explicit knowledge. Hence the nature of knowledge represents a critical factor for determining where IT can be expected to enhance knowledge flows.

Principle 11. Knowledge exhibits some properties of inertia such as *tendency to remain at rest*. Hence knowledge flow processes represent direct focuses of leadership and management action.

Principle 12. Experiential processes contribute principally toward workflows (i.e., doing), whereas educational processes contribute principally toward knowledge flows (i.e., learning). Hence changes to workflows demand changes to knowledge flows, and vice versa.

Principle 13. Knowledge flows lie always on the critical paths of workflows and organization performance. Hence knowledge flows should be planned and managed like workflows.

Principle 14. Time critical workflows must wait for enabling knowledge flows to run their course. Hence most knowledge flows must complete before critical and dependent workflows can begin.

Principle 15. *Knowledge* is a multifaceted, dynamic and multidimensional concept. Hence the dynamic nature of knowledge has great implication in terms of selecting the most appropriate organization processes to effect knowledge flows.

Principle 16. Information technology is helpful and necessary but not sufficient for knowledge management. Hence leaders and managers need to employ non technologic interventions to enhance knowledge flows.

Principle 17. People—not information technology—are central to tacit knowledge flows. Hence one cannot manage tacit knowledge without managing people.

Principle 18. Information technology plays mostly supportive roles in organization work routines, whereas people play most performative roles. Hence a

focus on IT represents commitment to supportive roles in the organization, whereas a focus on people represents commitment to performative roles.

Principle 19. Expert systems, software agents and like "intelligent" applications address and apply knowledge directly. Hence "intelligent" applications can play a performative role in the organization.

Principle 20. Simulation technology can enhance knowledge flows in addition to workflows. Hence simulation represents a different class of IT, one that facilitates learning as well as doing through virtual practice.

Principle 21. Knowing reflects knowledge in action. Hence knowledge must be put to use through action in order to be useful.

Principle 22. Learning reflects knowledge in motion. Hence learning both uses and increases knowledge.

Principle 23. Knowing and learning beyond the individual offer the greatest potential for knowledge superiority. Hence the impact of leadership and management increases in direct proportion to the reach of knowledge flows through an organization.

Principle 24. Knowing and learning are dynamic, mutually reinforcing activities. Hence promoting doing can limit learning, and vice versa.

Principle 25. Knowing and learning are path dependent, enabling both competencies and rigidities. Hence an organization's knowledge inventory both enables and inhibits what actions it can take.

Principle 26. Knowledge management involves organization change. Hence the leader and manager have much to learn from change management.

Principle 27. Knowledge inventory can be used to assess an organization's readiness to perform its work processes effectively. Hence the leader and manager need to measure the knowledge inventory for every organization.

Principle 28. When estimating the value of knowledge, it is often better to light a candle than to curse the darkness. Hence knowledge measurement provides an approach to assessing the relative efficacy of knowledge flowing through various organization processes.

Principle 29. Culture, trust and incentives affect organization learning and performance as much as process, technology and training do. Hence every organization process should improve its performance over time, and every leader and manager should measure the dynamic performance of repetitive processes.

Principle 30. Computational modeling is useful for knowing and learning about organization knowing and learning. Hence computational models of knowledge flows provide an approach to mitigating the risk inherent in KM programs.

e. KM Leadership Mandates

As noted above, the knowledge flow principles derive from both theory and practice, and they can be applied deductively. The set of leadership mandates summarized here derive from experience, but they can be applied deductively as well: the key is to learn from the experiences of other organizations. Indeed, the principles above have been applied to a set of nine organization cases in practice—three from the for profit sector, three from military and government, and three from nonprofits, which illustrates the broad range of applicability associated with the principles.

The resulting analysis has produced a set of 30 KM leadership mandates, which serve a purpose very similar to that of the principles: an organization can learn from the experiences of others, and hence ameliorate the cost and time of trial and error knowledge acquisition. (The astute reader will recognize similarity between some leadership mandates and preconditions for success and failure summarized above, but the corresponding redundancy is kept to a minimum.) The interested reader can refer to the source material (Nissen, 2014) for details.

Mandate 1. Realistic expectations, shared vision, and appropriate people participating full-time represent the preconditions for success that are absent or insufficient most often in KM projects.

Mandate 2. Reliance upon external expertise, narrow technical focus, and animosity toward staff and specialists represent the preconditions for failure that are present or sufficient most often in KM projects.

Mandate 3. Knowledge representation, attention to tacit knowledge, and focus on organization memory represent unique considerations that merit particular attention in KM projects.

Mandate 4. Knowledge audits can help organizations that do not know what they know.

Mandate 5. In cases where quick results in short conflicts are important, the organization should focus on explicit knowledge flows, but where sustained results in long confrontations are required, tacit knowledge flows offer greater energy.

Mandate 6. Knowledge value analysis privileges tacit knowledge appropriately.

Mandate 7. The greater the use of automation at the beginning of a process, the lower the improvement rate.

Mandate 8. Performance improvement reflected by learning curves involves more than just individual knowing and learning.

Mandate 9. Knowledge can be lost and found.

Mandate 10. Trust cannot be bought.

Mandate 11. Using computational models, organizations can be designed and tested virtually, in a manner similar to the design of airplanes, bridges and computers.

Mandate 12. Specialist and generalist knowledge represent (imperfect) economic substitutes for one another.

Mandate 13. Knowledge flow vectors can be used to represent dynamic knowledge requirements.

Mandate 14. It is essential to plan how knowledge technologies will be used by people.

Mandate 15. The learning curve measures knowledge flows through OJT.

Mandate 16. Socialization and acculturation represent viable approaches to enhancing tacit knowledge flows.

Mandate 17. Transorganization collectivities (e.g., communities) may have greater influence over employee knowledge, culture and performance than leadership and management.

Mandate 18. Knowledge flows critical to enabling critical workflows center on tacit knowledge.

Mandate 19. An organization process without consistent improvement over time suffers from knowledge clumping.

Mandate 20. Members of a team must learn to work with one another before knowing how to work together on a project.

Mandate 21. Ten unique knowledge-flow processes are required for military task force efficacy.

Mandate 22. OJT involves knowledge flowing at two different speeds: knowledge application through doing is fast; knowledge creation through learning is slow.

Mandate 23. Given the time critical nature of warfare, most tacit knowledge must already be in place when the officer reports first for duty.

Mandate 24. Systematic storytelling can increase the reach of this time honored and effective approach to sharing tacit knowledge.

Mandate 25. Socialization, teamwork and acculturation must interconnect to enable healthy knowledge flow circulation.

Mandate 26. Leading by example and evangelism represent viable approaches to enhancing acculturation knowledge flows.

Mandate 27. Once one understands a relatively small set of key knowledge flow processes, he or she can analyze any knowledge flows—healthy or pathologic—in any organization.

Mandate 28. The key to self-organization is having people enjoy what they do together.

Mandate 29. The ability of different people to work together on teams is just as important as the individual skills and experiences they bring individually.

Mandate 30. Leaders who are concerned about acculturation knowledge flows must address participants' beliefs.

2. Tools

By "tools" we mean the technologic implementations that enhance, facilitate and otherwise support people accomplishing work processes in the organization.

Table 8 Common KM Tools

Tool Category	Description	Examples
Groupware	Technology for collaboration	- email, web publishing, wikis, filesharing - Video/audio conferencing, chat, forums - Project management systems - Workflow systems
Intranet & Extranet	A small version of the Internet within the organization (Intranet) and between key connecting partners (Extranet)	- Web applications - File sharing - Transactions - Everything Internet but internal - Secure and private access
Data Warehouse	Centralized data to support decision making, pattern matching and knowledge discovery	- Big Data applications - Data mining - OLAP - Machine learning
Decision Support	Provide information and knowledge to support decision making	- Dashboards - Reports - Drill downs - Analyses
Content Management	Facilitate creation, management and distribution of Web content	- WordPress - Joomla - Drupal - Magento - Squarespace - Wix - TYPO3
Document Management	Facilitate publishing, storage, indexing and retrieval of documents	- Capture - Classification - Metadata - Indexing - Search & retrieval - Versioning - Security
Document Sharing	Share online documents	- ZenDesk - Helpjuice - Sharepoint - Help Scout - Freshdesk - Intercom - LiveAgent - HappyFox - Groove - AzureDesk
Knowledge Retrieval	Retrieve online knowledge and information	- Knowledge repository - Knowledge search - Knowledge summarization
Open Source Knowledgebase	Nonproprietary systems	- eXo - Documize - phpMyFAQ - OpenKM

As they pertain to KM, most tools leverage information technology (IT), and they are supportive in nature (Nissen, 2014), meaning that such tools support people as they perform knowledge work. The other major class of tools are performative in nature, meaning that such tools perform knowledge work directly, either in conjunction with or

in lieu of people. Many artificial intelligence (AI), machine learning (ML), autonomous and robotic systems are performative in nature. Simulation offers some combination of supportive and performative capabilities.

For several instances of supportive tools—with absolutely no attempt to be either exhaustive or comprehensive—Table 8 lists nine categories used commonly in the KM context. These include groupware, intranet and extranet, data warehouse, decision support, content management, document management, document sharing, knowledge retrieval and open source knowledgebase. We provide a brief overview of each in turn.

a. Groupware

Beginning with groupware, this category refers to IT for collaboration. Most of the examples listed are likely to be highly familiar to the reader and common in the contemporary office environment. The now ubiquitous email has largely replaced most paper systems for communication (e.g., letters, memoranda, reports) and is used by most knowledge workers every day.

Web publishing applications subsume the content management and document management categories discussed below, as they refer generally to facilitating the creation and organization of Web content within and between organizations. Generally a Webmaster or like role maintains control over each particular website.

Alternatively, Wikis refer to online content that is open to addition, deletion and refinement by users. *Wikipedia* represents a well-known example, but many organizations create wikis for internal use. Filesharing applications subsume the Document Sharing category below, as they enable files to be shared between peer computers (e.g., two end user machines) or between end users and one or more centralized file repositories.

Video and audio conferencing refers to technologies that enable live, synchronous conversations between people in different places (i.e., same time, different place). The earliest systems supported audio only (e.g., speaker phones, call joining), and then ISDN (integrated services digital network) created sufficient bandwidth to support video as well. We discuss more current technologies that extend well beyond ISDN below.

Chat refers to the ability to send text messages between devices. Many people with cell phones use chat to communicate via text in lieu of voice telephone calls, and as discussed further below, many contemporary websites employ chatbots to enable chat functions between users and organization representatives.

Forums (or fora) refer to websites that enable users to exchange ideas through topic areas and threaded conversations. Facebook provides an example of technology along these lines, as do discussion boards and like applications that have been in use for decades.

Project management systems provide online access to key documents (e.g., schedules, budgets, statements of work) used for coordination and management of projects in and between organizations. They are subsumed by workflow systems, which replace paper based approaches to organizing, coordinating and accomplishing work across multiple people in the organization. Paperless factories, hiring processes, loan applications, and many other applications of workflow systems are common.

b. Intranet & Extranet

Intranet refers to the same kinds of computer and network technologies that underlie the Internet (esp. TCP/IP [transmission control protocol and internet protocol], WWW [World Wide Web], HTML [hypertext markup language], routers) but are set apart and accessible only to people within an organization. Many organizations create and maintain extensive intranets that support browsing, search, web publishing, wikis, chat, forums, file sharing, transactions and other applications.

Extranet refers to the same features as intranet, except that access is extended beyond a single organization. Typical extensions across organizations include trusted partners such as suppliers, customers and project participants beyond the home organization. Extranets can integrate seamlessly with intranets and the Internet at large. The key difference, as with intranets, centers on limited access: Internet resources are accessible generally to everyone, whereas intranets

and extranets are accessible only within each specific organization and set of trusted partners.

c. Data Warehouse

Data warehouse refers to technologies that serve to centralize data—often from myriad different individual databases and sources—to support decision making, pattern matching, knowledge discovery and like applications.

Big Data refers to the current trend of constructing immense data warehouses for analysis. Data mining applications (e.g., Clementine, Palantir, ORACLE) are used to identify patterns in data warehouses.

OLAP (online analytic processing) leverages databases and related software to structure queries, produce reports and identify patterns through data analysis.

Machine learning (ML) represents a powerful AI technology that enables machines to learn over time and through practice. Most ML is supervised, meaning that one or more people must train each system through examples. Artificial neural networks (ANNs), which employ connectionist algorithms patterned loosely from neuronal connections in the human brain, represent a very common ML approach today, particular where deep learning (i.e., ANNs developed with many internal layers) is involved. We discuss ML further below.

d. Decision Support

Decision support refers to technology used to provide information and knowledge to support leadership and management decision making in the organization. Dashboard applications present an organization's key status information through an informative, generally graphic interface. "Stoplights" are common, through which the status of various organization projects, events, situations and endeavors is color coded (e.g., green implies all is well; yellow implies some issues; red implies serious problems).

Many decision support systems interface with databases (and data warehouses) to produce reports for leaders and managers. Many such reports must be created (i.e., programmed) by technical specialists for end users such as leaders, managers and staff personnel—many of whom lack the required technical

skills—whereas some systems are sufficiently intuitive and flexible to enable reports to be created directly by end users.

Drill down capabilities enable a leader or manager to examine details, sometimes through numerous levels, of dashboard, report and other decision support items. For instance, a dashboard could display status information for a leader's or manager's whole organization, and then a drill down capability could enable him or her to examine the details (e.g., status, issues, costs, schedules, responsible manager, contact information). As with reports, analyses can be designed and programmed by technical people, conducted by staff members, or possibly arranged by leaders and managers directly.

e. Content Management

Content management refers to technologies that facilitate the creation, management and distribution of Web content. The associated applications are analogous to how word processors are used to create, modify, print and share documents. WordPress, Joomla, Drupal, Magento, Squarespace, Wix and TYPO3 represent a few of the applications used historically for content management.

f. Document Management

Document management refers to technologies that facilitate the creation, management and distribution of documents. This is very similar to content management, but the focus is on documents as opposed to the broader content categories supported through content management. Hence content management subsumes document management and represents a more inclusive, newer technology category.

Nonetheless, document management plays an important role in the organization, as many organizations have huge documentation needs. A combination of centralized applications help organizations to capture documents from various departments, groups, users and locations, often in a central document repository or like system. Documents can be classified, for instance with metadata to indicate document types (e.g., contracts, reports, specifications), origins (e.g., creators, contributors, dates), sensitivities (e.g., classified, confidential, open) and other attributes.

With metadata and other attributes, documents can be indexed to facilitate search and retrieval, and some applications support versioning, which reveal how each document changes over time (e.g., who made a change, what change was made and when, how one can revert to a prior version). This is analogous to how contemporary word processing applications support change tracking, for instance.

Document management must clearly be concerned with security also. As noted above in terms of metadata, different documents have different levels of sensitivity, and document security is important to restrict access to people who are authorized to view them.

g. Document Sharing

Document sharing is related closely to document management, as it pertains specifically to technologies that facilitate the sharing of online documents. This represents very mature technology, as evidenced by the relatively large number of applications listed in the examples column (i.e., ZenDesk, Helpjuice, Sharepoint, Help Scout, Freshdesk, Intercom, LiveAgent, HappyFox, Groove, AzureDesk). Many of these applications have broader uses than just document sharing, but they illustrate a wide array of examples.

h. Knowledge Retrieval

Knowledge retrieval refers to technologies that enable people in organizations to retrieve online knowledge and information. Most of the technology categories from above are involved with knowledge retrieval (e.g., intranet & extranet, data warehouse, decision support, content management, document management). However, drawing from KFT above, one can make a distinction between *knowledge* and *information*: knowledge enables action, whereas information provides meaning and context for action (Nissen, 2014). Hence knowledge retrieval arguably operates at a higher level (i.e., focusing on actionable knowledge) than information systems (i.e., focusing on contextual and factual information).

One example would involve "know how" (e.g., the ability to accomplish some action in the organization) vs. "know what" (e.g., the understanding of what something in the organization means), "know who" (e.g., the understanding of

who is a subject matter expert in the organization), "know where" (e.g., the understanding of where some resource is located in the organization) and like distinctions.

In such light, a knowledge repository, for instance, would include resources that enable someone to accomplish actions in the organization. This could be via a "how to" document, training resource, instruction video, decision guideline or like content that enables performance of one or more actions in the organization.

Likewise, knowledge search refers to the ability to find "know how" within a knowledge repository, which could use many of the same features associated with document management (e.g., metadata, indexing, versioning).

Knowledge summarization in turn refers to presentation of knowledge to the most appropriate person, at the most appropriate time, and in the most appropriate format. Not everyone learns or processes knowledge and information in the same manner, so the same knowledge can be summarized in different ways (e.g., via documents, charts, graphs, videos) for different people.

i. Open Source Knowledgebase

Finally, open source knowledgebase refers generally to nonproprietary systems developed and employed to accomplish functions associated with one or more of the tool categories and examples above. Indeed, a great many of the tools, applications and examples in the table reflect proprietary systems, which are compiled by system developers and closed to users in terms of examining or modifying the underlying code. This is fine for a great many users—who lack the skills or interests in modifying source code—but some organization users are interested in customizing their applications. Open source knowledgebases enable user examination and modification of the code, and hence functionality, of the systems. A few examples are included in the table (e.g., eXo, Documize, phpMyFAQ, OpenKM).

Some of these categories and tools are a bit dated as of this report writing, but they provide a useful summary of tools, which we augment with more contemporary and emerging tools below. Our familiarity with and

understanding of these tools stem principally from our general KM experience, but we also contact professional colleagues for additional references and insights. For several instances of supportive tools, Table 9 lists five contemporary and emerging tool categories along with corresponding examples of newer applications. These include search, communication, knowledge organization, automation and extended reality. We provide a brief overview of each in turn.

Table 9 Contemporary and Emerging KM Tools

Tool Category	Description	Examples
Search	Locate & retrieve resources	- Google - Bing - Lexical -AIML
Communication	Support multimedia communication	- Cell phone & text - Slack - Skype - Zoom - Stream - Fluid - Teams - Cortex
Knowledge Organization	Organize knowledge resources	- Metadata - Taxonomies & ontologies - Frequently Asked Questions (FAQs) - Frequently Required Answers (FRAs)
Automation	Automate work processes	- Autotagging - Autoclassification - Natural language processing (NLP) - Chatbots - Knowledgebots - Digital Assistants - End user coding
Extended Reality	Technologies that simulate or enhance interactions with the world	- Simulation - Immersive interfaces - Virtual reality (VR) - Augmented reality (AR) - Spatial, Arthur, Flow, Hololens

j. Search

We note search above in the context of locating and retrieving resources, principally documents, in an online environment. Here the term applies to resources of all kinds (e.g., documents, plans, spreadsheets, presentations, videos, personnel contacts, instructions).

The first two examples are likely to be highly familiar to the modern reader: Google and Bing are two very well-known search engines that operate with most Web browsers. These engines accept natural language queries—which can be delivered via voice as well as text input—and produce prioritized outputs

in milliseconds. The underlying technologies differ across these and other engines, but they all involve some type of crawler—which traverses the Web and indexes websites—and search algorithm. Most such algorithms are proprietary, and many details are retained as trade secrets.

Lexical analysis tools enable search on indexed terms. This implies that the search involves meaning in addition to simple word matches. NASA uses a tool within this category called GOLDFIRE.

AIML represents the AI and ML technologies noted above. This involves generally proprietary search algorithms that organizations license, develop and use to both enhance search (e.g., via AI) and learn through experience (e.g., via ML). These represent cutting edge tools, which continue to emerge and evolve. In many cases, the AIML aspects are embedded within other search capabilities and remain opaque to the user; that is, most users are unaware of the underlying technologies that support their search tools.

k. Communication

Communication tools are also likely to be familiar to the modern reader. In addition to the kinds of groupware, intranet & extranet, document sharing and like tool categories discussed above, modern communication tools support multimedia communication within and between organizations. Modern communication tools can also utilize cellular networks for connectivity, which is particularly interesting at present with the gradual roll out of 5G (Fifth Generation) wireless cellular networking.

Not much needs to be said regarding cell phone and text communication. Cell phones enable people to make and receive calls without landline telephones, and they enable the exchange of text messages wirelessly as well. Most modern cell phones are also Internet capable, enabling Web browsing, supporting email, and facilitating a host of additional applications (e.g., banking, social networking, navigation).

Slack extends the capabilities of cell phones—and can be used on laptops and other computers as well—with persistent chat rooms (channels) organized by topic, private groups and direct messaging. Content, including files,

conversations, and people, is all searchable within Slack, and users can add emoji buttons to their messages, on which other users can then click to express their reactions. Slack teams allow communities, groups or teams to join a "workspace" via specific URL or invitation sent by a team administrator or owner. Although Slack was developed for professional and organizational communication, it has been adopted as a community platform, replacing many message boards and social media groups.

At the time of this writing—during the COVID19 Pandemic—video communications have gone mainstream. Long gone are the days of videoconferencing being expensive and the domain only of large organizations: Web video applications can be accessed and used for free in many circumstances by comparably unsophisticated people ranging from young children to the elderly.

One of the longstanding applications in this category is Skype, which has been used for many years from people's cell phones, tablets, computers and other Internet devices. Indeed, "Skype" became a common verb in the 2000s, where people would say something along the lines of, "I'll Skype you tomorrow morning." Skype, like other applications in this category, utilizes a set of Internet protocols to set up a communication session, maintain quality communication over the networks, and eventually tear down each session as people's machines detach. In addition to seeing and hearing one another, users can share their screens (e.g., to view and discuss documents or presentations simultaneously) and exchange files through the application to facilitate remote communication, work and collaboration. Most people use Skype for person to person communications between two people, although the application can support up to 50 people communicating simultaneously.

Zoom provides a similar capability, and this application has become very popular. Indeed, during this period of social distancing and working from home, many social, emotional, educational and professional activities are conducted via Zoom. The authors of this report use Zoom routinely for collaboration, for instance, and one of the authors has taught college courses via the technology. In addition to video conferencing, Zoom supports online chat, emoji participation

(e.g., raising hand, signaling approval or disapproval, clapping hands), limited file exchange, and breakout rooms, through which plenary groups can be divided—randomly or deliberately—into smaller groups and then regrouped.

The remaining communication tools listed are offered by a single vendor, and they have been integrated progressively into an ever expanding tool suite over time. Specific applications such as Stream (for video sharing) and Fluid (for remote collaboration) appear to be folding progressively into larger tool suites such as Teams, which integrates myriad Windows applications and permits all of the constituent capabilities (e.g., email, calendar, chat, video, screen sharing, file exchange, group channels) to work together in support of remote collaboration. Many of these capabilities are similar to those available through other tools (e.g., Zoom), but the Windows integration sets this one apart.

Finally, Cortex represents a very new application that uses AI to deliver insights and expertise through common applications (e.g., such as those noted for Teams above). Application documentation indicates that it uses AI to reason over content across teams and systems, recognizing content types, extracting important information, and automatically organizing content into shared topics like projects, products, processes and customers. Cortex then creates a knowledge network based on relationships among topics, content and people. Automatically generated new topic pages and knowledge centers enable people in the organization to curate and share knowledge through a wiki-like interface, and as with Teams, it interfaces seamlessly with other Windows applications.

l. Knowledge Organization

Knowledge organization refers to technologies that help to organize knowledge resources in ways that facilitate search, retrieval and use. We mention metadata above as a means to categorize the content associated with data, information and knowledge. Metadata describes the nature of such content and facilitates indexing for faster and more accurate search. Here the focus is more on knowledge content, but the techniques are largely the same.

Taxonomies and ontologies are used to establish and reveal structure to knowledge. With origins in Biology, where taxonomies are used to classify

different organisms (e.g., hierarchically, in terms of species, genus, family, order, class, phylum, kingdom, domain), organization knowledge taxonomies can be very helpful to facilitate knowledge search and retrieval, particularly when they are built around organization workflows and knowledge needs. Taxonomies can contribute to making explicit knowledge (esp. that is embedded in documents) available at the point of need. They also help with the mapping and categorization of tacit knowledge embedded in staff expertise.

Ontologies derive from Philosophy and are used similarly to interrelate concepts. Within our KM context, an ontology is a formal description of knowledge as a set of concepts within a domain and the relationships that hold between them. Most ontologies interrelate concepts using a graph (e.g., depicted often as a tree diagram), with instances (i.e., specific examples), classes (i.e., collections of similar specific examples), attributes (i.e., characteristics of classes and instances) and relations (i.e., relationships between instances and classes). Ontologies can also include restrictions, rules and axioms. Overall, they provide a visual and logical structure to interrelate key knowledge in the organization, and they are developed often using specific tools (e.g., OWL: Web Ontology Language). The Naval Special Warfare Organization is evaluating a tool in this category called TopBraid Enterprise Data Governance.

Frequently asked questions (FAQs) are very common across myriad websites today, as a great many users and people accessing organization sites tend to have similar questions. Instead of assigning organization staff members to field the same questions repeatedly, a FAQ list is created often and posted on the website, generally with strong encouragement for people to consult such list before contacting representatives within the organization. As new questions accumulate and become common, the FAQs can be expanded to incorporate them. FAQs in the KM context can be used to point people to knowledge sources, both explicit (e.g., documents) and tacit (e.g., subject matter experts or SMEs). Similarly, frequently required answers (FRAs) represent sets of answers to FAQs.

m. Automation

Automation is not unique to the KM domain, as the term applies whenever tasks are routinized and converted for automatic performance without human effort or intervention. Within the KM context, automation serves to automate work processes in the organization, focusing generally on those related to knowledge and knowledge work.

Autotagging represents a feature in several websites that automatically appends a custom code to destination URLs to help track user interactions via website tracking programs. Within the KM context, as websites are developed to help people in the organization to locate and utilize knowledge resources, autotagging can quantify which specific site resources are accessed most frequently, how long people spend on any particular resources, where they click next, and like information about how people interact with sites. This can help to guide site managers and developers to continually make more resources available, prune or highlight resources that are not accessed, and improve the utility of websites and knowledge resources.

Autoclassification is a set of technologies that make it possible for documents to be categorized without human intervention. Found often as features of content management systems, discussed above, an autoclassifier scans a document and assigns it a records management classification code based on its content. This can automate an otherwise burdensome, manual process while enhancing consistency and potentially enabling faster document retrieval.

Natural language processing (NLP) is a subfield of linguistics, computer science, information engineering, and AI concerned with the interactions between computer and human languages, in particular how to program computers to process and analyze large amounts of natural language data. NLP represents a huge leap from structured queries and restrictive forms, through which users must learn each system's specific interface and syntax. Instead, users are able to ask questions through words and phrases that are familiar to them—with each user potentially asking similar questions differently—and interface with systems that can interpret such questions and locate knowledge resources to help answer them.

NLP underlies several other tools in this category, and the interface can be via text or speech in many systems.

Chatbots, for instance, are AI systems that can simulate a conversation (i.e., chat) with a user in natural language through messaging applications, websites, mobile apps or the telephone. This provides a more interactive experience than that supported by FAQs and FRAs, but the idea is similar, in that organization personnel are not required to interact with users, hence the automation.

Knowledgebots, as another instance, build upon the capabilities of chatbot to access deeper knowledge and support more detailed and specific dialog. A chatbot may be able to understand a user query and access some knowledge resources (e.g., FAQs, FRAs, personnel lists) to provide answers, but the capability can break down whenever the most appropriate—or even satisfactory—resource cannot be located, which calls generally for a person to intervene and take over the dialog. Knowledgebots incorporate additional knowledge that is specific to a domain, which enables them to carry on longer and more in depth conversations.

As knowledgebots become increasingly knowledgeable (e.g., via AI) and capable of learning (e.g., via ML), their capabilities can continue to increase, particularly as they focus on a narrow and specific knowledge domain. Indeed, the narrower the knowledge domain, the more that bots can specialize and develop increasingly deep knowledge. Dreams of AIML systems with *both* broad *and* deep knowledge combined remain beyond our current technologic reach, but bots that have *either* broad *or* deep knowledge are powerful and technically feasible today. Digital assistant refers to such bots that are developed with increased knowledge and corresponding capability within a knowledge domain.

Finally, end user coding represents an approach to computer software development that enables people without software engineering or programming skill to develop, modify or refine systems. Within the KM context, one would like to see end users interface with their own knowledgebots and digital assistants to personalize them, without the need for programmer support.

n. Extended Reality

Extended reality (XR) refers to technologies that simulate, augment or enhance people's interactions with the world. Simulation does not extend reality per se, but it provides an opportunity for people to practice activities in an environment that resembles but is separate from reality. Flight simulators, for instance, enable pilots to learn and practice aircraft maneuvers without flying physically. Instead, a virtual representation of aircraft controls and cockpit views is created, with which pilots can interact to practice maneuvers that are routine (e.g., taking off and landing) and extreme (e.g., emergency procedures) without the cost, time or risk of flying physical aircraft. Many flight simulators, to continue this instance, offer sufficient fidelity that pilots receive credit in terms of "official flight hours" during their simulator time. Within the KM context, a simulator can enable anyone in the organization to develop and expand tacit knowledge through experience with the simulator, without the cost, time or risk of performing the corresponding organization actions physically.

Immersive interfaces, for instance used for many console and online games, are developed by programmers to give users the impression of being in an artificial world. Each person is represented generally by some kind of avatar, which interacts within such artificial world on behalf of the user. Artificial worlds are tedious and time consuming to create and maintain, hence they lend themselves to massive use of the same world (e.g., an online game played by many people). Within the KM context, immersion within an artificial world can provide people with insights into concepts and relationships that would be difficult to visualize, explain and understand otherwise. Many people studying very small entities such as molecules, proteins and viruses, for instance, can utilize artificial worlds for visualizing complex and challenging structures and interrelationships.

Virtual reality (VR) combines aspects of simulation and immersive interfaces to enable people to experience artificial worlds and practice performing activities within them. Within the KM context, VR can be used to help people in the organization engage with different kinds of customers, operate and maintain

different kinds of equipment, and any number of like activities that could add value to the organization and enable people to enhance their tacit knowledge through practice without incurring the cost, time and risk of interacting with the physical world. As with immersive interfaces, however, considerable cost, time and expertise are required to develop and maintain VR, and fully immersive experiences require special headsets, which can become uncomfortable and even disorienting for users.

Finally, augmented reality (AR) combines some aspects of VR with an ability to view and interact with the physical world simultaneously. Generally using some kind of headset or screen, a user can view and interact with the physical world as normal, but AR technology can superimpose additional images to enhance the user experience. A common example pertains to televised American Football games, where the field can be viewed on one's television screen and appear identical to the view of someone in the stands. However, via AR, such screen view is superimposed with other markers such as the first down line, which is not marked physically on the field, and which moves to various locations as each game progresses. Within the KM context, AR can support people performing organization work activities in an enhanced way. A technician could, for instance, examine directly some part or system that is not working correctly, but with AR support, the detailed drawings, schematics or like information corresponding to such part or system could be superimposed and view simultaneously.

Some XR tools include Spatial, Arthur, Flow and Hololens, all of which support organization collaboration using VR, AR and immersive interfaces.

3. Techniques

By "techniques" we mean the set of organization processes used to promote KM. Although many techniques are supported, enabled or enhanced by tools, the emphasis is on what is done by people, not tools. In this section, we describe a set of common and emerging techniques from practice, followed by a summary of Navy KM strategy.

a. Common and Emerging Techniques

We begin with a summary of common KM techniques found in industry, government and nonprofit sectors, principally in the US. Table 10—with absolutely no attempt to be either exhaustive or comprehensive—lists a number of such common techniques. These include on the job training, cross functional teaming, training and education, consulting and contracting, storytelling, mentoring and coaching, benchmarking, community of practice, social media, crowd sourcing, peer assist, simulation and enactment, tool adaptation and virtualization, C2 integration, and embedded and integrated KM. We provide a brief overview of each in turn.

Table 10 Common and Emerging KM Techniques

Technique	Description
On the Job Training	Learning by doing
Cross Functional Teaming	Teaming people representing different functions
Training & Education	Formal and informal courses
Consulting & Contracting	Hiring outside expertise
Storytelling	Sharing experiences
Mentoring & Coaching	Pairing novices with experts
Benchmarking	Studying the practices of other organizations
Community of Practice	Informal group of people sharing common interests
Social Media	Social media applications within the organization
Crowd Sourcing	Asking organization peers for input to problems and issues
Peer Assist	Asking organization peers for direct assistance with problems and issues
Simulation & Enactment	Learning and practicing through simulation
Tool Adaptation & Virtualization	Adapting existing tools for KM purposes, remote collaboration & performance
C2 Integration	Integrate KM with C2
Embedded & Integrated KM	Weaving KM into the organization work processes

(1) On the Job Training

On the job training (OJT) is a euphemism for trial and error learning: a person is assigned a set of work activities to perform and required to learn over time—often with minimal guidance, direction or support—as such activities are accomplished—often slowly and with many errors. Although OJT does not represent a particularly advanced technique—and both its efficacy and efficiency are highly questionable—it represents the most common KM technique in the Navy, if not most organizations: simply put someone in a job, and let them learn over time and through experience. Many of the techniques described below (e.g.,

training and education, storytelling, mentoring) are intended to mitigate or ameliorate the negative effects of OJT, hence accelerating learning.

(2) Cross Functional Teaming

Cross functional teaming is neither new nor specific to KM, but it represents an important technique. The key idea—borrowed from Project Management—is to form teams of people representing different functions (e.g., Marketing, Engineering, Manufacturing; N2/N6, N3/N5, N4) in the organization to participate on programs, projects or problem solving issues that span such functions. The technique can be effective in terms of breaking down functional silos and enhancing communication and collaboration across functions. This can help to accelerate knowledge flows and workflows alike, as people with different backgrounds and areas of expertise both share and apply tacit knowledge toward organization work.

The organization should use cross functional teaming only sparingly, however, for the overhead and coordination costs of forming and maintaining these teams can be high, and although the approach can lead to greater efficacy in the organization—particularly for problems that are fundamentally cross functional in nature—it is inherently less efficient than the functional hierarchy, particularly for routine work.

(3) Training and Education

Training and education are likewise neither new nor specific to KM, but together they represent an important technique also. Indeed, training and education are fundamental to Navy organization (e.g., the N7) and processes (e.g., training courses exist for nearly every rate and job), and a specialized organization like the Navy could not function without extensive training: the requisite skills are so unique that people cannot be expected to master them without being trained specifically.

Similarly with education, the Navy can and does certainly hire people with degrees from civilian colleges and universities, but the

education from such schools lacks a Navy focus. By comparison, Navy undergraduate (e.g., Naval Academy), graduate (e.g., Naval Postgraduate School) and specialty (e.g., Naval War College) education provide the same high quality as top civilian colleges and universities, but they also offer a specific Navy focus.

Training courses are designed generally at a somewhat lower, and more immediate, detailed and job specific level than their education counterparts. For instance, any A School or C School course for one rate would be specific to the corresponding job that a sailor would fill either currently or likely on his or her next assignment, and it would be very specific to the activities that must be performed through that job. When a sailor changes jobs or advances to higher organization levels, he or she must often complete additional training courses in preparation.

Education courses, in contrast, are designed generally at a higher, longer term, more general and job neutral level. For instance, a degree in Computer Science, Information Science, or Management would likely include more theories and models, address a wider range of different problems, settings and situations—including some that students may not encounter until they've worked in the field for many years—and not be specific to any particular organization or job (e.g., leadership). When an officer changes jobs or advances to higher organization levels, he or she would not necessarily expect to complete another education degree.

This being said, however, a specialized (e.g., Master of Science) or otherwise advanced (e.g., Master of Business Administration) degree may become important as an officer is screened for increasingly higher level jobs in the organization (esp. command). Indeed, many officers complete multiple advanced degrees during their shore tours.

The general distinction that we make above between training and education does represent a rigid difference or boundary. Whereas we tend to think of training in terms of specific courses and education in terms of degree programs, many collections of individual training courses can be

designed as a set and must all be completed before a sailor is qualified to perform a specific job. Likewise, whereas we tend to think of education in terms of degree programs, many individual education courses can be designed to be taken alone or in small sets (e.g., certificate programs).

Training and education represent some of the most powerful KM techniques available to the organization. Particularly in organizations that are tasked with heavy workloads, whose people are focused on task accomplishment—often under tight time constraints—it can be an immense challenge to get the attention of leaders and their people to learn about KM. This is despite the huge potential that KM offers to lighten the burden of heavy workloads, enable people to accomplish tasks more efficiently and effectively, and loosen the impact of time constraints.

(4) Consulting and Contracting

Consulting and contracting together represents an approach to the organization accessing specific knowledge from external sources. This can be useful when such knowledge is too specialized, advanced, urgent or ephemeral for organization personnel to learn directly, in addition to when the organization lacks a sufficient number of people to accomplish the associated work activities along with their other job responsibilities.

Regarding specialized knowledge, for instance, many organizations choose to contract for outside expertise to support cyber security activities: such organizations may lack the resources to have its personnel educated and trained to provide effective cyber security directly. Likewise with advanced knowledge, as another instance, many organizations choose to contract for outside expertise to support AIML tool development: such organizations cannot afford to send people away to earn the advanced degrees required to develop effective AIML tools directly. Similarly with urgent knowledge, as a third instance, many organizations choose to contract for outside expertise to support urgent requirements—such as the development of a new training course on working from home—that fall beyond its core competencies: such

organizations cannot afford to wait for its personnel to acquire the expertise needed to develop an effective new course. Finally with ephemeral knowledge, as a fourth instance, many organizations choose to contract for outside expertise to support some novel, nonrecurring task: such organizations cannot afford to disrupt the work and learning trajectories of its people just to address a problem that is unlikely to recur.

Differences between consulting and contracting are subtle, as the organization pays outside companies and like institutions to provide advice and perform work directly. In the case of consulting, the level of advice and work are generally relatively high (e.g., in support of leaders), and the term of engagement is generally relatively short (e.g., a year or less). Also, there is often little opportunity for knowledge sharing between consultants and organization personnel.

Alternatively, many contractors perform comparatively detailed work tasks directly and can remain working within the organization for many years. The organization can have more and better opportunities to learn from contractors, particularly where they work alongside organization personnel and accomplish enduring organization activities. Where organizations fail or are unwilling to take advantage of such opportunities, they can remain dependent upon contractor personnel for essential knowledge in perpetuity. This makes such organization dependent upon the contractor for essential work.

A third source of quasi outside expertise centers on the civilian workforce that is embedded within most military organizations. Although civilian personnel are not part of the uniformed military—and hence have different administrative lines, careers and job expectations—they represent an integral part of the corresponding military service, and they work both for and alongside military leaders and service members.

Most importantly as a KM technique, the use of military civilians supports the incessant rotation of military members. For instance with the officer corps of most US military services, officers are expected to grow

and progress through the organization more as generalists than specialists, with many people changing jobs every two to three years. This implies that such officers can acquire only limited knowledge while in any specific job, even though many jobs require much more time and energy to learn well. Their civilian counterparts, on the other hand, are expected to stay within a comparatively narrow career field, sometimes through their entire careers. This enables such civilians to accumulate deep organization knowledge over long periods of time. Such knowledge tends to be rich, experience based and tacit, which supports high energy knowledge flows through the organization. Unlike with consultants and contractors, whose personnel are distinctly outside the military organization, the civilian workforce is integral.

(5) Storytelling

Storytelling represents an ancient art and practice. Indeed, people have been learning through stories for millennia, and aside from OJT, storytelling represented the primary source of learning before people were able to read and write. As a KM technique, storytelling is very powerful, particularly because it represents a natural social activity that most people perform without even considering its KM implications; that is, storytelling comes naturally to most people, who practice it as a normal pattern of conversation, both within and beyond the organization and workplace.

Storytelling is powerful also, because it can support tacit knowledge sharing; that is, where participants have the opportunity to interact directly, each person can have multiple opportunities to ask questions and receive answers that are specific to him or her, and he or she can also ask follow up questions, proffer insights, consider related examples, and apply the morals and lessons of stories to personal and professional situations. This differs from reading explicit knowledge (e.g., documents) that is neither personal nor specific to someone hearing the story, and the level of interaction can become more intense through storytelling that is achievable often in the classroom. Moreover, people

can develop a sense of trust and relationship through storytelling, and such sense can facilitate mentoring and coaching.

(6) Mentoring and Coaching

Mentoring represents another ancient technique involving the pairing of novices with experts. Most people have experienced mentoring from their parents, so the concept is very familiar, but fewer people have experienced mentoring in the workplace. Most mentoring in the organization is informal, stemming generally from a more senior and higher ranking person taking a personal and professional interest in someone with less experience and lower position. Mutual satisfaction and benefit can accrue often through mentoring, as the mentor can enjoy helping someone to develop, and the mentee or protégé can enjoy the benefits of personalized tacit knowledge sharing.

Many organizations see clear benefits of mentoring, particularly as the technique can help to accelerate people's learning in the organization, and the trusted bonding that forms often between mentoring participants can enhance the organization climate. Some organizations push this natural and informal technique further and mandate mentoring as an institutional practice. Such practice comes with numerous challenges, however, as forced (mis)matches between senior and junior people in the organization can mitigate, obviate or even undermine the benefits of mentoring.

Coaching is similar to mentoring, as someone with considerable experience takes an active professional interest in someone with less and works to accelerate that person's learning in the organization. Coaching tends to be less personal than mentoring, and as with sports, one coach can take on numerous people, whereas mentoring tends to be dyadic. As with mentoring, coaching can also be informal or formal: in the former case, someone with experience voluntarily seeks out to assist less experienced people; whereas in the latter, a more senior person is directed to assist

others. Many of the same challenges stemming from institutional mentoring can accrue to formal coaching.

(7) Benchmarking

Benchmarking represents a technique that gained popularity during the Quality Movement of the 1980s, continued through the Reengineering Movement of the 1990s, and remains active today. The technique centers on comparing organization processes and performance metrics with those of industry leaders. This implies learning by imitation, although one organization's best practices may or may not be suitable for another organization. Many corporations in industry, for instance, have adopted organization designs and processes from the Military, but such designs and processes may be too rigid for fast moving industries. Likewise, many military organizations have attempted to become more businesslike, borrowing tools and techniques from industry, but the Military is not a business, and such tools and techniques may be inappropriate.

Nonetheless, if an organization can learn what other corporations, government agencies and nonprofits are doing, then such organization can gain explicit knowledge through benchmarking. Moreover, if this organization can obtain performance measures for (applicable) comparison with its own processes, then such measures can provide targets for improvement. It is important to emphasize the explicit nature of benchmarking knowledge, however: just because an organization is able to identify how another's processes are designed and function, this does not imply that such organization will necessarily be able to replicate those processes. Recall our example of reading a book about flying airplanes vs. experience with flying physically: just because one observes an experienced aviator in action does not imply that such person will be able to fly proficiently.

(8) Community of Practice

Community of Practice (CoP) represents a group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly. A CoP can evolve naturally because of members' common interest in a particular domain or area, or it can be created deliberately with the goal of gaining knowledge related to a specific field.

It is important to understand that CoPs are not teams. Rather, they represent groups of people, generally from across organization lines, that share common interests. Accountants, attorneys, financial planners, automobile enthusiasts, recreational boaters, and many like, informal groups of people—who do not (necessarily) work in the same organization—could form CoPs if they were to exchanges stories, experiences, heuristics and like forms of tacit knowledge with one another. CoPs can become powerful knowledge flow forces, particularly as people learn rich, experience based, tacit knowledge through interaction.

As with mentoring and coaching above, CoPs can form through informal interaction, or they can be instituted via organization fiat, with many similar advantages and challenges. Informal CoPs tend to develop trust bonds between participants, which enhances knowledge flow, whereas formal CoPs are similar to cross functional teams.

(9) Social Media

Social Media centers on the use of one or more common and contemporary tools (e.g., Facebook, LinkedIn, NextDoor) in an organization setting. The key is that such tools are used to enhance organization productivity, not for personnel entertainment and socialization, although people can get to know one another and develop trust bonds through technology mediated social interaction in the workplace.

Social media use as a KM technique can take on numerous forms. Some organizations, for instance, will distribute periodic (e.g., weekly, monthly) newsletters via social media to inform people about the kinds of KM initiatives, projects, tools, techniques and results that are occurring in the organization. Other organizations, as another instance, will publish periodic weblogs (aka blogs) with similar content, and such blogs can extend beyond written form (e.g., including audio and video recordings). Still other organizations, as a third instance, will use social media to organize synchronous events and interactions such as idea exchanges, tutorials and virtual townhalls. The authors of this report, for example, participate regularly via social media with other KM experts and professionals on a variety of topics along these lines. Given the popularity and ease of use associated with social media in people's personal lives, the associated techniques offer considerable potential to enhance KM in the organization.

(10) Crowd Sourcing

Crowd Sourcing represents a technique centered on asking peers in an organization for input to problems and issues faced by one or more people. The approach seeks to tap collective knowledge in an organization, and it enables many different people to participate and contribute to someone's problem solving. Many organizations employ crowd sourcing fora, through which community members can post questions and view answers from numerous people.

As a KM technique, crowd sourcing offers numerous advantages. These include relatively low cost, as the organization is not required to pay for knowledgeable and experienced people to answer workers' questions and to help address their problems (e.g., via Help Desk). The organization can also benefit from diverse people learning from one another, both about common issues and alternate solutions. As with social media techniques from above, people can get to know others beyond their formal organization units, and some trust bonding can develop between

people. Organization personnel can also learn to identify knowledgeable people across a variety of topics, and the results of such learning can form the core of an expertise network, which can be mapped, formalized and shared with some effort.

One of the major issues with crowd sourcing, however, stems from the asystematic nature of knowledge that is contributed through this technique. Just because one or more people decide to contribute potential solutions to someone's problems, this does not imply that any (much less all) of such people is necessarily an expert (or even knowledgeable) in the area. Thus, some (or all) inputs via crowd sourcing can be incorrect, damaging or counter to organization policy and productivity.

Another issue pertains to cost: although crowd sourcing represents a relatively inexpensive approach to organization problem solving, as noted above, in terms of not having to staff a help desk or like group, organization personnel can decide to spend considerable time participating in crowd sourcing activities instead of accomplishing their essential work activities. This issue can become particularly severe if such people are not contributing useful, helpful and correct inputs.

(11) Peer Assist

Peer Assist is a technique similar to crowd sourcing, where people in the organization ask others at the same relative organization levels and with comparable expertise (i.e., peers, not supervisors or technical experts) for direct assistance with problems and issues. The key difference is that crowd sourcing represents a technique for soliciting and receiving inputs to be used for problem solving, whereas peer assist represents a technique for engaging people in solving problems directly. In the former, people provide advice, generally in explicit form; in the latter, people provide assistance, generally sharing tacit knowledge through the process.

As a KM technique, peer assist can be very powerful. It encourages organization personnel to learn from one another, and as with crowd sourcing, people can identify and map expertise networks within

the organization. This technique also frees people from having to seek inputs and solutions from their supervisors or technical experts, and the approach is relatively inexpensive, like crowd sourcing. Additionally, peer assist can promote tacit knowledge sharing in the organization.

As with crowd sourcing, however, several issues can arise. Indeed, all of the same issues noted above for crowd sourcing can afflict peer assist techniques (esp. asystematic knowledge contributions, incorrect inputs, cost).

(12) Simulation and Enactment

Simulation is discussed above in terms of KM tools, but its use represents an important technique to promote tacit learning through virtual practice. Provided that the simulation technology represents a relatively good analog of the organization activities being simulated, then people have the potential to learn nearly as well as through direct experience, but they do not incur the risk of making costly mistakes, and people can attempt and practice particularly unusual or risky tasks. Simulation can also be employed in a training and education environment. The key disadvantages involve the cost of developing and maintaining simulators, along with the time and effort that people spend using simulators instead of accomplishing productive work in the organization.

Enactment extends simulation to address the accomplishment of productive work in the organization. Like simulation, this requires a relatively good analog of the organization activities being simulated. However, it requires further that such analog connect to physical processes in the organization, which imposes a substantial challenge in terms of corresponding tool development. For instance, many software systems in the telecommunications industry include both simulation and enactment capabilities: a network technician can simulate how a particular problem solving technique is likely to affect the network function in question, and when he or she is happy with the simulated result, the system can effect the network software change physically. From a KM perspective, this

reflects all of the costs and benefits of simulation, but with the additional challenge associated with tool development and the additional merit of accomplishing useful work.

(13) Tool Adaptation and Virtualization

Tool Adaptation refers to adapting existing tools for KM purposes. This facilitates organization flexibility, as existing tools and processes can be reused in different ways to address novel environmental impacts, shifts in competitive arenas and like changes that require adjustment. Email represents one example that is likely to be highly familiar to most readers. This technology has been used historically for communication purposes, but many organizations have adapted its use as a workflow application, through which work processes execute with the exchange of explicit knowledge from person to person, place to place, and time to time.

Virtualization is related closely to tool adaptation, as existing tools are used to support remote collaboration and work performance. A set of examples have emerged through the current COVID pandemic, as many organizations have been forced to adjust quickly to personnel working from home, in spite of not having prepared for this occurrence. In addition to email supporting workflows as noted above, organizations are finding new uses for other tools.

Videoconferencing systems, which found generally relatively infrequent use to connect personnel working from distant locations, are being used daily—if not more frequently—in some organizations today for the conduct of routine work across myriad departments, groups and functions. Likewise with job tracking systems, which have been focused on help desk and like applications in many organizations, that are being repurposed to support many different and novel applications (e.g., hiring, approvals, vacation requests).

(14) C2 Integration

Command and control (C2) represents a term used frequently in military organizations but with a wide variety of interpretations and meanings. Here we refer to C2 in terms of *leadership, organization and management*, which represent terms common to all organizations, as we refer to C2 as a *technique*, not a *technology*. C2 integration involves the deliberate integration of KM with C2. Clearly many people understand that C2 cannot be accomplished effectively without KM, as people in the organization must know what to do, along with how, when and with whom to do it well. This represents a tridirectional phenomenon. In a downward direction, for instance, leaders must communicate their intent (i.e., what they want accomplished in the organization) to the people responsible for accomplishing the corresponding organization activities. This initiates the need for people to know what to do.

In a horizontal direction, people must know how to accomplish the actions required for organization performance, which involves training, education, OJT and like KM techniques discussed above. People must know further when and with whom to do it also, which requires knowledge of plans, schedules, coordination requirements, organization contacts and sources of expertise. This involves search, knowledge retrieval and like KM techniques also.

In an upward direction, leaders need knowledge and information to support their understanding of organization status, which requires such knowledge and information to flow upward from activity areas to leaders. Leaders need knowledge and information also to support decision making, which requires leadership expertise to develop (e.g., via training, education, OJT) along with staff expertise, collaboration and tools to help make informed decisions.

Finally, it is difficult to accomplish KM well without aligning with C2. For KM to be useful in the organization, its activities must support and enhance the purposeful work that is accomplished to effect leadership

intent. Further, KM requires leadership support also, as many people—especially those who remain very busy—in the organization may have little incentive to modify their work and collaboration tools and practices to support KM. This is in spite of the huge potential that KM offers in terms of enhancing such work and collaboration. Hence in many cases leaders must mandate that people adopt and adhere to KM tools and techniques, often with very beneficial results.

(15) Embedded and Integrated KM

Embedded and integrated KM refers to weaving KM into the organization work processes. In contrast to the many organizations that establish KM as a function and set of tools and techniques separate from the routine work processes required for effective performance, embedded KM implies that such function and set are distributed throughout the organization areas where these routine work processes are accomplished.

For instance, instead of having a separate KM group report somewhere specific in the organization (e.g., as part of the leadership team, within the technology function, as an element of operations), embedded KM implies distributing the corresponding KM activities, tools and techniques throughout the organization. This means that every division, department and group in the organization would practice KM. Embedded KM as such offers considerable promise, particularly as the benefits can permeate the organization.

However, embedding KM can decrease organization performance if not implemented well. Some organizations, for instance, simply impose KM activities, tools and techniques upon busy people, which adds to their workloads; that is, in addition to all of their required work activities, people must accomplish additional activities to support KM, often without direct benefit to their required work. Not only does this exacerbate the demands placed on busy people accomplishing important organization work, it can stimulate resentment by such people, who are compelled to accomplish additional work without perceived benefit.

Contrast this with integrated KM, through which busy people practice KM as an integral part of their normal organization work activities. This requires more than leadership mandates: people in the organization must know how to perform KM activities, how to use KM tools, how to utilize KM techniques, and how to integrate them with their routine work activities. Most of the techniques noted above (esp. training and education, OJT, mentoring and coaching) are necessary to accomplish integrated KM, and leaders must insist upon it. It is important to understand that this involves organization change—which represents a relatively slow and demanding process—that is impeded often by culture and resistance. Reasonable expectations regarding the scope and pace of such change are essential—among organization leaders and personnel alike—and key to prevent KM integration efforts from stalling.

b. Navy KM Strategy

We continue with an overview of the most recent Navy KM strategy that we could find on record (Halvorsen, 2014), which outlines a vision to create, capture, share and reuse knowledge to enable effective and agile decision making, increase the efficiency of task accomplishment, and improve mission effectiveness. Achieving such vision is outlined in turn through four goals: 1) Expand awareness. 2) Instill KM principles and methods. 3) Maximize existing KM experience and resources. 4) Move toward a more centrally supported but universally available KM program. Goals 2 and 3 are comprised of the subgoals presented in Table 11. These goals reflect a number of KM techniques that are important for understanding and consideration in the present project. We provide a brief overview of each in turn.

Table 11 Navy KM Goals

2.1 Expand and support the Navy KM community of practice (CoP) and other KM stakeholders
2.2 Share experiences, lessons learned and results
2.3 Provide KM training and education
2.4 Include KM material in appropriate Navy and Marine Corps training courses
2.5 Assist people who are new to KM
3.1 Assist commands in building upon the experiences and resources of others
3.2 Collect, catalogue and advertise existing KM plans, documents, topical guides and other resources
3.3 Maximize the utility of existing technology to support KM implementation

(1) Goal 2.1

Goal 2.1 refers to the Navy KM community of practice (CoP) and stakeholders. As noted above, CoP represents a group of people who share a concern or a passion for something they do and learn how to do it better through regular interaction. A CoP can evolve naturally because of members' common interest in a particular domain or area, or it can be created deliberately with the goal of gaining knowledge related to a specific field.

In the context of the Navy, many potential CoPs can be identified readily by professionals' primary occupation. People who are naval aviators, submariners, surface warfare officers, engineering officers, ordnance technicians, and myriad other, like professions could choose to interact with one another—beyond their specific organization assignments—and hence form respective CoPs.

(2) Goal 2.2

Goal 2.2 refers to techniques for sharing tacit knowledge. The CoP represents one approach, but this goal is more general: people exchanging stories in the wardroom, for instance, engage in this kind or sharing. Indeed, one can say that such sharing is active—albeit informal—throughout the Navy at most times. The idea of the goal is to encourage more systematic sharing, either through explicit or tacit means. Speaking generally, explicit sharing implies that people's experiences, lessons learned and results are articulated in written form and then stored in some manner that supports and facilitates search and retrieval (esp. via the KM tools noted above).

Explicit sharing is powerful, for the shared knowledge can be preserved even after its contributor(s) leaves the organization, and such knowledge can be shared, simultaneously (e.g., via procedures, manuals, reports) with myriad people, often very quickly (esp. via computer networks). We understand, however, that knowledge articulated in explicit

form loses much of its energy, hence the organization activities enabled by such knowledge are accomplished generally at a lower performance level. Reading a book about flying an airplane, to repeat this instance, is highly unlikely to enable the same level of aviator performance as physically flying an airplane over time. Moreover, much explicit knowledge clumps in shared computer drives, databases, information repositories, file cabinets and like places that do not support effective much less efficient search and retrieval. The effort to articulate knowledge in explicit form is wasted generally unless such knowledge can be identified and used by others.

Tacit knowledge has strengths and weaknesses also. Because such knowledge is tacit, it flows with high energy and does not lead to the kind of performance degradation associated generally with its explicit counterpart. That is the key idea with CoPs, for instance: the exchange of energetic, experience based, tacit knowledge. Tacit knowledge, however, tends to flow comparatively very slowly and narrowly. Returning to the aviation example, whereas a person can read a book about flying in a number of hours—or perhaps days—learning to fly physically can take months, years or even decades. Moreover, whereas explicit knowledge (e.g., an e-book on flying) can be distributed to people across entire organizations, sharing and accumulating tacit knowledge occurs generally between much, much smaller groups of people (e.g., aviation instructor and student copilot).

(3) Goal 2.3

Goal 2.3 refers to formal KM training and education, generally via some combination of classroom interaction and distance learning. This represents a highly decentralized and powerful approach to KM: instead of, or in addition to, planning and executing a suite of centralized tools, systems and programs; training and education can equip a large number of people to recognize KM opportunities where they are most important—performing organization work activities—which offers the potential to

create hundreds of thousands of informed knowledge workers. A hundred thousand people making even incremental improvements has the potential to surpass immediately the best efforts of a centralized KM organization. This is the case in particular where such training and education can be integrated with and blended into courses and programs that people are required to take already (cf. Goal 2.4).

As educators ourselves, we understand personally and professionally the power of training and education. Given appropriate material shared in ways that encourage continued learning and application beyond coursework, training and education can equip people to identify and address knowledge clumps in the organization, to understand and leverage the relative strengths and weaknesses of different kinds of knowledge (esp. explicit and tacit, individual and group, static and dynamic), and to set up policies and procedures to enhance knowledge flow both within and across organizations.

One key is to engage scholars and professionals with high levels of KM knowledge and experience. These people can help to develop training and education course material that is informed and relevant. These people can work closely in turn with leaders at all levels (e.g., from Chiefs to Commanders) to target such material for high impact jobs throughout the Navy. Of course, one cannot attempt to reach the whole Navy at once, nor would a single set of course materials be appropriate for everyone. Rather, a core set of principles and learning outcomes can be developed from well accepted theory and practice, and such principles and outcomes can then be tailored to each rate. This would likely be a gradual process, addressing one rate at a time.

(4) Goal 2.4

Goal 2.4 is discussed in the context of Goal 2.3 above, but the keys are to identify courses that people are required to take already and to integrate appropriate KM material into them. Especially important is enabling each course attendee to apply such knowledge directly to his or

her job immediately and facilitating every attendee's continuous learning after completing each course.

(5) Goal 2.5

Goal 2.5 calls for developing a cadre of people who are knowledgeable and experienced in terms KM and who have sufficient capacity to assist people who are not. Such assistance could mirror the manner in which IT help desks are established in most organizations: a comparatively small cadre of people who are knowledgeable and experienced in terms IT are made available to assist people who are not.

As with IT, this requires a commitment of resources, but as with IT also, efficacy requires more than just talking about problems: organizations must have the knowledge, capacity and incentives to solve them. As noted above, many Navy and Marine Corps organizations have dedicated knowledge managers already, but most of these people are too busy *doing* KM to *assist* others with their KM learning and activities. A suitable cadre of KM people in the organization would likely play roles more along the lines of coaches.

(6) Goal 3.1

Goal 3.1 involves two parts. In the first, it also appears to call for a cadre of knowledgeable and experienced people, but at a higher level: whereas such people discussed under Goal 2.5 would be made available to assist individuals with KM learning and activities, those addressed here would be made available to assist command leaders and staff members, hence playing roles more along the lines of consultants.

The second part centers on learning from the experiences of others and leveraging their corresponding resources. This current project, for instance, is contributing toward this goal already, as we are building upon experience in industry, government and nonprofit sectors, in addition to the Navy. For learning to occur and proliferate, however, appropriate incentives must be put into place—at all organization levels—for people

to understand the power and potential of KM and to take time for it out of their busy schedules. Thus, the KM content and assistance must be highly focused on the circumstances and problems of each specific command, and it must be provided in manners that pay off immediately. This goal ties clearly and directly with those associated with training and education from above.

(7) Goal 3.2

Goal 3.2 centers on understanding what explicit KM resources the Navy has already. By emphasizing the collection, cataloguing and advertisement of such resources, the organization can avoid redundancy and recreating existing documents. By emphasizing explicit resources, however, this goal is subject to the same strengths and weaknesses noted above in terms of attenuated energy: knowledge dissemination can be broad and fast, but the performance level of activities that are enabled by explicit resources is limited.

(8) Goal 3.3

Finally, Goal 3.3 provides a direct link to KM tools. Instead of trying to invent, adapt and implement a suite of tools designed expressly for KM, the organization can seek to examine the tools that it uses already and to search for ways that such tools can also support KM. To the extent that existing tools can be employed and adapted toward this end, the approach makes great sense, saves money, and spares organization personnel from having to learn a new suite of tools. To the extent that existing tools cannot support KM, however, there is little potential here. Determining such extent represents an empiric question for further study.

III. RESEARCH METHOD

We describe the research method in this section. In addition to the literature review summarized above, we employ qualitative methods to understand Navy KM better, and we engage with senior Personnel representatives to identify one specific process to focus on for deep, detailed insight: Recruiting.

Recruiting begins the Navy talent management process, as naval personnel endeavor to attract high quality recruits to join and hopefully complete successful careers in the Service. This makes recruiting a particularly important process to study. Recruiting is an especially knowledge intensive process also, which each new recruiter must learn anew when assigned. There is some explicit recruiting knowledge in circulation, but the most important knowledge is tacit and learned on the job, generally quite slowly.

Moreover, very few people make careers in recruiting, and most recruiters serve only one tour. These factors combine to provide negligible opportunity for rich, experience based tacit knowledge to accumulate in recruiting commands and to pass from one recruiter to the next. Indeed, recruiting represents a somewhat extreme case to study—especially as many other Navy jobs are successive and accumulative, comprising distinct career paths—hence we expect our results to apply and generalize well to other processes. Qualitative methods are suited well to this situation.

Through coordination with senior Personnel people, we identify two specific recruiting commands to study: one that has completed a transformation to more of a functional or departmentalized organization structure and process—which reflects the vision for all recruiting commands—and another that has yet to complete such transformation—which reflects long tradition in terms of how the recruiting process is organized. This provides us with an opportunity to examine the same basic recruiting process as it is performed by organizations with different structures, processes and locations, and hence provides excellent basis for comparison and contrast.

Following helpful introductions from our research sponsors, we engage with the recruiting command leaders and arrange for access to key documents and people. Documents that describe the organization and process are reviewed first to get a sense for recruiting. We also recruit two knowledgeable graduate students to assist with the study,

one of whom has an abundance of recruiting experience, which enhances our ability to develop useful insights.

The core of our qualitative research centers on interviews with recruiting personnel at these two commands. We begin with the leaders and then identify a number of appropriate people to interview. We are interested in people who have developed considerable recruiting knowledge and experience in addition to those who are new to the process (i.e., high vs low experience), and we are interested in people responsible for active duty markets in addition to those who service reserve ones. This establishes the useful 2 x 2 interview frame pictured in Figure 16.

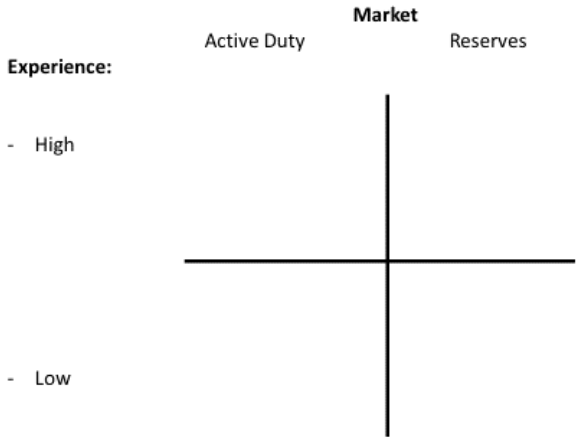

Figure 16 Interview Frame

To enhance candor, all interviews are conducted anonymously: the researchers use a unique code to identify each study participant, whose identity is not revealed. Nonetheless, interviews are conducted with audio and video recording to enhance our ability to analyze the qualitative data. Study participants are reassured regarding their anonymity and informed that recordings are deleted after the analysis is complete. Interviews reveal that most participants are very forthcoming in the interview sessions.

In advance of the interviews, each participant is asked a standard set of questions, which serve to establish a stable baseline of information. This enables researchers to use

interview time well and to focus questions on particularly interesting, informative and enlightening topics. Moreover, each interview can take on its own direction, with follow up questions that change based on what the various participants have to say.

The goal is for at least two researchers to engage in each interview, which enhances our ability to triangulate responses, and each researcher takes thorough notes, which are summarized immediately after each interview and compared across researchers for consistency. This enhances the reliability of our results. The list of interview questions is included in Appendix A.

Additional details pertaining to the interviews include a focus on field recruiters, those focused on both officer and enlisted candidates, with a total of 21 people (including officers and enlisted) from each command targeted for interview conversations (i.e., 42 participants total). Within this set, we plan to use a focus group approach, which enables participants to listen to one another and build upon an accumulating conversation. Four focus groups are planned for each recruiting command.

After all interviews are complete, the researchers compare notes and begin coding responses through a grounded, multiple case study approach. The coding process is necessarily iterative, and it continues until a stable set of concepts, themes and issues arises. This provides fodder for analysis via the Congruence Model and Knowledge Flow Theory, the results of which are reported in the following section.

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IV. RESULTS

We describe the key research findings and results in this section. We begin by summarizing the Navy recruiting organization. We continue with an overall summary of the qualitative data analysis activities. We then summarize some demographic information pertaining to our group of participants, after which we walk through each analytic step in considerable detail.

A. NAVY RECRUITING ORGANIZATION

The Navy recruiting organization reflects a regional distribution of effort. The regions are outlined on the CONUS map depicted in Figure 17.

Figure 17 Recruiting Regions

Because recruiting is a population focused activity, some regions are much larger than others in terms of both geographic and market size. The regions of specific focus in this study include Navy Talent Acquisition Group Rocky Mountain (NTAGRM) and Navy Recruiting District San Diego (NRDSD). As noted in the section above outlining our research method, NTAGRM has completed a transformation to more of a functional

or departmentalized organization structure and process, whereas NRDSD reflects long tradition in terms of how the recruiting process is organized[6].

We include an organization chart for NTAGRM in Figure 18 below. As mentioned, this reflects the transformed organization structure.

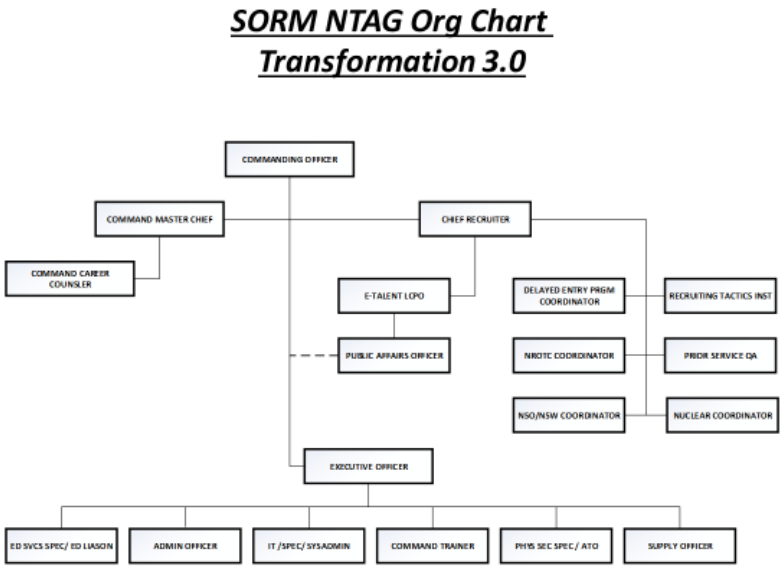

Figure 18 NTAGRM Organization Chart

We include an organization chart for NRDSD in Figure 19 below. As mentioned, this reflects the baseline organization structure.

[66] During the course of this study, NRDSD began its transition to an NTAG organization.

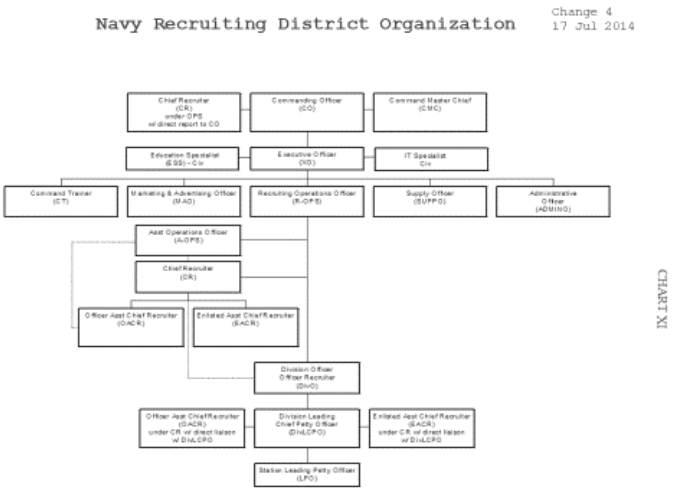

Figure 19 NRDSD Organization Chart

B. QUALITATIVE DATA ANALYSIS

Qualitative data analysis involves an iterative sequence of numerous, logical activities, which we depict via Figure 20. Briefly, the process steps progress in an iterative manner from the bottom up, beginning with Leadership conversations. This involves meeting with leaders of the organizations targeted for study, with the specific intent to glean the leadership perspective and to gain access to the organization. We speak with leaders of and gain access to two organizations. The leaders also help us to develop our sample frame.

Once the sample frame is developed, we distribute surveys to all study participants. The surveys help us to collect demographic data pertaining to the participants, and we use them to ask the eight interview questions planned. This affords each participant time to think about the questions well in advance of the interviews. It also affords us the ability to consider and evaluate their written responses to such questions in advance of the interviews. The result is more productive interview sessions.

Through the interviews, we collect raw qualitative data. As described in greater detail below, we organize participants into eight focus groups and collect roughly one hour of data from each. All research take notes during the interviews, which begin to

reflect each researcher's interpretation of the raw interview data. Myriad pages and files of handwritten and typed notes accumulate through this step.

Figure 20 Qualitative Data Analysis Activities

The next step involves researcher discussion. All researchers meet periodically to discuss the interviews and compare developing interpretations. A consensus begins to emerge regarding what was said and what was meant. Researcher interpretations of the data get reconciled in this manner.

At this point, we code the qualitative data through two steps: first and second order coding, which we discuss in greater detail below. Such coding generates grounded and clustered data, respectively. Overall, we identify 67 grounded codes and 10 clusters. With an understanding of and appreciation for the process, combined with the codes, we're able to diagnose three severe knowledge flow pathologies. Through knowledge analysis, which we discuss above, we generate 25 prioritized, sequenced and phased recommendations to treat the pathologies and outline a plan for process improvement.

The penultimate step centers on member checking. Here we share our key interpretations and results with several study participants to validate that what we remember hearing corresponds to what they recall saying. More importantly, we meet again with the organization leaders to discuss our findings and recommendations at a

high level. This provides additional validation, and it enables us to integrate the Leadership perspective into the results. Leaders from both organizations participate in this step.

The final step involves congruence analysis, which we summarize above. Such analysis builds upon the knowledge analysis and triangulates through a complementary perspective to identify fits and misfits in the organization. Nine noticeable misfits emerge through this step and add to our set of recommendations.

C. PARTICIPANT DEMOGRAPHICS

Participant demographics are summarized in Table 12 below. As planned, participation includes 21 people from each command. This includes 12 officers and 30 enlisted, of whom seven report as female and 35 as male. Experience ranges considerably, with five people reporting less than one year in recruiting, eight reporting experience between one and three years, and 16 reporting more than that. 13 people did not report experience level[7]. The majority of recruiters serve the active duty market, with only six addressing the reserves. 14 participants are Navy Counselor (NC). The dozen officers come to recruiting from several backgrounds (e.g., Aviation, Surface Warfare, other). The remaining participants represent a wide variety of rates (e.g., EM, YN, PS).

Table 12 Participant Demographics

Class	12 officer	30 enlisted		
Gender	7 Female	35 Male		
Experience	5: < 1 yrs	8: 1-3 yrs	16: > 3 yrs	13: nr
Market	36 active	6 reserve		
Rate	14 NC	12 officer	16 other	

D. FOCUS GROUP PROTOCOL

Two researchers lead and participate in all eight focus group sessions. The other researchers sit in on several sessions, and all researchers review all eight session recordings. Given the current COVID-19 Pandemic conditions, all sessions are conducted remotely, via tools that permit audio and visual communication in addition to recording. In each session, the leaders explain the focus and mechanics, and they reassure

[7] 64% of people participated. Analysis reveals no obvious nonresponse bias.

participants of their anonymity, encouraging all to be forthcoming and candid. After these session leaders introduce themselves and summarize their backgrounds briefly, each participant is asked to do the same. Then each survey question is posed to the focus group, with encouragement to build upon responses provided via survey and to build upon other participants' comments. Participants are encouraged to ask questions if anything is unclear, and session leaders ask numerous probing questions when particularly insightful topics seem to emerge from the group conversation. Most sessions last 40 – 60 minutes.

Given the interview, focus group format, all data are qualitative. Hence we undertake qualitative data analysis as summarized above. This begins with every researcher on the team reviewing each session recording—some multiple times—and noting words, statements, problems, issues, comments and suggestions that appear to be particularly relevant and important *to the participants*. This is very important: in a grounded study such as this, we are most interested in learning from the participants, from the bottom up via induction; as opposed to imposing one or more research models, theories or frameworks upon them deductively. Moreover, we are interested in the terms used by participants. This is referred to as first order coding (van Maanen, 1979) and is key to grounding our analysis in the data.

With myriad first order codes captured from the sessions, we then follow Gioia and colleagues (Gioia et al., 1994) to perform second order coding. In this second stage, codes assigned above become data for second order analysis, the latter of which brings in the researchers' perspectives that are informed by both Navy experience and academic literature. This enables us to focus on key points that offer good potential to inform our study and address the research questions. We include the 31 codes assigned to NTAGRM qualitative data in Table 13.

As noted above, each code reflects participants' words. However, the researchers employ their knowledge and experience to select this set of 31 as particularly promising for analysis. For several instances: Code 1 ("Process steps") reflects a statement by one or more participants that the organization lacks a complete set of steps for the recruiting process. Code 2 ("NORU Syllabus") pertains to the Navy Recruiting Orientation Unit (acronym is NORU), which nearly all people attend in advance of their first or a follow

on recruiting assignment; with emphasis here on the syllabus, about which a great many participants complain does not address the kinds of situations, circumstances and techniques that are important for recruiting efficacy in the field. Code 3 ("Recruiter PQS") pertains to the personnel qualification standards (PQS), about which a great many participants complain are out of date. Code 4 ("How to get into Navy") reflects a comment by one participant, who laments a lack of detailed guidance on the specific steps required to bring someone into the Service. We describe and explain the other NTAGRM codes through further analysis below.

Table 13 NTAGRM Codes

1. Process steps
2. NORU syllabus
3. Recruiter PQS
4. How to get into Navy
5. Recruiter incentives
6. SalesForce system
7. App Log
8. NAMs
9. e-talent
10. TAOC
11. Successful Recruiter
12. Schoolhouse = science
13. OJT = art
14. Turnovers
15. Shadowing
16. UI
17. Student flyer used to conduct interview
18. Integrity
19. Career recruiting force
20. High pressure to meet quotas
21. Officer recruiting is different
22. Medical recruiting is different
23. IT network inadequacies
24. Current forms
25. Awards & punishment w/o rationale
26. Playbook
27. 10 steps for recruiting success
28. Lessons learned
29. Lack of resources
30. No one to ask
31. Production oriented

Likewise, we include the 36 NRDSD codes in Table 14. The same attributes (e.g., participants' words, researchers' knowledge and experience) apply. For several instances: Code 1 ("Initiative & extra effort to mentor & train") pertains to statements by multiple

participants indicating that they expend effort beyond their job requirements to help new recruiters through mentoring and training. Code 2 (“Create useful training materials”) is similar, pertaining to statements by multiple participants indicating that they expend effort beyond their job requirements to help new recruiters by creating training materials.

Table 14 NRDSD Codes

1. Initiative & extra effort to mentor & train
2. Create useful training materials
3. Highly experienced people more willing to help
4. Mentor and train new people
5. No documentation
6. Storytelling
7. Geographic separation of units
8. New people have no clue, require months to learn
9. SalesForce
10. Process steps
11. NRD-NTAG transition
12. Training Syllabus
13. Overlay sheet
14. NRC sharedrive
15. NRC procedures
16. Monthly training at some units
17. Recruiting research led to TAOC Model
18. TAOC
19. Whom to contact
20. RPS
21. Counselor chits
22. Zero rider training
23. MS Teams training sessions
24. Shadowing & mentoring
25. People too busy to help
26. Pair new people up with others
27. Goals seem arbitrary and unrealistic
28. PQS outdated
29. Millington Annual Meeting
30. Mandate
31. Kits
32. pridemod
33. Program Authorization
34. Training Binder
35. Social media skills
36. Successful recruiter template

Code 3 (“Highly experienced people more willing to help”) pertains to statements that people with substantial recruiting experience are more willing to help new recruiters, whereas those with less experience are less willing. Code 4 (“Mentor and train new people”) is similar, referring to the efforts of some participants to assist new recruiters.

As above, we describe and explain the other NRDSD codes through further analysis below.

Even from cursory inspection of the tables above, common codes can be seen clearly. For several instances: NTAGRM Code 1 (RM1) and NRDSD Code 10 (SD10) both refer to recruiting process steps. RM3 and SD28 both refer to the recruiting PQS. RM5 refers to recruiter incentives, and SD1 refers to initiative and extra effort to mentor and train new recruiters; in the context of focus groups, the NRDSD people indicate that they work beyond the organization incentive structure to help others. RM6 and SD9 both refer to the SalesForce system, which represents a common system used across recruiting commands. This suggests that both recruiting commands share common aspects and issues. Given that both perform the same recruiting function, this is expected. Alternatively, many of the codes are unique to each command, and many reflect different aspects and issues. We examine such commonality and differentiation by merging the codes, but we exclude the corresponding table here due to its large size.

Through further qualitative analysis, we examine all of the codes and look for commonalities beyond the kind of close matches noted above. In essence, we are working to cluster the various codes into similar bins. This reflect second order coding. For instance, as noted above, RM1 and SD10 both refer to recruiting process steps. Within the context of the focus group sessions, the same can be said for RM10 ("TAOC") and SD18 ("TAOC"), as well as RM11 ("Successful recruiter") and SD36 ("Successful recruiter template"). Thus, we cluster all of these codes as "Process" and bin them together.

Moreover, these same codes cluster in terms of some additional bins as well. For instance, since all of these codes pertain to the recruiting process, one would also expect for such process to be documented and perhaps incorporated into formal training. Thus, we would bin these codes according to three clusters: *process, documentation* and *formal training*. We extend this analysis to all other codes in like manner, resulting in the set of 10 clusters as summarized in Table 15.

As noted above, each of these clusters can be used to help bin multiple codes, and each code can be binned through multiple clusters. For this analysis, we assign a

maximum of three clusters to any particular code, although several codes are assigned to only a single cluster.

Table 15 Clusters

Cluster	Implication
1. Process	Steps describing an organization process
2. Documentation	Documents describing organization processes or tools
3. Formal Training	Training courses with syllabi
4. Incentives	Extrinsic incentives intended to motivate desired organization behaviors
5. Knowledge Sharing	Techniques to share knowledge between people and organizations
6. Tools	Technologies designed to facilitate work
7. TTPs	Techniques, tactics & procedures: ways of accomplishing useful actions
8. Turnovers	Activities associated with a new person taking over a job
9. Resources	Organization resources, including labor, capital and time
10. Experience	People's accumulated tacit knowledge

For instance, Table 16 lists the codes—from both NTAGRM and NRDSD—binned primarily into the Process Cluster. It lists any other associated clusters as well. Notice that all codes bin according to Cluster 1 *Process* and Cluster 2 *Formal Training*, whereas codes associated with recruiting success bin to Cluster 3 *TTPs* instead of *Documentation*. This affords us the ability to bin numerous codes according to the primary cluster while simultaneously differentiating them through the secondary and tertiary counterparts.

Table 16 Process Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM1 Process steps	SD10 Process steps	Process	Formal Training	Documentation
RM10 TAOC	SD18 TAOC	Process	Formal Training	Documentation
RM11 Successful recruiter	SD36 Successful recruiter template	Process	Formal Training	TTPs
RM27 10 steps for recruiting success		Process	Formal Training	TTPs

Table 17 lists the codes binned primarily into the Documentation Cluster. As above, some of these codes bin into secondary and tertiary clusters also, but not all do. For instance, codes pertaining to the PQS, contacts and documentation all have *TTPs* and *Tools* as additional clusters, whereas the Playbook and Overlay sheet do not. As noted above, this affords us the ability to bin numerous codes according to the primary cluster while simultaneously differentiating them through the secondary and tertiary counterparts.

Table 17 Documentation Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM3 Recruiter PQS	SD28 PQS outdated	Documentation	TTPs	Tools
RM26 Playbook		Documentation		
RM30 No one to ask	SD19 Whom to contact	Documentation	TTPs	Tools
	SD5 No documentation	Documentation	TTPs	Tools
	SD13 Overlay sheet	Documentation		

Table 18 lists the codes binned primarily into the Formal Training Cluster. Notice how not every NTAGRM code has a corresponding NRDSD counterpart, or vice versa, yet they all bin well into the Formal Training cluster as primary. Notice further how three of the codes (RM12, RM21, RM22) have no secondary or tertiary clusters, whereas the first (RM2) and fifth (SD12) both have *Documentation* as a secondary cluster, and the last (SD35) includes both *TTPs* and *Tools* as additional clusters.

Table 18 Formal Training Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM2 NORU syllabus		Formal Training	Documentation	
RM12 Schoolhouse = science		Formal Training		
RM21 Officer recruiting different		Formal Training		
RM22 Medical recruiting different		Formal Training		
	SD12 Training syllabus	Formal Training	Documentation	
	SD35 Social media skills	Formal Training	TTPs	Tools

Table 19 lists the codes binned primarily into the Incentives Cluster. Similar comments apply.

Table 19 Incentives Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM5 Recruiter incentives	SD1 Initiative & extra effort	Incentives	Documentation	
RM18 Integrity		Incentives		
RM20 High quotas pressure	SD25 People too busy to help	Incentives		
RM25 Award rationale		Incentives		
RM31 Production oriented		Incentives		
	SD2 Create useful training materials	Incentives	TTPs	Documentation
	SD3 Experienced people willing	Incentives	TTPs	Tools
	SD27 Arbitrary & unrealistic goals	Incentives		

Table 20 lists the codes binned primarily into the Knowledge Sharing Cluster. Similar comments apply.

Table 20 Knowledge Sharing Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM13 OJT = art		K Sharing	Experience	
RM19 Career recruiting force		K Sharing	Experience	Tools
RM28 Lessons learned	SD6 Storytelling	K Sharing	TTPs	Tools
	SD8 New people have no clue	K Sharing	TTPs	Documentation
	SD16 Monthly training some units	K Sharing	TTPs	Tools
	SD23 Teams training sessions	K Sharing	TTPs	Tools
	SD26 Pair new people with others	K Sharing	TTPs	Tools
	SD29 Millington annual meeting	K Sharing	TTPs	Tools
RM4 How to get into the Navy		K Sharing	TTPs	Tools
RM17 Student flyer for interview		K Sharing	TTPs	Tools

Table 21 lists the codes binned primarily into the Tools Cluster. Similar comments apply.

Table 21 Tools Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM6 SalesForce system	SD9 SalesForce	Tools	Formal Training	Documentation
RM7 App Log		Tools	Formal Training	Documentation
RM8 NAMs		Tools	Formal Training	Documentation
RM9 e-talent		Tools	Formal Training	Documentation
RM23 IT network inadequacies		Tools		
RM24 Current forms	SD14 NRC sharedrive	Tools	TTPs	Documentation
	SD7 Geographic unit separation	Tools		

Table 22 lists the codes binned primarily into the Turnovers Cluster. Similar comments apply. Notice that each NTAGRM code has a corresponding NRDSD counterpart and that all of these codes share the same three clusters. This reflects considerable similarity across commands.

Table 22 Turnovers Cluster Codes

NTAGRM Code	NRDSD Code	Cluster 1	Cluster 2	Cluster 3
RM14 Turnovers	SD34 Training Binder	Turnovers	TTPs	Tools
RM15 Shadowing	RM24 Shadowing & mentoring	Turnovers	TTPs	Tools
RM16 UI	RM4 Mentor & train new people	Turnovers	TTPs	Tools

Notice that not every cluster listed in Table 15 is used as a primary bin. Indeed, although Clusters 1-8 are used to bin codes as such, Clusters 9-10 are used for secondary and tertiary binning instead.

E. KNOWLEDGE FLOW ANALYSIS

With this qualitative data analysis, our binning of participant codes into clusters provides sufficient information and insight to perform knowledge flow analysis. Understanding the recruiting process as a whole, we examine the static and dynamic knowledge associated with each process step. Recall from above that knowledge enables action: where someone in the recruiting process is expected to perform some process

action, he or she must possess the corresponding knowledge to do so. In particular, referring to the Life Cycle dimension from our knowledge flow visualization discussion above, we are particularly interested in three knowledge events: 1) learning or creation, 2) transfer or sharing, and 3) use or application. Each of these individually—and in particular all three in concert together—is essential to recruiting in particular and the Navy in general.

We begin with an example. Recall the discussion centered on Table 16, which lists the codes associated with the Process Cluster. Recall further how both NTAGRM (RM1) and NRDSD (SD10) have codes corresponding to the lack of recruiting process steps. This has great potential to be a problem in terms of knowledge enabling the corresponding action: if a new recruiter, for instance, does not know the recruiting process steps, then he or she will likely have a difficult time accomplishing useful work for the recruiting command. We term this a knowledge flow *pathology*, which must be diagnosed and treated before such new recruiter can apply the requisite knowledge to accomplish useful work in the office.

Figure 21 can help us to visualize the situation. Recall the multidimensional knowledge flow space discussed above: The explicitness dimension indicates the extent to which some amount of knowledge has been articulated in explicit form (e.g., written documents) vs. remaining tacit (e.g., people's experience). The reach dimension indicates how many people in the organization are able to utilize such knowledge. The life cycle dimension indicates what is being done with this knowledge. In this figure, we show Point A to represent the new, inexperienced and ignorant recruiter. Since this person knows nothing about the recruiting process (esp. not even the process steps), he or she does not even have a place in the multidimensional space (i.e., this person has no knowledge that is relevant to the recruiting task at hand).

Alternatively, we show Point B to represent 10 experienced recruiters working in the office. Point B is positioned at zero along the explicitness axis (i.e., Point B is in the tacit plane), indicating that knowledge of the recruiting process steps is tacit (e.g., experiential, acquired via OJT) for all 10 recruiters. This point is positioned at 10 along the reach axis, indicating that 10 people are able to utilize this recruiting process knowledge. Point B is positioned at the use/apply point along the life cycle axis,

indicating that these 10 people are using or applying their tacit recruiting process knowledge to accomplish work in the organization.

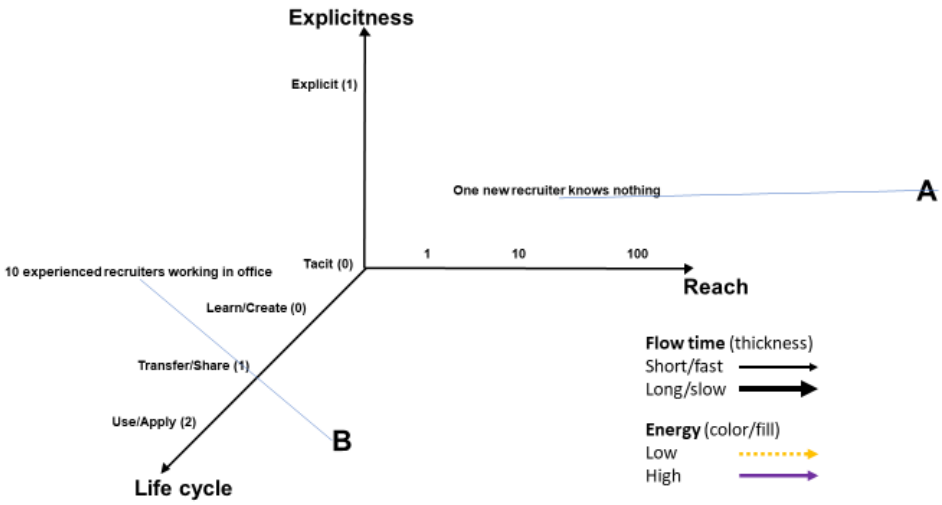

Figure 21 New Recruiter Joins Office

Since 10 people at Point B have and are using the recruiting process knowledge, but the person at Point A lacks such knowledge, we identify the knowledge flow pathology as a *knowledge clump*: the relevant and necessary knowledge is clumped among the 10 recruiters at Point B, and it is not flowing to the person who needs it at Point A. We use this same approach to diagnose pathologies associated with myriad other codes and clusters from above.

Now that we have diagnosed this pathology, we must work to identify one or more feasible recommendations to treat it. Notice how this approach to reasoning parallels that predominate in Western Medicine: a physician must first diagnose a patient's pathology or problem before recommending an appropriate treatment (e.g., medication, rest, surgery). Looking at the diagram above, we must identify one or more approaches to getting the new recruiter at Point A into the multidimensional space; that is, such person must learn the recruiting process steps somehow.

1. Treatment Option 1 – NORU Instruction

One approach is implicit in the clusters for the recruiting process steps code: recall the secondary cluster *formal training*, which suggests that the recruiting process steps could be learned through formal training. Since nearly all new recruiters attend the NORU course, for instance, this could be a place where the process steps are learned. Our focus group interviews suggest that process steps are not part of the current curriculum, however. Let's see how this treatment would look in terms of multidimensional knowledge flow visualization.

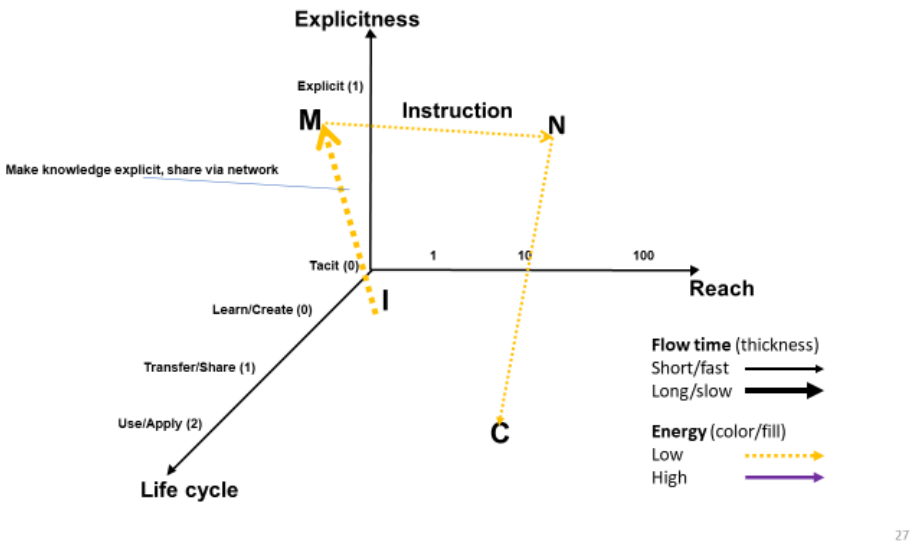

Figure 22 NORU Adds Knowledge to Course

Figure 22 illustrates the corresponding knowledge flows. The flow begins at Point I, where an NORU instructor has learned the recruiting process steps. This point is at the tacit end of the explicitness axis (i.e., his or her knowledge is tacit), at the unitary point along the reach axis (i.e., this instructor is acting alone), and at the learn point along the life cycle axis (i.e., he or she has learned the knowledge[8]).

The first knowledge flow is delineated by the dotted-orange vector from Point I to Point M, where the instructor articulates his or her tacit knowledge into explicit form.

[8] Note, we assume here that the instructor learned this recruiting process knowledge previously. Hence we do not delineate that knowledge flow in the diagram. Rather, we show how the instructor's tacit knowledge flows, through coursework, to the class participants.

This could be through any explicit representation (e.g., texts, graphs, diagrams, examples), but let's say that the instructor creates a short, written course module on the recruiting process steps; uses a word processing system to document these steps; and incorporates such module into the NORU curriculum.

At Point M, such knowledge is explicit (e.g., written down via document) and incorporated into the curriculum, where it can be taught through instruction. Instruction is represented by the knowledge flow vector from Point M to Point N. In this case, we show Point N at the reach level of 100 people, suggesting a class of 100 students learning the recruiting process steps.

Finally, the figure delineates a third vector from Point N to Point C, which represents 100 students in the NORU class learning the process steps. Let's assume that the new recruiter (i.e., Point A on the previous diagram) is among these students. When this student completes the NORU course and comes to the recruiting office, he or she will know the recruiting process steps and be able to accomplish useful work through the actions enabled by the corresponding knowledge.

Notice, however, the dotted-orange lines used to represent the knowledge flows in this figure, and recall the two corresponding dimensions associated with flow vectors: the thickness of a knowledge flow vector is used to represent *flow time* (i.e., how quickly knowledge flows from one point to another), and the pattern and color are used to represent *energy* (i.e., the performance level of actions enabled by the knowledge).

The first vector (I-M) represents the instructor articulating his or her knowledge in explicit form. We represent this in the figure as a relatively thick vector, indicating that articulating one's experience based tacit knowledge into explicit form can be time consuming, as anyone who's ever developed course materials can confirm. We represent this in the figure as a dotted-orange vector, indicating relatively low energy (i.e., the performance level of actions enabled by this knowledge is relatively low): reading about recruiting process steps does not enable performance at the same level as rich, experience based tacit knowledge. Hence something is lost every time knowledge is articulated into explicit form: this is a law of nature.

Continuing, the next knowledge flow (M-N) is represented by a thin, dotted-orange vector, indicating that sharing the associated course materials through instruction

can occur quite quickly (e.g., distributing in advance via network, discussing in class, using for homework) but still flows with relatively low energy.

The final knowledge flow (N-C) is similar: the relatively thin vector indicates that students can read and learn about the recruiting process steps quickly; however, the low energy suggests that their performance level will be relatively low, certainly when compared with that of experienced recruiters. Nonetheless, people in the class have an opportunity to learn the process steps: something that was missing previously.

Thus, when a new recruiter joins the organization, after completing the NORU course, he or she knows the recruiting process steps and is able to perform the corresponding actions and accomplish useful work in the organization. This dissolves the clump and enables knowledge to flow. We delineate this via Figure 23.

In the figure, this new recruiter is represented still by Point A, but notice that such point is inside the multidimensional space now: in the tacit plane at the zero level of explicitness[9]; at the unitary level of reach; and at the learn/create level of life cycle. This represents a substantial step forward, both for the new recruiter and the organization. Moreover, having learned the recruiting process steps, this new recruiter is able to use or apply his or her knowledge to perform the corresponding actions and accomplish useful work in the organization. This is represented by the knowledge flow vector from Point A to Point O (A-O). Notice, however, that such vector is represented by a relatively thick, dotted-orange line, suggesting that the new recruiter will not be able to apply his or her knowledge quickly or at a high performance level (e.g., because it was learned via an explicit flow). This is to be expected when learning via explicit knowledge flows that are characteristic of most classroom training pedagogy.

[9] Even though the knowledge was learned in explicit form, we represent the person at Point A as having learned such knowledge tacitly. In other words, whenever someone learns, the associated knowledge is considered to be in tacit form.

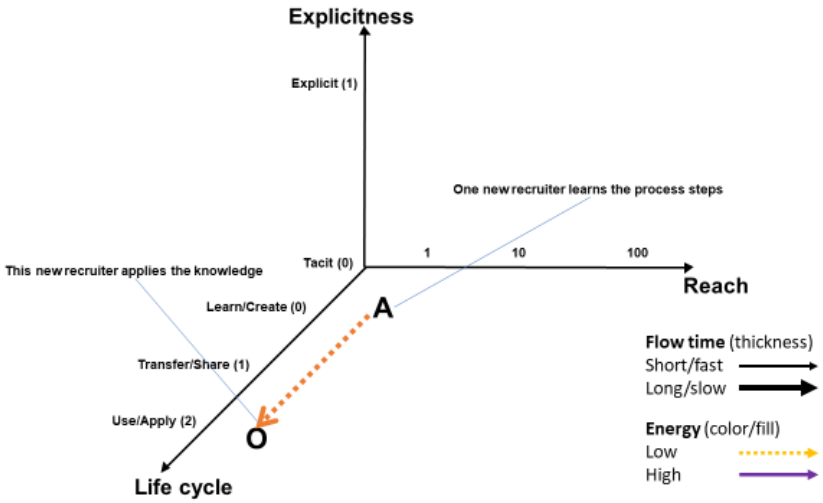

Figure 23 New Recruiter Learns Process Steps

2. Treatment Option 2 – Office Documentation

Another approach is implicit in the clusters for the recruiting process steps code also: recall the tertiary cluster *documentation*, which suggests that the recruiting process steps could be learned through documentation, made available in the recruiting office, for instance. This approach is quite similar to the NORU instruction treatment above. Indeed, we use figures similar to those above to describe this treatment.

Figure 24 illustrates the corresponding knowledge flows. The flow begins at Point L, where someone, say the lead chief petty officer (LCPO) in a recruiting command office, creates a document describing the recruiting process steps. This is represented by Point L in the multidimensional space, as the LCPO makes the knowledge explicit (Vector L-M). This person then disseminates the explicit knowledge via network, sharedrive or other office channel (Vector M-N). From there, recruiters in the office or command can access the explicit knowledge and apply it (Vector N-R). We represent this in the diagram at the reach level of 100 people, suggesting that all, say 100, people in a recruiting command have access to and can utilize such explicit knowledge to understand the recruiting process steps and accomplish the associated work activities that it enables.

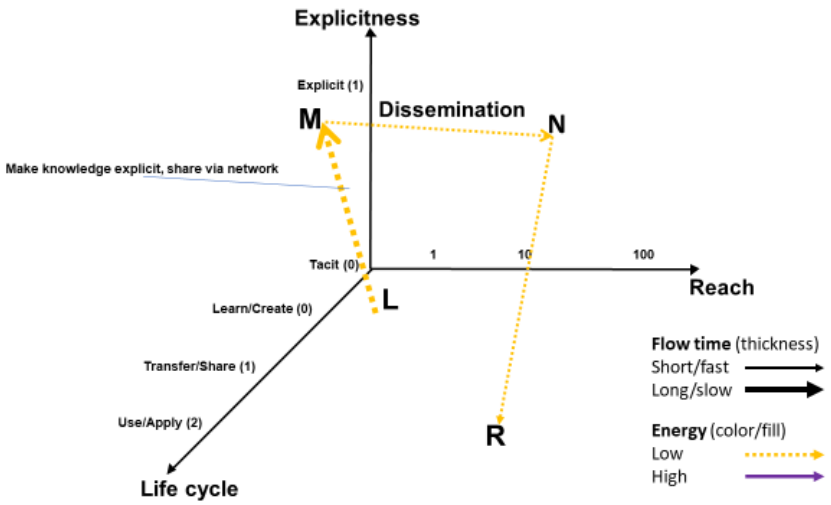

Figure 24 LCPO Creates Document

Notice that the knowledge flow vectors reflect all of the same characteristics delineated in the previous treatment example (e.g., relatively fast flows, dotted-orange lines indicating relatively low energy levels and correspondingly low work performance levels). Nonetheless, as via the treatment option above, the new recruiter would have access to documentation of the recruiting process steps and be able to apply the corresponding knowledge to accomplish useful work in the organization. As above also, this would dissolve the clump and enable knowledge to flow.

Thus, when the new recruiter joins the organization, after accessing and reading the documentation, he or she knows the recruiting process steps and is able to perform the corresponding actions and accomplish useful work in the organization. We delineate this via Figure 25. Notice that this figure is identical to the one presented for Treatment 1 above. The specific approach to dissolving the knowledge clump differs, but the result is the same: Having learned the recruiting process steps, this new recruiter is able to use or apply his or her knowledge to perform the corresponding actions and accomplish useful work in the organization. This is represented by the knowledge flow vector from Point A to Point O (A-O). Notice, as above, that such vector is represented by a relatively thick, dotted-orange line, suggesting that the new recruiter will not be able to apply his or her

knowledge quickly or at a high performance level (e.g., because it was learned via an explicit flow). As above, this is to be expected when learning via explicit knowledge flows that are characteristic of most organization documents.

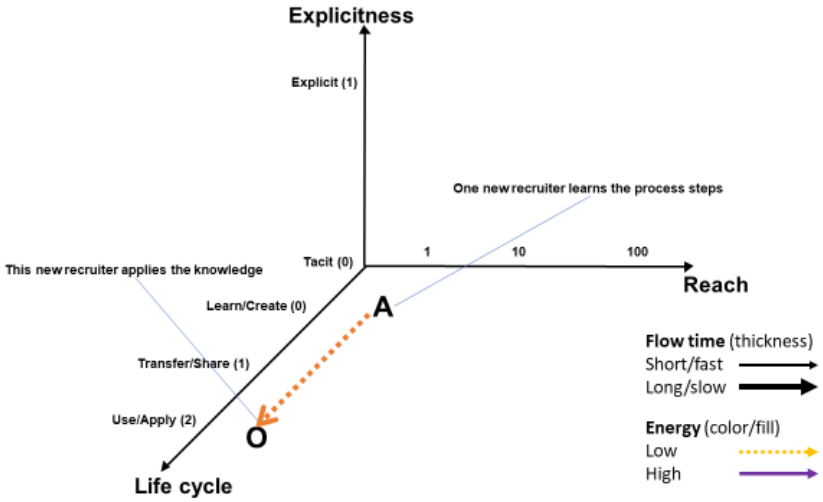

Figure 25 New Recruiter Learns Process Steps

3. Treatment Option 3 – Office Mentoring

A third treatment option could take a different approach. Say, instead of having someone (e.g., NORU instructor, NRD official, command LCPO) create explicit knowledge to help new recruiters learn the recruiting process steps, that we ask or assign one person in the local office to work directly with the new recruiter and to help him or her to learn the process steps through a mentoring relationship. This would not necessarily imply a long term or intense mentoring relationship; it implies only that at least one experienced person in the office is willing and able to help the new recruiter to learn the process steps through interpersonal interaction (e.g., discussing each step, providing examples, telling stories about successes and failures, asking questions, providing answers).

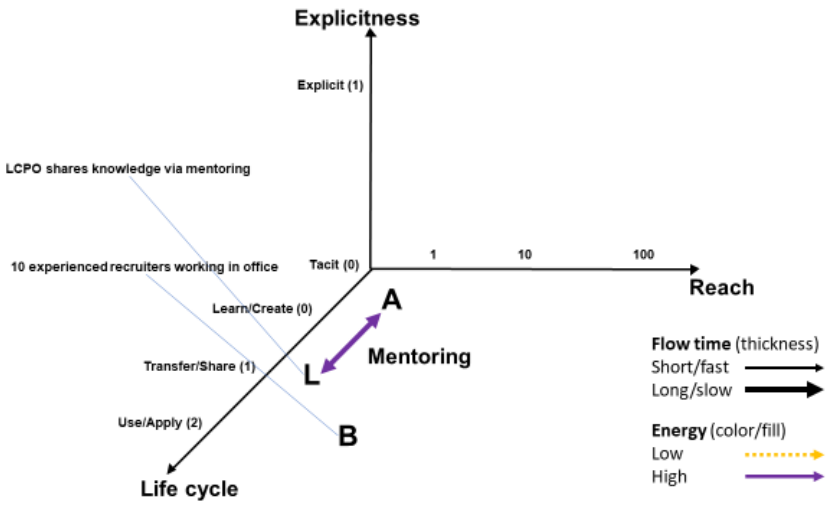

Figure 26 LCPO Mentoring

Figure 26 delineates this knowledge flow. As above, the office has 10 experienced recruiters working toward meeting their goals (Point B). From this group, one person, say the LCPO (Point L), breaks away to share knowledge with the new recruiter (Point A) via mentoring. Notice that such LCPO is sharing (Point L is at the transfer/share level on the life cycle) experience based tacit knowledge (Point L is in the tacit plane, at an explicitness level of zero), as an individual (Point L is at a reach level of one), with the new recruiter (Point A).

Notice numerous differences between this treatment and the two delineated and discussed above. For one, the entire knowledge flow takes place within the tacit plane. Quite distinct from both previous treatments, the relevant knowledge is never articulated in explicit form. Rather, it flows interpersonally from one person to another (i.e., LCPO to new recruiter). This is represented by the knowledge flow vector connecting Points L and A directly. For another, this knowledge flow occurs between two individuals. Quite distinct from both previous treatments also, the relevant knowledge is not distributed or disseminated to a large number of people. Rather, it flows from one individual to another. For a third, the arrow used to represent this knowledge flow vector is relatively thick, indicating that the mentoring process can be time consuming. Considerable time and

energy can be required to teach someone through mentoring. Moreover, while the LCPO in this example is spending time mentoring the new recruiter, *he or she is not spending time accomplishing his or her own work.*

This knowledge flow vector is also solid-purple, indicating a comparatively high energy level, and hence implying a correspondingly high performance level in terms of the organization actions and work to be accomplished. This stems from the interpersonal and extended nature of the interaction between the LCPO and new recruiter: the former continues to mentor until the latter learns the knowledge well. Finally, the knowledge flow vector is represented by an arrow with two heads: this represents knowledge flowing from the LCPO to the new recruiter in addition to knowledge flowing in the reverse direction: the LCPO can learn from the new recruiter (say, for example, that the new recruiter is the first in the office to come from the Aviation, Medical or Information Warfare Community).

The end result is delineated via Figure 27. As with both treatment options delineated and discussed above, the new recruiter learns the process steps and is able to apply the associated knowledge to accomplish useful work in the organization. Notice here, however, that the knowledge flow vector differs from those above: It is thin, representing knowledge flowing comparatively quickly, as the new recruiter has learned (via mentoring) the knowledge well, and hence is able to apply it quickly. It is also solid-purple, representing knowledge flowing with comparatively high energy, which indicates a relatively high level of performance associated with the corresponding organization action and work. Moreover, notice the A-B vector, which represents the new recruiter becoming an integral part of the team. As depicted by the thick vector arrow, this takes some time for him or her to socialize and acculturate, but the solid purple vector indicates that the energy level of the corresponding knowledge flow is high.

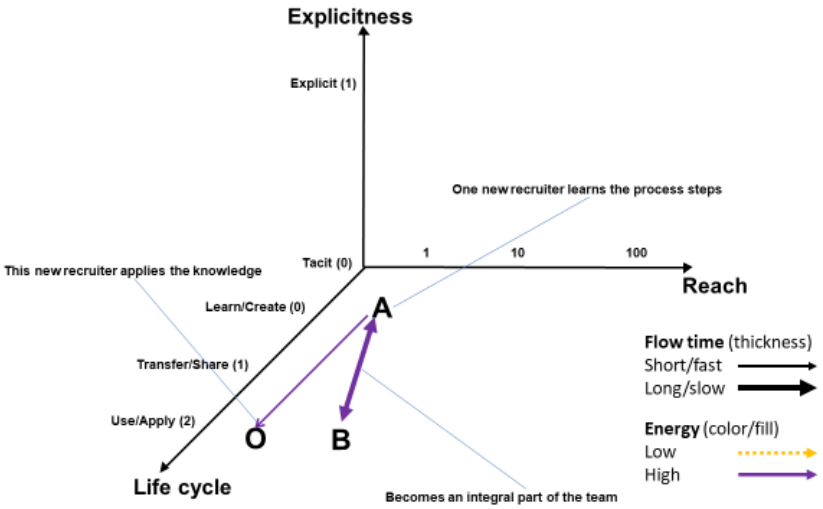

Figure 27 New Recruiter Learns Process Steps

Thus, this third treatment option requires more time and effort—both from the LCPO and the new recruiter—to dissolve the clump and get recruiting process knowledge to flow, but after the learning has been accomplished, the new recruit is able to apply such knowledge more quickly and at a higher performance level.

Organization leaders can decide which treatment option is best, and such decision will likely vary depending upon organization goals, resources and timing, in addition to the motivations, incentives and characteristics of the experienced recruiters. Our purpose here is to delineate and describe three alternate treatments, using multidimensional knowledge flow visualization to help delineate, describe and communicate some of the key considerations. As noted above, we can approach every knowledge flow pathology through similar analysis.

F. KNOWLEDGE FLOW PATHOLOGIES

Here we summarize all of the knowledge flow pathologies identified through our analysis. The analytic process is the same as discussed at length above. For interest of space and reader attention, we summarize the results simply and directly. Indeed, examining the whole list of clusters noted and discussed above, the vast majority suffer

from the same pathology: *knowledge clumping*. This implies that treatment options similar to those delineated and discussed above offer potential for all such clumped knowledge. For space reasons, we do not list all of the associated codes and clusters in a table.

Alternatively, a number of other codes and clusters suffer from a different pathology: *misincentivization*. Misincentivization occurs most frequently in organizations that establish incentives that run counter to rapid, reliable and energetic knowledge flows. Organization leaders can establish, defend and maintain such incentives (e.g., where resources are constrained, where higher level leaders establish demanding performance targets, where incentives are constrained by organization regulation or fiat), but many leaders are unaware of the deleterious impact that misincentivization can have. We summarize the codes and clusters via Table 23.

Table 23 Misincentivization Pathologies

NTAGRM Code	NRDSD Code	Characterization
	Create useful training materials	Very few people are motivated to create useful training materials for new recruiters
	Experienced people more willing to help	Very few people are motivated to help new recruiters
Recruiter incentives	Initiative & extra effort to mentor & train	Recruiters are incentivized to focus on meeting quota instead of assisting others
Suspended recruiter integrity		Some recruiters sacrifice ethics to make quota
High pressure to meet quotas	People too busy to help	Recruiters are incentivized to focus on meeting quota instead of assisting others
Awards & punishment w/o rationale		Recruiters do not understand why some people are rewarded & others punished
"Production oriented"		Recruiters are incentivized to focus on meeting quota
	Goals seem arbitrary and unrealistic	Recruiters do not understand the reasoning behind or legitimacy of goals

Here we include codes from both commands, for several of them overlap, and they all point to misincentivization as a source of knowledge flow difficulty. In the first (NDRSD), discussing how some people in the command expend time and energy to create useful training materials for new recruiters, only very few people appear to be motivated as such. Nearly everyone else in the command, according to our study participants, is motivated instead to meet quota. Some additional exploration reveals that the people most likely to create new training materials are very senior and experienced,

but that does not explain the phenomenon: perhaps it centers on altruism. In any case, whatever incentives are in place appear to not motivate the creation of materials that can facilitate knowledge flows to new recruiters.

In the second (NDRSD), discussing how only the most experienced people appear willing to help new recruiters, this mirrors the misincentivization pathology instance above: nearly everyone else in the command, according to our study participants, is motivated instead to meet quota.

The third (NTAGRM & NRDSD) pathology instance mirrors the two above also, but this one aligns with both recruiting commands in our study: the vast majority of recruiters are motivated to meet quota.

The fourth (NTAGRM) pathology instance is mentioned more than once in the focus group interviews. This pertains to some recruiters that, allegedly, mislead applicants in order to get them into contracts and meet quota, sometimes to the detriment of the applicants. This is anathema to many participants in our study, who say that the negative ramifications (e.g., disgruntled recruits feeling betrayed, warning their friends not to join, performing below their potential, highly unlikely to reenlist) are severe and outweigh exponentially the gains of making quota. Nonetheless, this practice is said to occur, and it appears to result from incentives that motivate some people to suspend ethics in order to meet quota.

The next (NTAGRM & NRDSD) pathology instance mirrors the ones above also: high pressure to meet quotas motivate people to not help new recruiters.

Awards and punishment without rationale (NTAGRM) emerges from the focus group interviews in a couple of different lights. In one, participants in our study mention how recruiting goals are passed down through the chain of command, and how some recruiters receive awards. Many participants mention some notion of mystery regarding why certain people receive awards and others do not. The same mystery applies to punishment. If incentives are intended to motivate desired behaviors in the command, then the recruiters should understand the nature and direction of such incentives.

The “production oriented” instance follows most others in this set: recruiters are incentivized to focus on meeting quota.

The final instance in this set (NRDSD) stems from interviews, as some participants indicate that they do not understand the rationale behind recruiting goals. One participant mentioned working exceptionally hard to make a challenging goal one month, only to see the same challenging goal appear the following month. These participants expressed the importance of understanding why they are working so hard and why each goal is in place.

Finally, we summarize the pathology *technical deficiency* in Table 24. The first (NTAGRM) represents something of a catch all pathology, as it points quite broadly to IT network inadequacies that cause many issues with learning to use systems (e.g., SalesForce) and with finding important knowledge (e.g., recruiting process) and information (e.g., current forms). The second represents a catch all also, as most recruiting commands have personnel dispersed geographically, which inhibits their ability to interact interpersonally and to learn from one another. Our treatment recommendations in the section that follows will address these and all of the pathologies noted and summarized above.

Table 24 Technical Deficiency Pathologies

NTAGRM Code	NRDSD Code	Characterization
IT network inadequacies		Many issues with learning to use systems and with finding important knowledge & information
	Geographic separation of units	Inadequate means and opportunities to interact with recruiters from other geographic locations

G. RECRUITING COMMAND RECOMMENDATIONS

From the numerous knowledge flow pathologies noted and summarized above, we need to prioritize the list. This can help the commands to focus first on treating the most important pathologies. Addressing the complete list of pathologies noted and summarized above, we consult with experienced recruiters to assign a priority level to each pathology: those assigned Priority 1 should be addressed first, followed by Priority 2, and then Priority 3 as time and energy permit. Such prioritization divides the list of pathologies roughly into thirds, which makes it more manageable.

The Priority 1 pathologies are summarized in Table 25. We retain the code and cluster labels for reference to the summaries above, and we add the pathology label to

help group this set of instances. The first 12 represent knowledge clump pathologies. These represent our initial focus, but we address their misincentivization and technologic deficiency counterparts as well.

Table 25 Priority 1 Pathologies

NTAGRM	NRDSD	Cluster 1	Cluster 2	Cluster 3	Pathology
No one to ask	Whom to contact	Documentation	TTP	Tools	K Clump
	Social media skills	Formal Training	TTP	Tools	K Clump
Career recruiting force		Ksharing	Experience	Tools	K Clump
	New people have no clue	Ksharing	TTP	Documentation	K Clump
Process steps	Process steps	Process	Formal Training	Documentation	K Clump
Successful Recruiter	Successful recruiter	Process	Formal Training	TTP	K Clump
"10 steps for recruiting success"	Successful recruiter	Process	Formal Training	TTP	K Clump
SalesForce system	SalesForce	Tools	Formal Training	Documentation	K Clump
Current forms	NRC sharedrive	Tools	TTP	Documentation	K Clump
Turnovers	Training Binder	Turnovers	TTP	Tools	K Clump
Shadowing	Shadowing & mentoring	Turnovers	TTP	Tools	K Clump
UI	Mentor and train new people	Turnovers	TTP	Tools	K Clump
	Create useful training materials	Incentives	TTP	Documentation	Misincentivization
	Experienced people help	Incentives	TTP	Tools	Misincentivization
Recruiter incentives	Initiative & effort to mentor	Incentives			Misincentivization
Integrity		Incentives			Misincentivization
IT network inadequacies		Tools			Tech Deficiency

1. Knowledge Clump Pathologies

As noted above, knowledge clump pathologies indicate that knowledge fails to flow rapidly, reliably and energetically to enable productive work in the organization. This represents a critical issue: an organization cannot expect to meet its performance expectations unless its people know how to accomplish the work activities that are essential for performance. Similarly, misincentivization pathologies motivate people to behave in manners that are counterproductive to the organization, and technical deficiency pathologies center of technologies that fail to integrate into work processes and support productive work directly.

As a first attempt to address these pathologies, we examine how such pathologies impact the Congruence Model as an open system in ways that are easy to understand. The second step involves analysis of the SalesForce system which is followed by discussion of the recruiting information and knowledge ecosystem. We then discuss knowledge as related to ignorance. This is followed in turn by our use case vignette entitled "A Day in the Life of a Productive New Recruiter," which illustrates a healthy information and knowledge ecosystem from the perspective of a new recruiter. This concludes with a set of phased recommendations corresponding to the pathologies above.

All of the recommendations are highly appropriate at the level of a recruiting command. However, some pathologies stem from higher organization levels, and hence merit higher level recommendations. In the subsequent section, we filter and consolidate such recommendations down to four that are most appropriate for higher level organization leaders.

a. Congruence Model Analysis

The Congruence Model analysis reveals further the power of visualization and helps to interpret the pathologies via an open systems lens. A simple view of one layer of the pathologies is offered via Figure 28.

As can be seen in this leadership view of the model there are multiple problems that interact with different vectors within the system. As an open system, the information is obtained from outside the system and informs the internal workings of the system. Thus, as an example, if NORU is seen as insufficient in training new recruiters, this affects relationships to technical and task feasibility, slowing productive work and creating further impacts throughout the organization. In a similar way, if the politically feasible vector is also a problem (e.g., shifting the monthly recruiting goals), then the relationship to the formal organization, MOEs and individual incentives are likely to be affected.

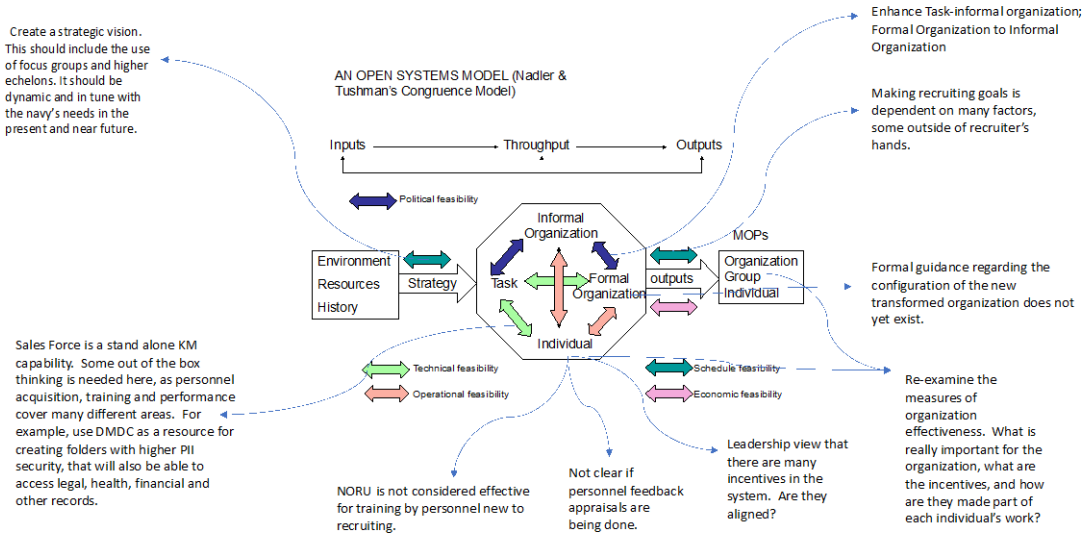

Figure 28 Top Level Congruence Model visualization

What is not obvious in this analysis is the impact of knowledge flows on the feasibility vectors. More work is needed here, but we can say that each of the three knowledge flow possibilities covered earlier will be integral to this dynamic model of relationships. Indeed, Table 26 summarizes numerous interrelationships between Congruence Model and knowledge flow impacts stemming from conversations with Leadership at the two recruiting commands studied in detail and reported above.

Specifically as depicted in Figure 20, following the interviews and qualitative analyses, we have another conversation with the Commanding Officer (CO) of both recruiting commands as a form of member checking. This affords Leadership an opportunity to hear the results of our analysis that is based on interviews with recruiters in their organizations. This also affords us an opportunity to increase the level of balance in the study by incorporating the Leadership perspective.

Table 26 includes three columns: 1) Leadership Perspective refers to comments made by the COs during these member checking conversations. Each comment is coded by color to depict the organization (i.e., NRDSD or

NTAGRM), but we do not specify in order to preserve some degree of anonymity. 2) CM Feasibility Impact refers to how such comment impacts Congruence Model (CM) feasibility. 3) Knowledge flow impact refers in turn to how such comment impacts knowledge flows. Our integration of CM and knowledge flow interrelationships represents a substantial theoretic achievement, and it provides considerable insight into the recruiting organizations. The astute reader can trace most of these comments back to the categories, pathologies and phased recommendations presented above, for these formed the grist of our conversations with Leadership. Alternatively, we present them here more in the conversation format associated with the leaders' comments.

Table 26 Leadership Perspective

Leadership Perspective	CM Feasibility Impact	Knowledge Flow Impact
The KM process in recruiting is broken or not being executed as expected.	Recruiting is process heavy. Lacking relationship between feasibilities in Congruence Model reduces effectiveness by making each part independent.	Flow is interrupted at each step of the process, creating multiple knowledge clumps.
There is a need for KM as a process-based system.	Affects technical feasibility.	Individual to task vector is affected, slowing processing and requiring a reliance on tacit knowledge.
As a leader, the 6 months of training prior to arrival was a waste of time.	Individual to task and individual to the formal organization are affected, technical and operational feasibility.	Task knowledge and requirements of the formal organization are OJT.
Notice major frustration among the junior people doing recruiting. Story telling: This is done in Detail at NORU as well as at the command level by all CRF and experienced recruiters on a daily basis	Political feasibility. Enables the informal organization.	Tacit knowledge flow is important.
SalesForce and OJT are not drivers of success.	Technical feasibility and political feasibility.	Points to individual as drivers of success, with a need for better training via explicit knowledge.
SalesForce has potential to be an excellent tool. However, implementation of COTS tool was abysmal. Flag leadership enforced its use, but middle management did not understand its use.	Technical, political and strategy feasibility.	Some disagreement between commands, one emphasizing the need for better implementation of a mandate without competent dialogue, the other assuming that knowledge provided by NORU is sufficient. Tacit v. explicit knowledge. The informal

Training is provided in detail at NORU as well as step by step instructions posted to the portal. Additionally there is training provided through chatter on SalesForce as well as on every page in SalesForce it tells you what needs to be done.		organization is point of knowledge for tacit knowledge.
Recruiters are now Talent Scouts without much understanding on how to do this.	Operational feasibility.	Explicit knowledge of the role and processing related to talent scouting is missing.
No grace period for new recruiters. As recruiters are added, the organizations contract goals go up.	Operational feasibility.	Without knowledge obtained through formal training, difficult to make explicit knowledge of the formal system useful.
Organization structure is still a problem.	Schedule feasibility.	This is related to knowledge, tacit and explicit, of the organization's strategy.
Civilians with long tenure really control change. Their corporate knowledge is high but willingness to change is low.	Operational and political feasibility.	Related to the above comment. Largely tacit knowledge about what works and what does not. Implementation of org change is important.
See little difference between transformed v. non-transformed organization performance.	Operational and political feasibility.	Knowledge of significant differences, good or bad is not incorporated.
Automation of entry to SalesForce is required.	Technical, operational and schedule feasibility.	Explicit knowledge on how to be most efficient with SF is needed, and a mechanism to provide input for improvements needs to be provided.
Need embedded training and software changes in SalesForce so that it "fits" the actual work of recruiting.	Operational and economic feasibility.	Knowledge of fit between processes and knowledge needs where clumping occurs is needed to improve organization MOEs.
No Knowledge Manager assigned, or billet allotted. Currently semi-formal at chief level in the Training department.	Operational feasibility.	Knowledge paths that reduce clumping should be the job of a KMO. Without this, little will change.
Contracted assistance comes and goes as contracts run out or are at the mercy of the contracting system.	Technical feasibility.	Explicit knowledge on how to use tools has been expressed as a need. Interruptions contribute to clumping pathologies.
A training team from within does not exist. Knowledge repository: Information is located on the portal under the NORU page as well as under the RTI link on our command Page	Technical and operational feasibility.	Explicit knowledge transfer is not occurring. Assumption is that NORU provides sufficient information along with OJT.

Process steps: Provided in detail at NORU and in required JQR/PQS modules Recruiter template: This is a great idea, could be done at the command level, but might also be worthwhile to be done at the divisional level, because you can have a vastly different experience based on vastly different markets within the same command. Expertise locator: Currently there is a command contact list that includes everyone by rate and position to include the command training team. In addition at the RDB reiterates training and develops additional training for those who are in need of it. They are obviously connected with those in the station, and we encourage collaboration with others in their division.		Implementation of talent search and templates would be very useful in aiding both explicit and tacit knowledge flows.
Incentives are not at the team level, but at the individual level. Awards are unusually high compared to the Fleet. Incentives: Incentivize mentor and training? Mentors are required through the SAILOR program controlled by the CMC and training is a divisional requirement and billeted position at every command. Recommend accountability vice incentivizing. Concur that training has to be a priority and finding a balance with training and production is always the trade-off. The onboarding process needs to be codified with strict timelines, specifically for how long	Incentives affect the operational and schedule feasibility.	Incentives seem misplaced, towards goal attainment. The result is a kind of "watering down" of the naval achievement or naval commendation medals usually awarded for operational excellence. Knowledge needs to shift from medals to specific letters and recommendations for excellence in recruiting.

someone is onboard before they are required to start putting people in the Navy. We have not incentivized the training process, I've never really considered it. In my opinion, the ramp up and training process for a new recruiter is part of their job requirements and I've always felt that the recruiting enterprise as a whole has more incentives and awards than anywhere else in the Navy.		
CO's need more latitude to correct manning issues to cover the administrative load.	Operational feasibility.	Explicit knowledge in the formal structure in implicated here.
Recruiting is considered mission essential but receives little support.	Schedule feasibility in support of strategy.	Explicit knowledge of the recruiting strategy across the navy and at a particular region.
Every recruiter talks with CR during the orders negotiation process, but the extent of the conversation revolves around where they will be located in the AOR. Recruiting specific info is not really passed at this point. It is more along the lines of closest base and MTF, Tricare remote, other issues Sailors in that part of the AOR have historically encountered. Not sure if that is what is meant by "helpful" info?	Technical feasibility.	Knowledge between the individual recruiter and tasks expected of them on arrival needs to be explicit prior to training and arrival.

b. SalesForce Analysis

Here we discuss the SalesForce application. Most of this discussion is supported by conversations with recruiting leaders and technologists, through which we have pieced together this narrative history and analysis. Although some of our details may be a bit off target, the major effects, observations and findings are likely to be metaphoric bulls eyes, and this analysis remains ongoing at the date of this report.

As noted at the beginning of our Background section above, as KM gained power within the academic literature and professional practice over the years, the creation of means to use knowledge in an actionable form was co-opted broadly

across many organizations, by people who were mostly dedicated to building platforms that are information management focused. Indeed, such technical focus corresponds to one of our preconditions for KM failure (i.e., #12), which blurs the line between (data and) information management and the flow of actionable information (i.e., knowledge) to where, when and how it is needed to complete work tasks by participants in the organization.

Clearly there have been many developments in data management and data science, including deep learning and artificial intelligence for business analytics. How these developments impact tasks within the transformation of information to outputs that align with the strategic purpose of the organization is not always a close fit, however. The Congruence Model assists us in understanding functional relationships but not people-task-knowledge relationships. To understand this, one must understand the processes dependent on accomplishing tasks and the knowledge needed to do this work.

SalesForce is a relatively new tool for use by the recruiting commands. It was preceded by Application Relationships Management software. The decision to move to SalesForce was made at the Flag level, and long term maintenance and upgrades were not included. SalesForce appears to be a good fit on the surface, with lots of business analytics and other features. PMW 160 contracted the acquisition, and PMW 240 is now the implementing organization.

As implementation has continued, SalesForce has begun to show itself more adaptable to the previous management style of recruiting (i.e., NRD) and not as much for the transitioned structure (i.e., NTAG). Some web capabilities such as webstream (locates recruiting stations around the country) were not compatible with SalesForce and are no longer in use.

As noted above, a broad lack of knowledge regarding how to use SalesForce effectively represents a major knowledge clump in the recruiting organizations. Two days of training at NORU is acknowledged to be too little time to provide full understanding of what SalesForce is capable of achieving. For the “prospecting” function, SalesForce does support automatic population of Forms 680, 2807 and 1966. While this is a good example of task assistance, many

of the processing functions that follow do not have the same task to SalesForce clarity.

Other difficulties with the system include an insufficient team to train personnel on site, an activity left mostly to OJT. SalesForce is a very good example of what has happened generally across the KM field . That is, new platforms are created constantly—ostensibly to address an organization problem (pathology) through technology—but many such platforms enforce the organization to adapt its work processes in conformance with the technology, not vice versa. Hence the organization serves the machine, which represents the reverse use case behind the technologic decision making and implementation.

Nonetheless, many view SalesForce as a success. This is the case in particular with system analytics. Apparently myriad diverse reports are prepared and disseminated from SalesForce information, and higher levels of the organization appear to be pleased with this aspects of the system. The line recruiters, however, are required to feed the system, and the current state of implementation, training, documentation and experience suggest that such feeding results in duplicative effort. Paraphrasing what multiple interview participants summarize, "I spend an hour making phone calls and the next 30 minutes inputting data into SalesForce." Whether this reflects user ignorance, inadequate training, poor documentation, user inexperience, or some other factor, SalesForce needs to be integrated into the line recruiting work in a way that supports the recruiters directly. Moreover, close fit of information to task is needed in the analysis of any new tool, and an implementation plan needs to be well developed and trained, in order to create a successful transition to a new platform.

c. Recruiting Information and Knowledge Ecosystem

Figure 29 provides an overview of the recruiting information and knowledge ecosystem. The major process areas are depicted as colored boxes with major functions listed with them. The process begins with the Leads Process (purple box). This process focuses on lead generation, which involves marketing and advertising to generate leads to potential recruits. Public involvement represents another major lead source, along with a variety of others listed. The

website Navy.com represents an important system that supports this process, as do other technologies like online chat.

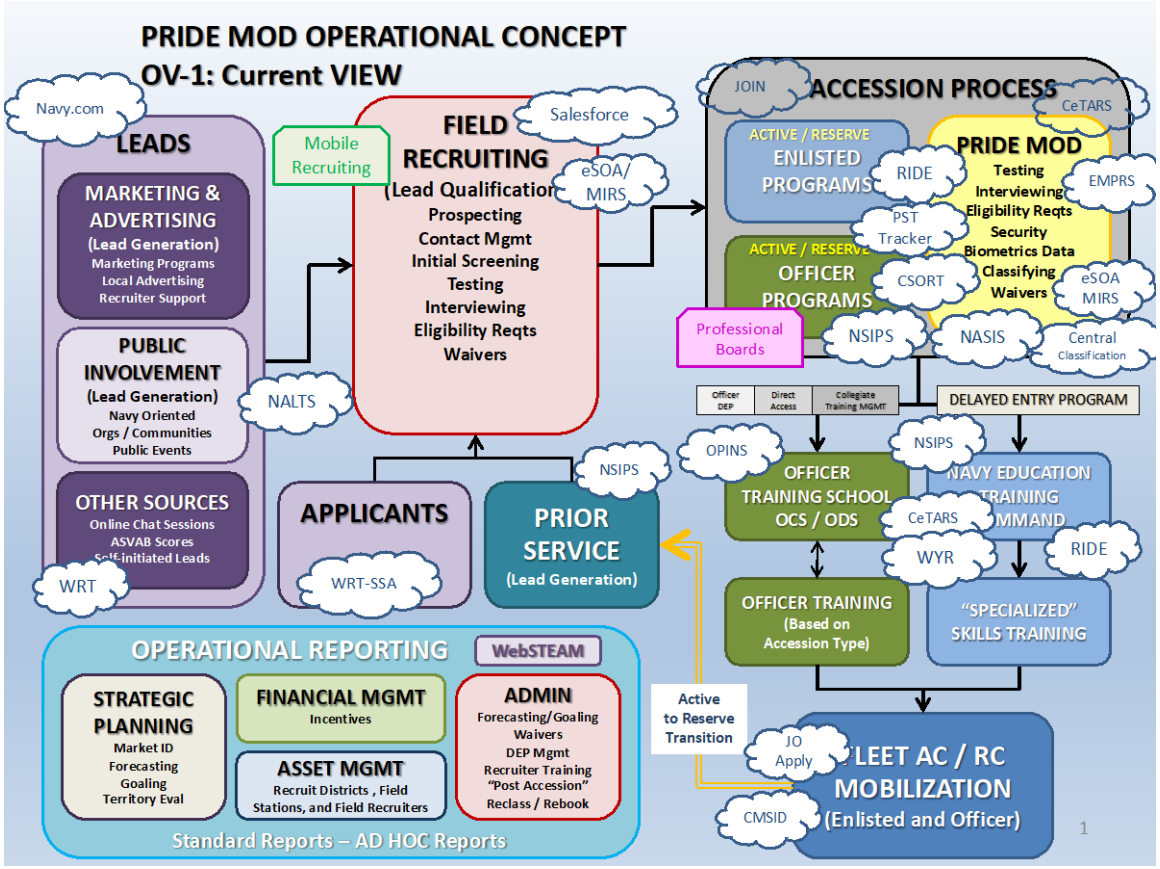

Figure 29 OV-1 View of Information and Knowledge Ecosystem

The next process is Field Recruiting. This process focuses on lead qualification, which involves prospecting, contact management and other major functions. Field Recruiting is followed by Accession Process, which involves active and reserve programs for officer and enlisted personnel slated to join the Navy; in addition to Pride Mod, which involves testing, interviewing and like functions. The Education and Training Process follows. Potential officers attend Candidate School and proceed to officer training appropriate for their chosen or assigned professions. Potential enlisted report to the Navy Education and Training Command and proceed to specialized training for their chosen or assigned jobs.

The final process centers on Fleet Mobilization, where new officers and enlisted go to work.

This ecosystem also reflects myriad different systems and related flows of information across the various sequential processes. The work accomplished within each process requires knowledge. Notice the level of complexity apparent within this ecosystem. Such complexity is exacerbated by the many additional databases (i.e., data at rest) that are not shown in the figure and the movement of data between each of the processes (i.e., data in motion). Likewise, this complexity is exacerbated further by the various knowledge flows required for people to perform useful work on process tasks.

Indeed, one can count eighteen individual process parts, which could be connected in 18^2 different ways. Such complexity implies enormous variety, control of which we know from Ashby requires even greater variety. Unfortunately, Recruiting as an organization lacks such variety, hence the ecosystem remains uncontrolled. This provides insight into the numerous knowledge flow pathologies and congruence misfits noted above.

The concept of a knowledge lake is a metaphor for the collection of data, information and knowledge important to the ecosystem as a whole. Such metaphoric lake should provide timely and energetic knowledge flows, where, when and how it's needed, even across process and organization boundaries. However, without corresponding data rivers, such flows cannot move knowledge from where, when and how it is to where, when and how it's needed.

This is an area in which knowledge engineering is important. Knowledge engineers can address unhealthy information and knowledge ecosystems in ways that can get knowledge flowing in healthy and energetic ways. Surveying the ecosystem represents a productive start, but such surveys need to be followed by identification of knowledge clumping, misincentivization and technologic deficiency pathologies, the analysis of which can identify effective use of organization, tools and techniques to get knowledge from where, when and how it is to where, when and how it's needed. The knowledge engineer can also help to overcome ignorance in the organization.

d. Knowledge Relations to Ignorance

Ignorance as a verb can mean "to ignore"; that is, to not take in all knowledge at once. However, the more common noun form of the word implies an absence of knowledge. Not all knowledge—or ignorance—is the same, however, as the comparative severity of missing knowledge depends upon the corresponding level of ignorance. From Denby and Gammack's short article, "Taxonomy of Ignorance," and originally in Holtzman (1989) one can view ignorance and its severity through a number of levels, which we depict via Table 27.

Table 27 Taxonomy of Ignorance

Ignorance Level	Description	Knowledge Required
1. Combinatorial	Computational task too difficult, e.g. problem with 10 variables.	Mathematics model available; use of supercomputers.
2. Watsonian	Cannot make the connection from all the clues; solution method incomplete.	Method for determining the important facts from the unimportant ones, and drawing the right conclusion.
3. Gordian	King Gordius tied a knot for the future king of Asia to untie. Alexander the Great was able to "untie it" by cutting the knot with his sword, thus solving the problem in an unusual way.	Lateral thinking; are there "rules" to be broken?
4.Ptolemaic	Attributed to the Greek mathematician and astronomer, Ptolemy, whose model of the universe centered around a stationary earth.	Evidence and observation of reality.
5. Magical	"No one knows how it works, but everyone knows that it works", e.g. the use of Aspirin and other similar drugs.	Trial and error.
6. Dark	No model is available but one is aware of the issues, e.g. "What is Life?", "Consciousness", etc.	Future of Science
7. Fundamental	Unaware of the issue.	Don't know what we don't know.

Briefly, Level 1 represents Combinatorial Ignorance. This is the easiest and most straightforward level, for the corresponding knowledge can be attained through mathematic models and computers. This level can be addressed well through technologic tools.

Alternatively, Level 2 represents Watsonian Ignorance. This is more difficult and less straightforward to address, for identifying important information and making effective, timely decisions is unclear. Some tools such as decision support and data analysis can be helpful here, but the people using the tools must have sufficient experiential knowledge to distinguish important information and understand the appropriateness and timeliness of decisions. This requires a combination of explicit (e.g., from documentation) and tacit (e.g., from experience) knowledge.

Continuing down the ignorance taxonomy, Level 3 represents Gordian Ignorance. This provides even greater challenge for tools to address, as lateral thinking (i.e., creativity) is required. Some AIML applications can be said to exhibit aspects of creativity, but most people consider this to be a predominately human capability, one that is enabled by objective observation, unbiased consideration and experiential knowledge.

Level 4 represents Ptolemaic Ignorance. Overcoming ignorance at this level involves breaking paradigm and accepting new models of how the world works, particularly where existing models grow increasingly complex and ineffective. Although some tools can be helpful with data analysis, identifying new ways of working in the organization, for instance, involves research, and implementing such new ways requires a willingness to accept novel approaches. This study represents an example of research to help conceptualize new ways of working with knowledge in the recruiting organization.

Level 5 represents Magical Ignorance. Overcoming ignorance at this level requires the development of new knowledge through science. Aside from aiding scientific research, tools are of little use at this ignorance level. Much organization culture and many processes operate at this level, as no one knows why things are done the way they are, and people say that it's always been this way. Information tools can, however, explain the "what" (e.g., process steps), even if the "why" remains unknown.

Level 6 represents Dark Ignorance. A key point is that ignorance at this level can be local: people in one organization, for instance, may suffer from dark

ignorance regarding some aspect of the organization (i.e., knowing that they're ignorant but not knowing how to overcome it), whereas people from another organization may have discovered (e.g., through serendipity, science, espionage) the requisite knowledge.

Finally, Level 7 represents Fundamental Ignorance. Here people do not know what they do not know. At the local level (e.g., within an organization), there is little opportunity to overcome fundamental ignorance, but where such ignorance is local (e.g., as noted above with Dark Ignorance), tools can be useful to point people toward the requisite knowledge. For instance, a new recruiter may clearly experience deeper levels of ignorance, including Level 7: not knowing what he or she doesn't know.

Seen another way, Figure 30 illustrates the task ignorance to knowledge gap. Where ignorance regarding task performance (vertical axis) is relatively low, the corresponding knowledge gap—which could be filled with either tacit or explicit knowledge—is low also. This corresponds well with Level 1 Ignorance from the taxonomy above. An example is where a recruiter in the organization knows what to do and where to find what he or she needs, say a particular form that can be found using an appropriate tool.

As the ignorance level increases, however, a larger knowledge gap develops. This corresponds better with Level 2 Ignorance. An example is where a recruiter in the organization does not know how to accomplish his or her work tasks. To fill a knowledge gap such as this, the organization must have considerable knowledge available. The worker needs to know where to learn what needs to be done next and how to do it. Knowledge and information repositories, search engines, workflow systems and like tools can be useful here, but the recruiters must know how and when to use them effectively.

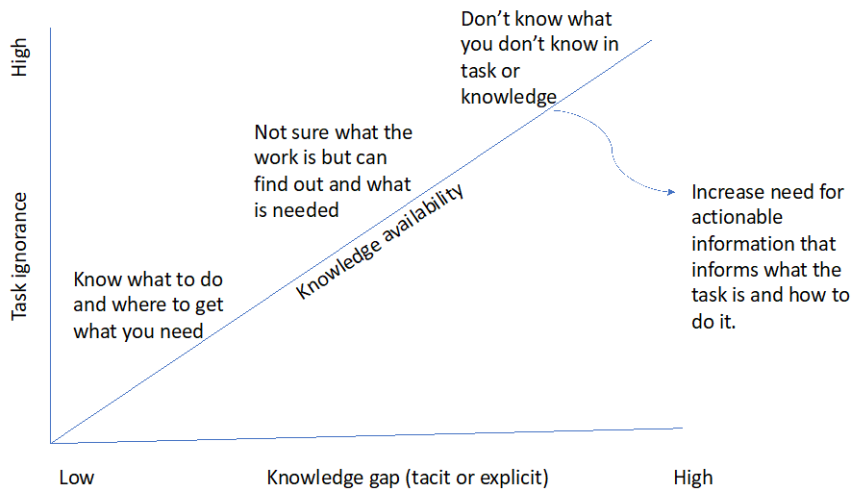

Figure 30 Task Ignorance to Knowledge Gap

Continuing up the ignorance axis, someone may not even know what he or she doesn't know, which corresponds to Level 7 Ignorance. This requires a great amount of knowledge to be available and *learnable*. We emphasize *learnable* here, for it is insufficient to tell such ignorance person that, "the knowledge is on the share drive," or "read the manual." A well-organized information and knowledge ecosystem could be very useful here, particularly when people in the organization understand it. As noted above, someone who is new to recruiting may reflect Dark Ignorance of this nature. He or she will require actionable information (i.e., knowledge) of what needs to be done and how to do it. Education and training (e.g., NORU) could be effective, as could an informative guide to all recruiting processes, activities, tasks and steps, inclusive of how to accomplish them effectively.

Our use case vignette, "A Day in the Life of a Productive New Recruiter," seeks to address such dark ignorance. Key aspects of a healthy information and knowledge ecosystem are **highlighted in bold** for emphasis.

e. A Day in the Life of a Productive New Recruiter

ET1 Getter arrives at the office early for her first day as a recruiter in the recently transformed Navy Talent Acquisition Group (NTAG), where she was assigned following a relatively long, forward deployment aboard ship. Before starting her own day, the LCPO stops by to ask how the transition is going so far.

ET1 says, "very well, thank you," and explains:

> The transmission has been very smooth. In addition to the "Welcome Aboard" message received from the Command Master Chief, I really appreciated hearing from the Chief Recruiter well in advance of my reporting date. CR provided a **wealth of helpful information** about the command in general and the recruiting process in particular. Having no prior recruiting experience, I found it especially helpful to follow CR's links to the **recruiting process steps** and my **personalized training plan**. After six years in the Navy, I'm really impressed by how well organized this command is!

LCPO replies, "Great. I am personally responsible for you completing your training plan successfully, and this is what I have in mind:

> Here on your first day, I will introduce you to all of the **key members of your office team** here. Since people in this command are distributed across a large geographic region, it is very important to know who knows what. Each person in our office is included on your **Expertise Locator**. After meeting everyone, you and I will have a meeting with the experienced recruiter who has been assigned as your **Mentor**. You will **Shadow** him until we both feel that you're ready to fly solo, but both he and I will **remain available to assist** you throughout your tour here at the NTAG. Don't worry about bothering us with even small questions: **Leadership provides incentives** for us to assist and ensure that you become as productive as possible as quickly and as long as possible. Indeed, **my performance appraisal is connected to yours**: the better that you do, the better that I do. When you become competent and experienced, you will likely **become a mentor** in the future too. **Leadership will incentivize you** to do that too. Here is a list of **links to the knowledge repository**, which you can **search** to find key knowledge and information. These links will **guide you** through everything you need to know about the **tools, systems and processes** that we use; including recruiting techniques, tactics and procedures (**TTPs**); standard operating procedures (**SOPs**); lessons learned (**LLs**); **current forms and information**; **expertise locator**; and **reference documents**.

ET1 meets with LCPO and Mentor, the latter of whom is a **career recruiter**, as planned. Mentor says that he will go about his usual day, explaining

the what, how, when and why associated with each step, decision and action. He says also that he expects lots of questions: "That's an important part of my job," he explains.

The day continues with **SalesForce**, the command customer relation module (CRM) and activity tracker. "You have the link to **current documentation** in your **onboarding package**," he says, but you can always access the frequently asked questions (**FAQs**) and view the frequently requested answers (**FRAs**) that we all use routinely.

> At 1000 I have a **video conference** with three of my command counterparts in different geographic locations. We try to meet weekly to **exchange stories** about what we're experiencing, both in the office and the field. At first I thought this would be a waste of time, but it's extremely helpful! Although the term *community of practice* (**CoP**) has developed something of a bad reputation, together we're able to **crowd source** and **peer assist** to address unfamiliar problems. Each of my counterparts is mentoring a new recruiter also, so you can **meet some people in the same boat** as you. I encourage you to get to know them, exchange your own stories, and help one another as peers.

At the end of the day, ET1 meets with LCPO again to debrief the day's activities, challenges and accomplishments:

> Glad your first day was productive. Ever since **Leadership** began **prioritizing and incentivizing the onboarding and training process**, new recruiters have gotten up to speed and become productive much, much more quickly than ever before, and through **benchmarking**, we've observed our unit and command productivity increase unbelievably. Tomorrow we have some **command training** scheduled through videoconferencing to address the use of **social media** to facilitate and enhance our recruiting performance. You won't want to miss that. By the way, we have developed a **successful recruiting template**: you should definitely look that over and see how you can adapt it to fit your personality and talents.

f. Recommendations for the Recruiting Organization

To summarize this vignette, several key points elucidate how the model NTAG could manage to embed KM into its mission, process and daily activities. We summarize the principal elements via a set of recommendations summarized in Table 28, which we discuss in turn below.

Table 28 Principle Elements and Recommendations

Element	Recommendation
Incentives	Leadership prioritizes & incentivizes the onboarding & training process
Incentives	Leadership incentivizes people to mentor and train
Performance appraisal	Leadership links performance of mentors/trainers & mentees/trainees
Advance information	LCPO provides wealth of *helpful* information in advance of check in
Process steps	LCPO provides link to recruiting process steps
Recruiter template	List of qualities and activities that lead to a successful recruiter *in this command*
Personalized training	LCPO develops personalized training plan
Expertise locator	Expertise locator lists everyone in command, by office, in terms of experience & expertise
Mentor	Career recruiter is assigned as Mentor
Shadow	Experienced recruiter lets new person shadow over extended period
Assistance	LCPO and Mentor have open door policy to assist whenever necessary
Knowledge repository	Key knowledge and information available and easy to locate in single location online
SalesForce	Current documentation linked via onboarding package. Mentor provides training.
FAQs & FRAs	Online documentation includes FAQs & FRAs via Wiki: anyone can contribute.
Videoconferencing	Use to connect people from geographic separate units
Storytelling	Use to surface common problems, issues, workarounds and successes
Crowd sourcing	Use peers to help answer questions
Peer assist	Use peers to help solve problems
New recruiters	Connect new recruiters with others across command (CoP)
Command training	Help with problems & issues deemed timely & important to command
Social media	Learn to use social media for facilitate & enhance recruiting performance

As indicated in the table, the first three principal elements of embedded KM *stem from leadership*. We cannot over emphasize the importance of this: Leadership sets the priorities and incentives for the organization, which in turn drive people's focus, attention, effort and activity. In short, if Leadership is interested in dissolving knowledge clumps and effecting rapid, reliable and energetic knowledge flows through the other principal elements summarized in this table, then it must authorize and motivate its people to do so. This is Job 1.

The first element involves the prioritization and *incentivization of onboarding and training for new recruiters*. As described in the vignette above, the productive attention and assistance directed toward the new recruiter is likely to occur only if people in the organization see it as a priority and understand incentives aligned with such attention and assistance. It is far too easy and common for organization personnel to be too busy focusing on their own production outputs, and working to meet their own recruiting goals, to help new recruiters. Clearly many leaders are likely to complain that their people do not have time to both help the new recruiters and meet goals. However, even a minor investment in making new recruiters productive quickly can *pay dividends*

immediately through their increased productivity: a new recruiter who doesn't know what to do will contribute zero to the organization's mission and goals.

Likewise, leadership needs to *incentivize at least some people in the organization to mentor and train new recruiters*. Some examples of incentives include direction to do so, but leaders should also plan to allot time for people to mentor and train as such: reducing their quotas and goals would be a step in the right direction, realizing that the new recruiters are highly likely to more than make up the difference through accelerated learning and productivity.

Another incentive centers on *linking the performance of mentors and trainers to the performance of the people they assist*; that is, measure them as a team instead of individually. If a new recruiter becomes knowledgeable and proficient quickly, then he or she will become productive quickly as well, hence both the new recruiter and his or her mentor or trainer should benefit. Unless such mentoring and training is emphasized, monitored and rewarded, however, it is unlikely to be approached and accomplished in earnest, and hence unlikely to be successful.

The next element involves *helpful information* provided by the Chief Recruiter (CR) or Lead Chief Petty Officer (LCPO) *in advance* of the new recruiter checking into the command. As suggested in the vignette, such information can include standard welcome and onboarding points (e.g., regarding the local area, uniform requirements, command organization), but it could also include links to recruiting process steps, lessons for self-study, and other important resources, with which a new recruiter can begin familiarizing him or herself well in advance of reporting. Almost everyone wants to be productive, and most people are likely to engage in productive self-study in order to get a head start when moving to a new organization.

The *process steps* represent an item that emerges again and again in our focus group interviews: it's very surprising how many people stated that they did not understand the recruiting process even after being on the job for some time, and recall from above how more than one new recruiter endeavored to develop a list of process steps individually. There is no reason why a command cannot *make*

the process steps available: this is basic and essential for learning the recruiting job.

Related to this is the *successful recruiter template*. Many study participants indicate that recruiting is not a one size fits all activity: recruiting officers is different than enlisted; recruiting in Florida is different than in California; recruiting medical officers is different than general officers; recruiting in blue collar neighborhoods is different than affluent locations; the long list goes on. This imposes limits on standardization, but *within a command*, certain qualities and activities of successful recruiters can be discerned, and there is good reason to articulate such qualities and activities in terms of a successful recruiter template.

New recruiters can *use such template as a checklist* to help focus their activities, and where they may not be aligned naturally in terms of personality or disposition (e.g., introverted and shy instead of extroverted and gregarious), new recruiters can *identify areas for improvement*. A new recruiter who is naturally introverted, for instance, could recognize this and join a Toastmasters unit or perhaps work informally with like recruiters. Such new recruiters could also be paired with natural extroverts, as another instance, or perhaps they could find a better fit within the organization through processing or administration, as opposed to scouting.

Personalized training occurs within the command, even within the unit. No two new recruiters are identical, so each should have an individualized training plan. NORU may be beneficial for some people and waste of time for others. Toastmasters may be beneficial for some people and waste of time for others. Explicit training on how to search for and locate organization resources may be beneficial for some people and waste of time for others. The list goes on. If a command can *treat each new recruiter as an individual*, then such individual can learn first what he or she needs most and then pick up the rest, either through natural talent or experience over time.

An *expertise locator* represents and invaluable resource in every organization. This is the case in particular for those such as Recruiting that have

units and people dispersed geographically. Even more than know-what and know-how, it is essential to *know who knows what*: these are the people one can turn to for quick answers to otherwise difficult and time consuming questions. Even a simple directory—patterned after the standard organization chart, and hopefully online with clickable links to each person's background, experience and contact information—can go a long way toward making explicit an *organization's implicit knowledge network*.

Mentoring represents a very powerful approach to knowledge sharing. If an experienced person has the motivation and incentivization to serve as a helpful mentor, then he or she can *accelerate a new recruiter's learning by an order of magnitude* or more. A quality mentor takes personal and professional interest in the development of his or her mentee, and such mentor makes him or herself available to answer questions and provide professional guidance over considerable time. The career recruiter represents the most likely candidate to serve in a mentor role.

Shadowing is related closely to mentoring. Indeed, a mentor may ask each new recruiter to shadow him or her as the most basic approach to mentoring and learning. When shadowing, a new recruiter is able to see what an experienced recruiter does, how he or she does it, what problems are encountered, how they are resolved, and even how to act and behave in terms of recruiting persona. Moreover, the new recruiter has ample opportunity to ask questions, and over time, he or she can assume an increasingly prominent role in the recruiting process; progressing from a disengaged but observant shadow, through active participation, to leading the activities with a mentor in tow, just in case questions or problems arise. Particularly when combined with mentoring, shadowing can *accelerate a new recruiter's learning by an order of magnitude* or more.

Assistance represents an essential activity that is presumed in most organizations. However, if people are too busy pursuing their own goals to assist others, then the process breaks down. Clearly not everyone in the organization needs to maintain an open door policy, but certainly every new recruiter should have access to one or more such people (esp. Mentors, LCPOs, CRs), who in turn

should be incentivized to assist others. Moreover, those people who provide greater assistance to others should be *rewarded for doing so*. This can be woven into a command's activity and reporting scheme: who assists whom.

Knowledge repository represents a single, authoritative source of knowledge and information in the command. It must be online, current and easily accessible to all personnel. There is *no good reason why a new recruiter is unable to access* current forms, process steps, areas of expertise, instructions for using systems, or any other factual knowledge or information pertinent to his or her productive work in the organization. Online guidance represents an extension of the knowledge repository. Here one would find knowledge and information to guide users through the use of various tools, systems and processes in the organization. Further, such repository would include TTPs, SOPs, LLs, reference documents and like information that is essential to recruiting.

SalesForce represents a system that receives a surprising amount of negative attention in our focus group interviews. Many people do not know where to find documentation, how to use the system, or when during their day to interface with it. As central as this system is, current documentation should be provided via onboarding packing, and mentors should provide training, in addition to documentation that should be found easily through search of the knowledge repository. Moreover, at present SalesForce appears to require effort beyond the essential recruiting tasks: it would be great to see recruiting commands *embed* its constituent activities in a value added manner: so that using *SalesForce would contribute directly toward productive recruiting activities*, and vice versa.

FAQs represent questions that are asked frequently, and *FRAs* represent the corresponding frequent answers. Since many new recruiters are likely to ask the same questions, the command should prepare by including FAQs and FRAs. Indeed, this set of FAQs is likely to vary across commands and units, as well as over time, so a Wiki like application—one that allows for growth and change—may serve this function best, perhaps *encouraging anyone to contribute to it*. Regardless, the answers should be helpful and authoritative, and the questions

should not be redundant, so someone needs to be responsible for its content. Again, the CRs in an organization may be the best choice. Another approach is to *appoint someone to serve as Knowledge Management Officer* (KMO) for the command, even just during the transition from knowledge clumping to knowledge flowing rapidly, reliably and energetically.

Videoconferencing is essential to connect geographically separated people. The technology is both common and inexpensive now, and people have become very familiar with it through the COVID Pandemic. Remote technology such as this can help to *integrate disparate people* and make separate units operate as a more cohesive whole.

Indeed, videoconferencing can be used to enable and encourage systematic *storytelling*, where people can describe problems, issues and unique encounters, in addition to solutions, approaches and common factors, in a group (albeit remote) setting. *Sailors have been learning through stories for millennia*. This represents an exceptionally powerful technique. Moreover, particularly common or compelling stories can be *captured through video recording* and incorporated both into command training materials and searchable online repositories.

Crowd sourcing and *peer assist* represent similar approaches to people asking one another for assistance. In crowd sourcing, someone with a question or problem could pose it to the group—perhaps via email or a crowd sourcing Intranet channel—for input from people who have experience or insight. Peer assist is a bit more direct, where someone asks a peer to assist directly (i.e., not just provide advice) with a problem. These represent powerful knowledge sharing techniques. As with numerous techniques above, however, *Leadership must reward people for contributing and assisting*.

New recruiters can learn much from one another. Since many new recruiters will experience similar problems and issues—and they are likely to have dissimilar backgrounds, experiences and skills—they may be adept at helping one another, and periodic interaction can help them to bond into informal teams of communities of practice over time. Plus, new recruiters may be more willing to ask other inexperienced people questions that they may hesitate to ask

supervisors and more experienced peers. Further, by interconnecting new recruiters, a command can *mitigate the effects of isolation, frustration and motivation loss*.

Command training can be used to familiarize all personnel with common problems, socialize novel approaches, communicate Leadership initiatives, introduce new tools and techniques, and accomplish additional functions that are unique to each command. *Particularly through videoconferencing*, such training can be accomplished across geographically disparate units.

Finally, *social networking* is central to the people the Navy seeks to recruit. Many Millennials and other potential recruits use social media extensively, and the Navy has the potential to augment its array of recruiting tools and techniques to take advantage of social media. Specific tools and techniques are likely to vary across geographic regions, markets and recruit characteristics, but *every recruiter should probably be competent at social media* and using it daily.

g. Tools and Techniques to Improve the Process

Here we outline and discuss a set of tools and techniques to dissolve the knowledge clumps and improve the recruiting process, particularly as it pertains to new recruiters joining an NTAG. Before doing so, however, we must reemphasize that *Leadership must embrace and support such emphasis on new recruiters, and it must both resource the requisite tools and incentivize the enabling techniques*. Without a Leadership commitment as such, it is doubtful that any tools or techniques will prove to be effective in enhancing knowledge flows through the command.

The first order of business centers on a command wide, online knowledge and information repository that is accessible via the Web. Gone must be the sharedrives and like information silos that are searchable only by a rare few in the organization. Instead, we need a single site, with a name along the lines of "NTAGXX Knowledge and Information Repository." This site, which can become part of the organization Intranet, should have easy and clear navigation to all of the important documents, instructions, procedures, forms, FAQs, FRAs,

incentives and support tools that any recruiter will need to access. We include a very rough example of how such a webpage could be organized via Figure 31.

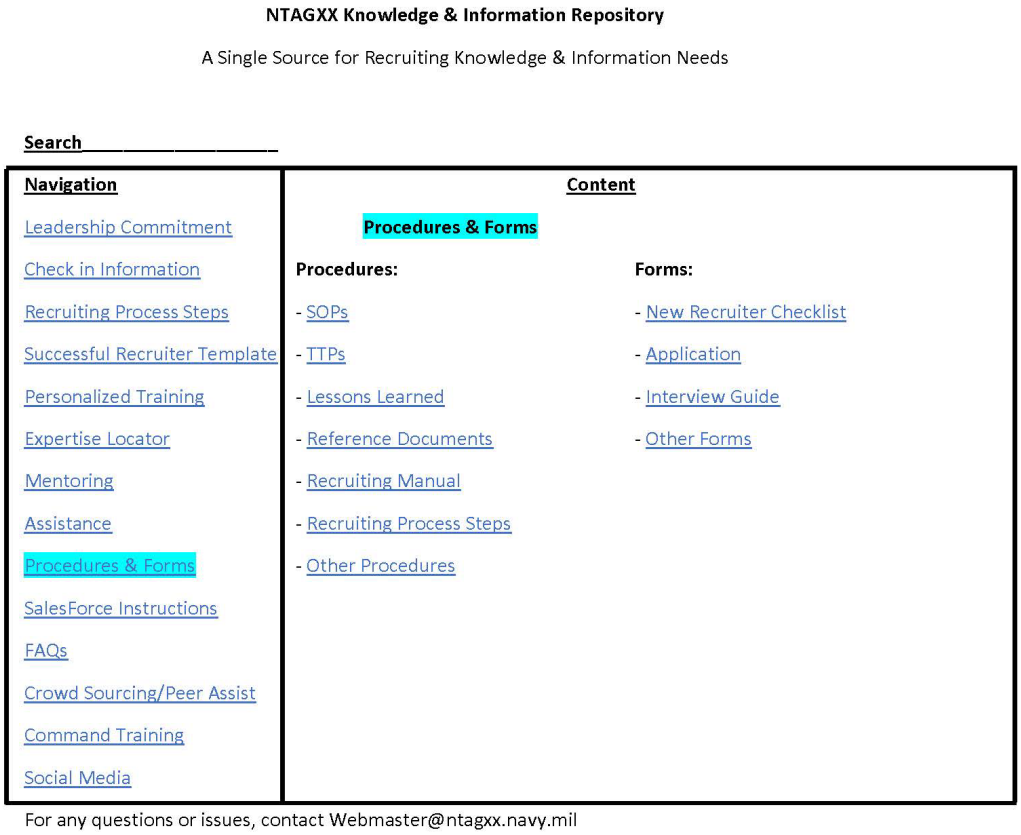

Figure 31 Example Knowledge & Information Repository Page

There is clearly nothing extraordinary about this particular example[10]. Yet it reflects good website practices, and it reveals *in one place* all of the current and relevant procedures and forms that a recruiter would need to access. Notice that it includes a Search function at the top, a navigation bar on the left with links to resources, and a content area with linked resources. Assuming that the appropriate knowledge and information are available, a talented Web developer could likely create a site such as this in a few weeks. However, loading it with content would clearly take longer, and *someone must be assigned to keep this page up to date*!

[10] Indeed, the Naval Recruiting Command maintains the excellent site *Recruiters eToolbox*, which reflects many of these design principles (see eToolbox, 2021) .

Again, a KMO may be prudent to appoint, at least through development of and transition to online resources such as this. A KMO may help provide access and training, but a *Knowledge Engineer* is truly what is needed, bridging technology and understanding of where, how and what knowledge is available and connections that are possible to aid in the flow of knowledge.

We suggest a relatively large number of approaches to dissolving knowledge clumps in the NTAG. Clearly not all need—or should—be undertaken simultaneously. Indeed, *best practice suggests implementing them incrementally*, beginning with something relatively easy and straightforward—to get the transition process started and to score a quick win—and then proceeding step by step through the list. *Best practice also suggests assigning a small team of people to address the transition*: a new recruiter, an experienced LPO or LCPO, a CR, someone with Web skills, and perhaps a KMO would represent excellent team composition.

Further, *best practice suggests limiting each transition to only a small part of the command organization*. One particular unit can be designated to plan, test and enhance each change; and only after it has been implemented well and is operating smoothly would other organization units be invited or directly to adopt each change. *The key idea is to avoid disrupting the organization as a whole with each transition*, yet Leadership will want to ensure that the whole organization can benefit—over time—from all of the successful and effective transitions.

In terms of sequence, clearly we should begin with the principal elements and recommendations summarized in Table 28 above. We sequence this set of recommendations via Table 29. The suggested order reflects our recommended sequence of changes to pursue in the command, which we divide into four phases for implementation. Again, the key idea is to avoid disrupting the organization as a whole with each transition. One particular unit can be designated to plan, prototype and work through each change; and a small, select team of people can be tasked with planning, prototyping and working through each change. We include this in the table as Step 2.

Table 29 Sequenced and Phased Recommendations

Element	Recommendation
Phase 1	
1. Incentives	Leadership prioritizes & incentivizes the onboarding & training process
2. Team	Task a small team with planning, prototyping and working through each change
3. Advance information	LCPO provides wealth of *helpful* information in advance of check in
4. Process steps	LCPO provides link to recruiting process steps
5. Recruiter template	List of qualities and activities that lead to a successful recruiter *in this command*
6. Expertise locator	Expertise locator lists everyone in command in terms of experience & expertise
7. SalesForce	Current documentation linked via onboarding package. Mentor provides training.
8. Pause & evaluate	Allow team time to work through this first set of changes
Phase 2	
9. Knowledge repository	Key knowledge and information available and easy to locate in single location online
10. New recruiters	Connect new recruiters with others across command (CoP)
11. Storytelling	Use to surface common problems, issues, workarounds and successes
12. FAQs & FRAs	Online documentation includes FAQs & FRAs via Wiki: anyone can contribute.
13. Command training	Help with problems & issues deemed timely & important to command
14. Videoconferencing	Use to connect people from geographic separate units
15. Pause & evaluate	Allow team time to work through this next set of changes
Phase 3	
16. Personalized training	LCPO develops personalized training plan
17. Mentor	Career recruiter is assigned as Mentor
18. Shadow	Experienced recruiter lets new person shadow over extended period
19. Assistance	LCPO and Mentor have open door policy to assist whenever necessary
20. Pause & evaluate	Allow team time to work through this next set of changes
Phase 4	
21. Incentives	Leadership incentivizes people to mentor and train
22. Performance appraisal	Leadership links performance of mentors/trainers & mentees/trainees
23. Crowd sourcing	Use peers to help answer questions
24. Peer assist	Use peers to help solve problems
25. Social media	Learn to use social media for facilitate & enhance recruiting performance

Step 1 is for Leadership to prioritize and incentivize the onboarding and training process for new recruiters. Nothing else can succeed without this step.

Step 2 is for Leadership to designate one particular unit to plan, prototype and work through each change. A small, select team of people can be tasked as such. A new recruiter, an experienced LPO or LCPO, a CR, someone with Web skills, and perhaps a KMO would represent excellent team composition. This team should report to Leadership periodically (e.g., weekly, monthly).

Step 3 centers on specifying and assembling a collection of advance information that can be provided to new recruiters before they check into the command. Some aspects of such information (e.g., recruiting process steps, successful recruiter template, knowledge repository) may not exist in explicit form when this team begins, but its work can be useful to guide subsequent steps.

Steps 4 and 5 are to articulate and document the recruiting process steps and the successful recruiter template. These can be included among the advance information ensemble specified in Step 3. These can exist as paper documents at first, but we will want to incorporate them into one or more online resources as they become available.

Step 6 is to develop the expertise locator. Everyone in the command should be listed, along with their contact information, current job, background (e.g., prior assignments before recruiting), tenure with the recruiting command, and particular areas of expertise (e.g., scouting, SalesForce, processing). As above, these can be included among the advance information ensemble specified in Step 3, and they can exist as paper documents at first, but we will want to incorporate them into one or more online resources as they become available.

Step 7 centers on collecting, summarizing and making available the key SalesForce documentation and instructions. This should be more than just the systems documentation: it should include instruction on how and when to use the system, complete with screen shots and explanations so that anyone (esp. a new recruiter) can learn to use SalesForce effectively. As above also, this can be included among the advance information ensemble specified in Step 3, and they can exist as paper documents at first, but we will want to incorporate them into one or more online resources as they become available.

Step 8 is to pause and evaluate. This will enable the team to work through this first set of changes and to provide Leadership with time to consider the subsequent steps. If these first steps offer potential to add value, dissolve knowledge clumps and enhance the recruiting process, then Leadership may decide to implement them in the designated unit beyond the team; that is, have everyone in that particular unit become familiar with and begin using the work products specified and developed through Steps 3-6. If this appears to be effective and successful, then such work products can be distributed to another unit for incorporation. If effective and successful in this additional unit, then such work products can be distributed in turn to additional units for incorporation until they have permeated the whole command. This pause also affords Leadership the

opportunity to inform higher headquarters, as appropriate, of the efforts and results.

Step 9 represents a relatively larger undertaking, which can be accomplished in parallel with one or more others below: start specifying, developing and organizing content for the knowledge repository. Because this involves some technical effort, the appropriate people (e.g., Web developer) will need to be integrated into the team, but it will be very important to begin consolidating, centralizing, and making key knowledge and information available to all command personnel via simple, intuitive, easy to use website.

The sequence and timing of the remaining steps can vary to accommodate Leadership priorities, team experiences and resource availability. Here we outline a sequence that appears logical and likely to continue a stream of incremental changes with effective and successful results.

Step 10 then would involve connecting all of the new recruiters with others across the command. This will enable them to compare notes, ask questions, and most importantly to begin populating the FAQs: new recruiters likely have the most questions and may be the best qualified to organize them as FAQs.

Step 11 involves storytelling. These new recruiters can utilize videoconferencing and like technologies to overcome geographical barriers and exchange stories about common problems, issues, workarounds and successes. These stories can become fodder for FAQs.

Step 12 then would be to begin developing the FAQs and FRAs. Clearly people other than new recruiters should be invited to contribute here, but to populate the FAQs initially, the new recruiters are probably the best and most highly motivated people to do so. The corresponding FRAs will likely require input from the more experienced members of the team. As with numerous steps and items above, this can be included among the advance information ensemble specified in Step 3, and they can exist as paper documents at first, but we will want to incorporate them into one or more online resources as they become available.

Steps 13 and 14 center on command training. At this point in the process and transition, the command has accomplished much, and there is much to share with all of its constituent units. Videoconferencing can be used to reach all geographically separate units simultaneously—or incrementally if simpler to accomplish one at a time—and explain how to utilize all of the resources and to leverage all of the changes set forth through Steps 1-12. This can also set the tone and establish a precedent for regular (e.g., weekly) command training.

Step 15 repeats Step 8 and includes time to pause and evaluate. This will enable the team to work through this next set of changes and to provide Leadership with time to consider the subsequent steps. This pause also affords Leadership the opportunity to inform higher headquarters, as appropriate, of the efforts and results.

Step 16 involves personalized training. The most likely people to plan and prototype a personalized training plan would be the new recruiter and CR assigned to the change team. Indeed, with inputs from the LPO/LCPO and Leadership, a training plan can be developed for this new recruiter. Such plan could include mentoring, shadowing and assistance as outlined via Steps 17-19 below. With time to examine, assess and refine this approach, other new recruiters across the command can be afforded the same opportunity to have personal training plans developed and implemented.

Steps 17 through 19 involve mentoring, shadowing and assistance. As with the personalized training plan outlined above, the most likely people to plan and prototype a mentoring, shadowing and assistance approach would be the new recruiter and CR assigned to the change team, along with assistance from the LPO/LCPO.

Step 20 repeats Steps 8 and 15, which include time to pause and evaluate. This will enable the team to work through this next set of changes and to provide Leadership with time to consider the subsequent steps. This pause also affords Leadership the opportunity to inform higher headquarters, as appropriate, of the efforts and results.

Step 21 involves formulating incentives to motivate and reward mentoring and assistance, will likely require considerable Leadership judgment—perhaps including interaction with higher headquarters—and may benefit from limited rollout and experimentation.

Step 22 is similar and extends Step 21 to link the performance of mentors and trainers with their mentees and trainees. This may be a challenge to implement due to myriad rules and regulations regarding performance appraisal, but this would be the time to try if feasible.

Steps 23 through 25 complete the ordered principal elements of embedded KM. Crowd sourcing and peer assist will require some experimentation to see what works best in each unit, but such capability will be enhanced greatly if the Command Intranet (esp. the knowledge and information repository) includes functionality to facilitate asking questions of others and seeking assistance from peers. Perhaps the command can introduce some internal social networking (e.g., Command Facebook) toward such end. In either case, most people in the (esp. scouts) should learn to use social media, hence this may represent an opportunity target for command training as well.

2. Misincentivization Pathologies

As noted above, knowledge clump pathologies indicate that knowledge fails to flow rapidly, reliably and energetically to enable productive work in the organization. As noted above, the Priority 1 pathologies summarized in Table 25 include five codes corresponding to the pathology *misincentivization*. Such codes include the creation of useful training materials, experienced people being willing to help, recruiter incentives, initiative and effort to mentor, and integrity. Although we identify these via a separate pathology, our discussion of the principal elements in Table 28 includes attention to incentives. Upon further review, the discussion of such principal elements above—particularly in conjunction with the ordered elements of embedded KM listed in Table 29—appears to address misincentivization quite well. Indeed, attending to Steps 21 and 22, along with steps to address the other knowledge clump pathologies, should address these issues as well. Hence we do not discuss these further here.

3. Technical Deficiency Pathologies

As noted above, knowledge clump pathologies indicate that knowledge fails to flow rapidly, reliably and energetically to enable productive work in the organization. Technical deficiency pathologies are more difficult to address than their knowledge clump counterparts above. For one, we do not have detailed knowledge of or experience with the technology ecosystem supporting the recruiting commands, so it is difficult to identify specific issues, aside from people's difficulty finding and sharing the resources that they need in a timely manner. Difficult to navigate sharedrives, forms with questionable currency, a lack of authoritative resources that are accessible easily to all recruiters, and other issues arise from our focus group interview sessions, but it is well beyond the scope of this study to examine the IT infrastructure in detail.

Instead, we outline some general guidelines, with the fundamental objective of having IT able to support and enable all of the steps above pertaining to the knowledge clump pathologies. In other words, whatever is necessary to support and enable Steps 1 through 25 above, this represents the requirement for enhancing the IT infrastructure. Thus, we include a 26th step to pursue in parallel with all of those above:

Step 26 is to enhance and modify the IT infrastructure in parallel with and to both support and enable all of the ordered principal elements of embedded KM noted and discussed above. Leadership will need to coordinate this closely with its N6 technology people.

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V. HIGHER COMMAND RECOMMENDATIONS

As noted above, some pathologies stem from higher organization levels, hence we filter and consolidate our recommendations as appropriate for higher organization leaders here. This higher level set stems from those discussed above, but they also reflect input from recruiting command leadership and pertain to the Naval Recruiting Command and even OPNAV N1 (and beyond). This set includes the four set forth in Table 30. We address each in turn.

Table 30 Higher Level Recommendations

Pathology	Recommendation
1. Knowledge Clumping & Hemorrhaging	Redesign NORU
	Motivate teamwork
	Capture expertise
2. Information Diaspora & Disorganization	Implement I-Site
	NRC maintains
	NORU trains
	NTAG uses
3. Nonintegration of Work and Tools	SalesForce implementation support & training
	NORU, I-Site, RTI, Help Desk
	Question tools that do not support work directly
4. Nonintegration of KM	Seek ROI
	Address tacit & explicit knowledge
	Need people to lead & support initially
	Everyone's a knowledge manager eventually

A. KNOWLEDGE CLUMPING AND HEMORRHAGING

First we have Knowledge Clumping and Hemorrhaging. This higher level pathology is related directly to Knowledge Clumping discussed above. Indeed, the term *clumping* is consistent across levels, where knowledge fails to flow from where, when and how it is to where, when and how it's needed. Similarly, *hemorrhaging* refers to the huge knowledge clumps that walk out the door every time an experience person leaves the organization. We have three high level recommendations to address this pathology.

1. Redesign NORU

To begin, NORU requires major redesign. From the discussion above, it does not serve the recruiting organizations well, and many study participants view it as a waste of time. For several instances, we understand that NORU does not instruct on the NTAG organization model, relegating instruction to the nearly outdated NRD design. Assigning instructors that understand the NTAG organization design represents a necessary first

step, as does updating the curriculum accordingly. A new recruiter should emerge from NORU with a thorough understanding of how the NTAG is organized, how the various jobs are performed, and the skills necessary to perform such jobs proficiently.

As another instance, new recruiters emerge from NORU with minimal skill or experience that can translate directly to work productivity when they reach the recruiting organization. Reorienting instruction to address the kinds of skills and experiences gained currently via OJT represents an important second step, likewise with the curriculum update. A new recruiter should emerge from NORU with the skills necessary to work productively on the first day in a recruiting office.

As a third instance, new recruiters emerge from NORU without the knowledge necessary to use SalesForce and other recruiting tools effectively. Reorienting instruction to address tool use, in detail, represents an essential third step, with the appropriate curriculum update essential. A new recruiter should emerge from NORU with the ability to utilize all necessary recruiting tools effectively on the first day in a recruiting office.

These do not represent difficult requirements for NORU. Indeed, the Navy has an extremely effective training process—via its "A Schools" and "C Schools"—for nearly every other important job. Why not treat the critically important job of recruiting with the same degree of thorough training? This may be in part because so few sailors make careers in recruiting, because Leadership does not feel that recruiting requires that level of training, or some other rationale that fails to convince. If recruiting is important, then the Navy needs to invest in the training process. Otherwise, the status quo will continue; new recruiters will not be productive; recruiting organizations will struggle; and the knowledge ecosystem will remain unhealthy.

2. Motivate Teamwork

To continue, recruiting organizations at all levels need to motivate teamwork. Recruiting remains a highly individual activity: most recruiters work alone; they are rewarding for individual achievements; and they have little motivation to help others. This mirrors closely the Sales Model in industry, in which diverse salespeople in an organization compete for individual rewards, but it may not be the most effective model for Navy recruiting. For one reason, many salespeople in industry spend entire careers in Sales, whereas most Navy personnel spend only a single tour as recruiters. For another,

successful salespeople in industry can continue in Sales indefinitely, whereas the Navy rotates its people frequently, hence recruiting expertise fails to accumulate.

Most Navy organizations demand teamwork. Recruiting is no different. When a new recruiter, for instance, has a question, he or she should be able ask anyone with knowledge (i.e., dissolve the knowledge clump) and get assistance. This starts from the top: Leadership must recognize first the need for teamwork. Then it must set expectations accordingly, adjust people's production goals to reflect a team approach, and demand that people assist one another.

One approach would be to team new recruits with experienced counterparts, and to set joint goals for such teams. The new recruits would learn much from their experienced counterparts, and hence climb the learning curve much more quickly. Likewise, the experienced recruiters would gain a fresh perspective from people just leaving the Fleet, and hence maintain currency with Fleet operations and needs. This could translate directly into identifying and investing time and energy into better prospects.

3. Capture Expertise

To complete addressing the knowledge clumping and hemorrhaging pathology, we focus on the latter: the incredible knowledge hemorrhage that occurs every time someone with experience leave the recruiting (or any) organization. Indeed, improving job turnovers represents the single most important KM task in the Navy. In addition to conventional techniques (e.g., turnover binder, turnover interview, limited shadowing when billets are not gapped), recruiting organizations have the potential to effect much, much more effective job turnovers through the capture of expertise.

For instance, in this age of YouTube and like videos on demand that can guide a person through tasks ranging from sharpening a knife to forging a steel blade, recruiting commands—at every level—could record key activities performed by highly successful people. One recruiter who is particularly good at generating leads, for example, could record a short video that explains how he or she spends an hour of time each morning doing so. Another recruiter who is particularly good at managing meetings with parents, as another example, could record a short video depicting a particularly normal or challenging parent meeting. Today's Millennial sailors relate to video on demand as a

technique for just in time learning (JITL). The investment to accomplish this for recruiters is not large. The key of course is to make such videos searchable and relevant. This is a knowledge engineering job.

As another instance, Wikis (think *Wikipedia*) permit anyone in the organization to add new knowledge. Recruiting Wikis that are open to all recruiters could be effective at knowledge capture also. Someone in the organization would be required to organize and prune the Wikis of course. This is a knowledge engineering job.

As a third instance, profiles of what it means to be a successful recruiter—specific to a recruiting organization and market—could articulate a set of expectations and behaviors that new recruits could study and seek to emulate. This would go far beyond the PQS, which establishes a minimum level of proficiency. Instead it would establish a maximum proficiency level, toward which every recruiter should strive. A knowledge engineer could work with recruiting leaders and personnel to identify and articulate such profiles.

Finally, the idea of articulating rich, effective, experience based techniques, tactics and procedures (TTPs) is expected throughout the warfighting parts of the Navy. There is no reason why recruiting could not do likewise. Moreover, the warfighting parts of the Navy have developed a cadre of weapons and tactics instructors (WTIs) to help develop and disseminate what amounts to best practices, and it has the Naval War College to develop warfighting officers. Many recruiting organizations include someone with the title Recruiting Tactics Instructor, and Recruiting has NORU. A rich, effective, experience based set of recruiting TTPs—and an RTI willing, able and motivated to teach them—would complete these recommendations to capture expertise.

B. INFORMATION DIASPORA AND DISORGANIZATION

Second, we have Information Diaspora and Disorganization. This higher level pathology is related directly to Knowledge Clumping also, but it draws from the technologic deficiency issue as well. Recruiting organizations possess huge amounts of information, but it is difficult to identify and find authoritative information in a timely manner. One approach to treating this pathology leverages a single, searchable, authoritative and intuitive knowledge and information repository like the I-Site design

discussed above. Assuming that the pertinent knowledge and information is available, a productive team could build a resource like I-Site quickly.

One key to success would be for a high level organization such as Naval Recruiting Command (NRC) to maintain such a resource (esp. to ensure current and authoritative knowledge and information) and for training organizations (esp. NORU, RTIs) to train recruiters on its use. Of course the NTAGs would need to adopt and utilize it. Another key would be for the resource to be clean and easy to use. This is the antithesis of information stored on numerous share drives around the organization, which represents the current state in many recruiting organizations. We repeat the I-Site design again here in Figure 32 for reference.

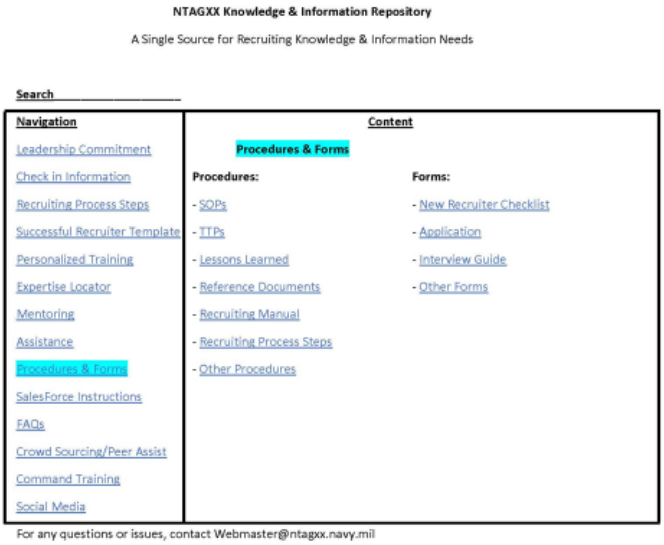

Figure 32 I-Site Design

C. NONINTEGRATION OF WORK AND TOOLS

Third, we have nonintegration of work and tools. SalesForce represents the most prominent example of such nonintegration, as described above. Given that recruiting organizations are required and expected to use this system, higher level organizations (e.g., NRC) need to provide resources to implementation support and training. Recruiters need to understand how to use this tool, and they need to learn how to integrate it into

their daily work tasks, as opposed to entering information as tasks in addition to their recruiting work.

Additionally, NORU should be able to instruct new recruiters thoroughly on the use of SalesForce, and a knowledge and information repository like I-Site should include all of the documentation and training materials necessary for its effective use. The Recruiting Tactics Instructor (RTI) should be versed well in SalesForce use, and he or she should be available to assist recruiters that struggle or have questions. Finally, most organizations staff some kind of Help Desk to assist users with technical questions regarding information systems and like tools. Whether such a Help Desk is established at the local level (e.g., within each NTAG) represents a tactical question, but it probably makes the most sense to staff it at a higher level (e.g., NRC) for efficiency.

Further, beyond SalesForce, which represents the prominent negative exemplar, there appear to be many diverse tools in use throughout the recruiting organization. Each should be examined to assess its degree of integration into the daily work or recruiters. Where such integration is lacking or deficient, Leadership and knowledge engineers need to consider how to change the tools or how to refine the process to increase integration and improve knowledge and workflow.

D. NONINTEGRATION OF KNOWLEDGE MANAGEMENT

Finally, we have nonintegration of KM. Leaders at all organization levels should be able to understand that KM can provide a return on investment (ROI); that is, the gains from increased knowledge, organization and productivity can exceed greatly the cost of KM establishment, implementation and maintenance. An organization that is too busy chopping wood to sharpen its metaphoric axe will find it increasingly difficult to cut wood at all after the axe becomes sufficiently dull. Likewise with recruiting: people at all levels are too busy striving to make their goals to invest in KM.

The investment does not have to be large, however. Some investment in staff (e.g., a knowledge engineer) represents a first step, and some investment in education and training of recruiters represents a second. Beyond that, some temporary relief of production goals would be in order while the metaphoric sharpening occurs, with the expectation of course that such relieved goals would be more than made up subsequently,

along with the corresponding expectation that future production would maintain goals above their original levels.

It is important to recall that both tacit and explicit knowledge must be addressed through KM. Many organizations default to addressing only explicit knowledge, which stems commonly from a misguided focus on tools. As noted above in our discussion of knowledge, tacit knowledge flows more slowly and narrowly than explicit, but it does so with much greater energy. This means that the performance level of work enabled by tacit knowledge is much higher than that supported by explicit knowledge. Tacit knowledge is inherently human and experience based. This means that KM must address people in the organization (cf. tools), with techniques such as education, training, mentoring, coaching and teamwork rising to prominence.

Establishment and integration of KM will require people to lead and support the effort initially. This is part of the investment noted above, and knowledge engineers are the most appropriate people to bring into the organization. After time, training and experience, however, the knowledge engineering tasks will likely diminish, and eventually—with ample education, training, mentoring, coaching and teamwork, in addition to appropriate tools—every recruiter in the organization will become a de facto knowledge manager.

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VI. CONCLUSION

In this final section we summarize the study approach, findings and recommendations from above, and we outline a set of further research topics.

A. SUMMARY

Organization tacit and explicit knowledge are required for high performance, and it is imperative for such knowledge to be managed to ensure that it flows rapidly, reliably and energetically. The Navy N1 organization has yet to develop a formal process for knowledge management (KM). This places N1 in a position of competitive disadvantage, particularly as thousands of people change jobs every day, often taking their hard earned job knowledge out the door with them and leaving their replacements with the need to learn such knowledge anew.

Building upon initial efforts to engage with industry and conceptualize a Navy KM strategy, the research described in this study employs a combination of Congruence Model analysis, Knowledge Flow Theory, and qualitative methods to outline an approach for embedding a formal Navy KM process. Through our discussion of the Congruence Model, we see how this approach to organization design (OD) leverages Contingency Theory to examine organizations for fit, which represents a powerful tool for analyzing N1 and its KM efforts. Likewise, through our discussion of Knowledge Flow Theory, we see how to visualize, analyze and measure dynamic knowledge, which represents another, complementary tool for analyzing N1 and its knowledge and workflows. Then through discussion of our research method, we see how qualitative analysis enables in depth understanding of specific N1 organizations and processes, which adds a third, complementary, analytic power tool.

This work involves surveying best tools and practices in the industry, government and nonprofit sectors, through which we identify, classify and describe over a dozen KM organizations, 17 preconditions for success and failure, 60 knowledge flow principles and leadership mandates, over 100 tools and 15 common and emerging techniques for effective KM. From this we find that positioning of KM in the organization matters in terms of scope and efficacy, with the greatest results corresponding with comparatively

high placement of KM in the organization. In the case of Navy organizations such as carrier strike groups (CSGs), this equates to placement of the Commander's Staff. We find also that a few preconditions for success (esp. senior management commitment, realistic expectations, appropriate people participating full time) and failure (esp. reliance on external expertise, narrow technical focus, too many improvement projects) are particularly important for KM efficacy.

Additionally, the set of knowledge flow principles form a theoretic basis for understanding and evaluating dynamic knowledge in the organization, and the complementary set of leadership mandates provide practical guidance for organization leadership. Further, from the 100+ tools examined, many are relatively common, familiar and understood (e.g., groupware, decision support, document sharing), whereas a number of others represent contemporary and emerging capabilities (e.g., artificial intelligence driven search, knowledge taxonomies and ontologies, extended reality). Likewise, the KM techniques reflect both common (e.g., training & education, mentoring & coaching, communities of practice) and emerging (e.g., crowd sourcing & peer assist, simulation & enactment, KM & C2 integration) techniques. Together, this background work equips us well to analyze Navy knowledge flows.

Given the large size and scope of the N1 organization, we focus our field research on the important Recruiting organization, which requires considerable knowledge work, encounters substantial knowledge flow challenges, and provides excellent visibility into the knowledge, work and tools associated with recruiting. This fieldwork centers on understanding Recruiting in depth, which we accomplish through archival research, conversations with leadership, and focus group interviews with line recruiters. Indeed, we identify 42 recruiters from two different command for surveys and interviews, and through our iterative, 11 step analytic process, we identify numerous knowledge flow pathologies afflicting the organizations. Through further conversations with Leadership, we develop a detailed set of recommendations for the recruiting organizations, which we generalize into a smaller set appropriate for higher level organizations, including the Naval Recruiting Command (NRC) and N1.

Four such pathologies emerge as highly prominent:

1) Knowledge clumping and hemorrhaging

2) Information diaspora and disorganization
3) Nonintegration of work and tools
4) Nonintegration of KM

Each pathology can be addressed by corresponding recommendations:

5) Redesign NORU; motivate teamwork; and capture expertise
6) Develop a single, searchable, authoritative and intuitive knowledge and information site; maintained by NRC; taught at NORU; and utilized by NTAGs
7) Provide SalesForce implementation support and training; utilize NORU, I-Site, RTIs and Help Desks to assist recruiters; and question any tools that do not support work directly
8) Look for the return on investment in KM; address both tacit (esp. people's experience) and explicit (esp. documented knowledge and information) knowledge; assign knowledge engineers to help organize and lead the KM implementation effort initially; strive to have every recruiter become a knowledge manager eventually

These recommendation offer excellent potential to treat the knowledge flow pathologies outlined above for Recruiting, and they provide insight into establishing a KM capability for the N1 organization. Armed with myriad powerful KM tools and techniques, along with the analytic approach to identify how, when and where to leverage them, we can help recruiting leaders to improve knowledge and workflows in their organizations, and we can help N1 leaders to integrate KM into their organizations. These represent topics for further research.

B. FURTHER RESEARCH

Building upon the progress made through this study, the first set of further research topics center on assisting with KM integration. As noted above, we have identified a relatively large set of recommendations for the two recruiting organizations examined in depth through this study. An excellent next step would involve working with Leadership to help implement such recommendations at these commands. To the extent that such implementation proves to be successful, many of the same recommendations

would likely serve other recruiting organizations likewise, and using the first two commands as models, working with Leadership at the other commands would likely bear good metaphoric fruit.

Further, several recommendations apply to the NRC organization as well. An excellent subsequent step would involve working with NRC Leadership to implement such recommendations at that command. What is learned through that work—leveraging the analytic techniques, findings and recommendations of this study—could then provide focus and impetus for working with N1 Leadership to conceptualize, design and implement an integrated KM capability.

The next set of further research topics center on reconceptualizing knowledge engineering in the Navy. People are the metaphoric currency of the N1 organization. It will be important to educate and train a cadre of knowledge engineers, people equipped to analyze naval work, tools, organizations and knowledge flows to get high energy knowledge from where, when and how it's located to where, when and how it's needed. Moreover, since knowledge is dynamic, and naval personnel change jobs frequently, such knowledge engineering would represent an ongoing and vital function in the Navy. It will be important to outline what knowledge engineering should entail, what knowledge engineers need to know, and how to equip them best through education, training and experience.

The third set of further research topics center on addressing the Navy knowledge ecosystem. Beginning with the N1 organization, and using it as a model, we need to explore, survey and map Navy knowledge stocks and flows. This will help Navy Leadership to understand KM integration better, and it can serve to facilitate the integration of KM Navy wide.

This clearly represents a broad set of further research topics, one that can be divided into smaller parts for easier and quicker accomplishment. This can involve faculty research of course, but student thesis work can be very helpful as well. We recommend continuing to work with N1 Leadership to outline the most appropriate topics, to align them with faculty, student and N1 expertise, and to pursue them in the most logical manner. Standing by.

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VIII. APPENDIX A – KEY RESEARCH DOCUMENTS

We summarize the focus group interview questions in this appendix. These questions are distributed first via email and then used to guide focus group interviews.

1. How does formal recruiting training differ from reality?
2. What factors has your organization documented that impact knowledge gained from OJT?
3. How does your organization share OJT?
4. What characteristics has your organization determined successful recruiters to have in common?
5. Describe a successful recruiting instance your organization has documented?
6. Describe a failed recruiting instance your organization has documented?
7. What lessons learned does your organization share with future recruiters?
8. What type of training has your organization found had the most impact, OJT, formal, or a combination? How/why?

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