

Nimble knowledge transfer in high velocity/turbulent environments

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Abstract

Purpose – This paper aims to clarify the relationship between explicit and tacit knowledge in specific organizational environments. It seeks to explore processes and strategies currently being deployed as best practices in the military to see what can be learnt from them and to improve the use of knowledge assets in large-scale organizations in high-velocity and/or turbulent environments.

Design/methodology/approach – High velocity/turbulent environments are defined. The paper uses examples from the public sector and the private sector and provides a model for knowledge management in high velocity/turbulent environments (HVTE) and offers several propositions for further exploration.

Findings – The paper provides insights into how and why tacit knowledge is more important to decision making and strategic positioning in high velocity/turbulent environments. The complexity of knowledge management is enormous.

Practical implications – What the authors learned from the military can serve as lessons for businesses to improve their agility in high velocity/turbulent environments. Businesses can apply this knowledge in considering the types of environments they operate in and which methods of knowledge transfer would serve them best to remain competitive.

Originality/value – This paper addresses what the authors believe is missing in knowledge management research to date – how and when tacit knowledge is more critical to organizational success than the use of explicit knowledge. The analysis also provides an environmental framework that distinguishes the use of tacit and explicit knowledge.

Keywords Knowledge, Knowledge management, Knowledge transfer, Organizational processes, Strategy, Environment, Business analysis

Paper type Research paper

Introduction

Knowledge is a crucial organizational asset. The three aspects of knowledge for any organization involve considerations of how the knowledge is obtained, how it is stored and organized, and more importantly, how that knowledge is accessed and shared in real time. It is this third aspect of knowledge that is of interest to us. It is not enough to have a process for obtaining knowledge and for its organization and storage. Knowledge that cannot be accessed quickly, is not instantaneously available worldwide, and when needed in times of challenge and crisis is simply unacceptable.

Organizations require relevant, timely information and knowledge to make sound decisions. In a military environment knowledge is sometimes needed in more mission-critical situations like a battlefield, where real time decisions can have life or death consequences and where knowledge delivered late is useless. These high velocity/turbulent environments (HVTE's) form the basis of inquiry for this paper.

How organizations develop, store and transfer knowledge is becoming a strategic asset. Yet, organizations seem to struggle with obtaining knowledge, maintaining that knowledge

Received December 2011
Revised March 2012
March 2012
Accepted March 2012

over time and transferring it throughout the organization so that all elements could benefit. While it is relatively easy to create, store and share explicit knowledge, we focus on the intangible tacit knowledge in this paper in an attempt to understand how to use it effectively, especially in HTVEs.

We offer the following illustration of the recent British Petroleum's (BP) Deepwater Horizon Oil Rig explosion in the Gulf of Mexico in April, 2010 as a good example of inadequacies in knowledge management for your consideration. The result of the explosion was 11 dead and the unleashing of the largest oil spill in history (Guardian, 2010). The CEO of BP admitted that they made up a response as this tragedy unfolded and that the public saw this response as "fumbling and incompetent" (Macallister, 2010). More importantly from a knowledge perspective, BP experienced a similar huge leak in Azerbaijan 18 months prior to the Deepwater accident. In this incident, BP was able to evacuate 212 workers safely. One cause of this accident was noted as a potentially "bad cement job" by Halliburton (the same firm who did the work on the Deepwater Horizon Rig) and problems with valves. At the time BP angered both the government of Azerbaijan and its business partners with the tight secrecy around the problem (Webb, 2010). Why were BP executives seeming unaware and unprepared for a similar problem with the same suppliers with the Deepwater Horizon Rig given this prior disaster?

This case serves as reminder that throughout history, businesses and governments have struggled to learn from the past and how to store and access crucial organizational knowledge over time. How do organizations collect crucial, relevant information and knowledge in a real time manner, filter it, and make it accessible to decision makers who require this knowledge to build on their prior knowledge and experience to make optimal decisions? In this paper, we explore these questions by reviewing the literature primarily from the military perspective. Based on the lessons learned from prior research and theories developed, we attempt to assimilate them to develop a set of propositions along with a new model of knowledge acquisition and distribution in high velocity and/or turbulent environments that can be generalized to most organizations (Bourgeois and Eisenhardt, 1988, Eisenhardt, 1989, Eisenhardt and Bourgeois, 1988; Chen *et al.*, 2010; Emery and Trist, 1965; Weick *et al.*, 1999).

High velocity/turbulent environments (HVTES)

It is important that we understand what is meant by high velocity/turbulent environments (HVTES). Bourgeois and Eisenhardt (1988) were among the first to introduce the idea of high velocity environments (see also Dess and Beard (1984). For Eisenhardt and Bourgeois (1988), high velocity environments are "[...] those environments in which there is rapid and discontinuous change in demand, competitors, technology, or regulation, so that information is often inaccurate, unavailable, or obsolete" (p. 738). They further observe:

However, in this environment, the "wait and see" and "me too" decision strategies may also result in failure, as competitive positions change and windows of opportunity close. The dilemma of strategic decision-making in this environment is that it is easy to make a mistake by acting too soon, but equally ineffective to delay decision-making or to copy others (739).

It is in these types of environment that the ability to obtain, transmit and use knowledge is especially challenging.

In addition to high velocity environments, there are also "turbulent environments (Emery and Trist, 1965, Terreberry, 1968) defined as four types of environments that organizations face based on the degree of connectedness that exists among the components of the environment, The four types are: placid, randomized (according to Terreberry "goods and bads are relatively unchanging and randomly distributed"); placid, clustered, again, according to Terreberry, "goods and bads are unchanging, but clustered;" and disturbed, reactive, which is significantly different from the first two environments in that it is characterized by similar systems in the field. The theory of oligopoly according to Terreberry is an example of a disturbed, reactive environment. It is the fourth environmental type, the

turbulent field that is of primary interest to us here. Terreberry (1968) provides a rich description of this environment.

Dynamic processes "arise from the field itself" and not merely from the interactions of components; the actions of component organizations and linked sets of them "are both persistent and strong enough to induce autochthonous processes in the environment. An alternate description of a turbulent field is that the accelerating rate and complexity of interactive effects exceeds the component systems' capacities for prediction and, hence, control of the compounding consequences of their actions. Turbulence is characterized by complexity as well as rapidity of change in causal interconnections in the environment.

Synthesizing this literature then, we argue that high velocity environments are those situations where change is rapid, large and discontinuous (that is, changes occur at intermittent times and are not related to what occurred most recently). An example of this in the military would be a company engaging in more than one fire fight in a day. Each situation is rapid, of significant impact and unrelated to the next fire fight. However, high velocity situations are by definition limited in duration and time and knowledge results not just from each situation but from recognition of the patterns across each individual situation – usually after the situations are finished and time is taken for serious reflection, refinement and development of the knowledge base. In these environments knowledge development is discrete (from each individual situation) and innovative (from assessment across each individual situation)

Turbulent environments, on the other hand, are more long lived and reflect large (or small, but significant) changes in the interactions between and among players in an environment (e.g. government, military actions, individual situations, or between business, government, external stakeholders) AND where those changes impact on the processes of interactions themselves. In the military situation, an example would be war gaming – where each side learns from the unfolding patterns of engagement and simultaneously alters those patterns and processes in addition to the specific responses made. As such, knowledge development and refinement in turbulent environments is an ongoing, continuous and nearly simultaneous process as the constantly changing environment offers new knowledge and the opportunity for continuous knowledge innovation and dissemination.

It is, however, entirely possible that a turbulent environment can have high velocity situations contained therein, but a high velocity environment does not contain the elements of a turbulent environment – hence our use of high velocity/turbulent environment (HVTE) should be understood within this discussion.

Simply put, in high velocity/turbulent environments the pace of changes, the magnitude of changes, the interactive effects of change and magnitude, the evolving competitive environment and relationships in the environment place the acquisition, storage and transfer of knowledge in a distinctively new position than that found in lesser environmental situations.

Stable environments, on the other hand do not present dynamic pressures for refinement and development of knowledge. Often the existing knowledge base is sufficient and minor or moderate adjustments are all that is required. The challenges in environments are communications and complacency. The communications challenge is, as in any environment to make sure that knowledge is available and transmitted where needed. The complacency challenge is to recognize that the environment might be changing to a high velocity/turbulent environment and to move quickly to alter knowledge management and communications systems to respond to this new state of affairs. We now turn our attention to the two types of knowledge.

Explicit and tacit knowledge

There are two generally accepted and acknowledged types of knowledge: explicit and tacit knowledge, both are important, and neither is complete without the other. Explicit knowledge is the easiest to describe and understand. It is knowledge that can be spoken,

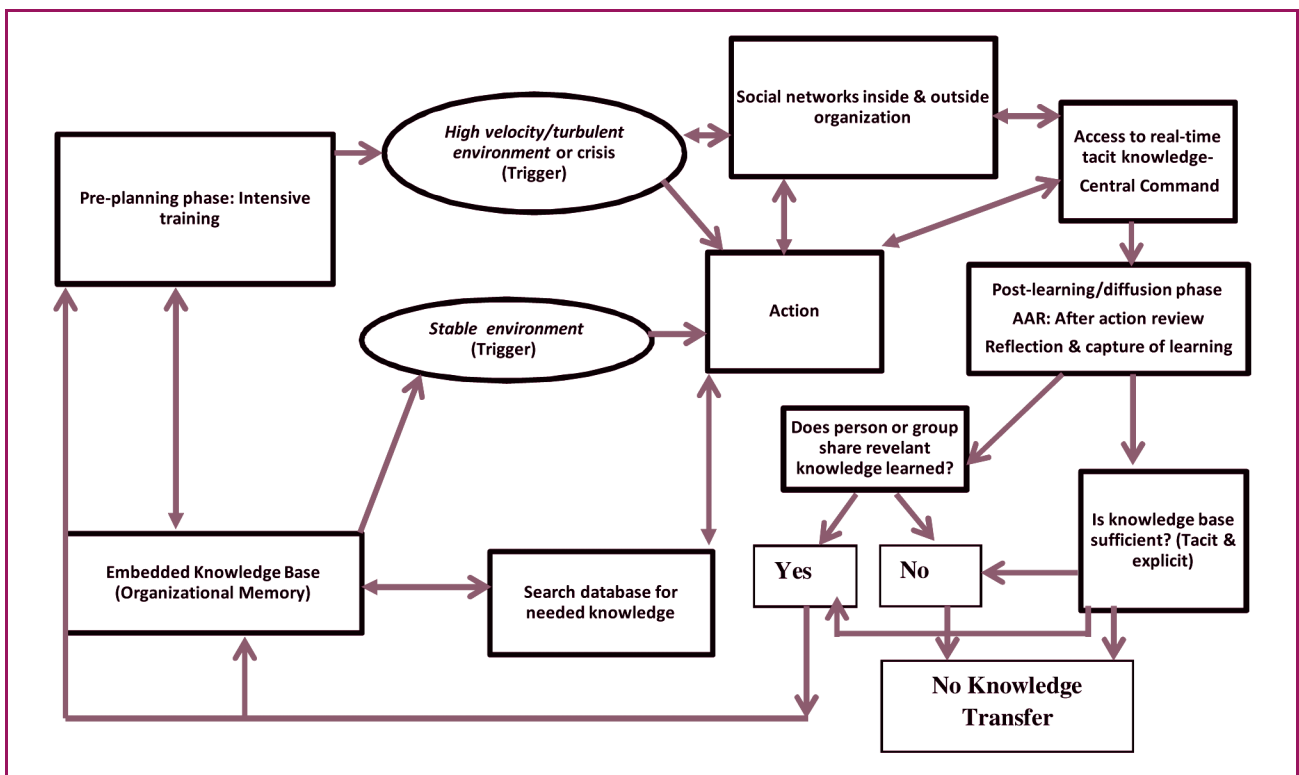
communicated, transmitted, processed and stored relatively easy. It is information that is interpreted, put in context and anchored in beliefs and commitments of individuals (Nonaka *et al.*, 2000) and as such, subject to easy codification, storage and retrieval. This is the type of “knowledge” that most firms and organizations are familiar with, and can be found in the codification of plans, operating manuals, scientific formulas and military field manuals and operating procedures (de-Alwis-Seidler and Hartmann, 2008).

Although explicit knowledge is important to the operation of any organization – it is tacit knowledge that is crucial to survival and long-term success. Tacit knowledge is far more difficult to describe and explain – it is reflected in the procedures, rooted in action and is acquired by the sharing of experiences, by observation, and by imitation. The initial definition of tacit knowledge is often attributed to Polanyi (1966) who contended that we often know more than we can tell. He described tacit knowledge as the contextual accumulation of learning, reflection and experiences that creates what we know. The “after action reviews” done in the military are an example of people articulating their tacit knowledge from their experiences “in the trenches”. Tacit knowledge yields insights necessary for the understanding of explicit knowledge and for the placement of that knowledge in context. According to Kikoski and Kikoski (2004) it is tacit knowledge that creates the learning curve for others to follow and ultimately provides the competitive advantage for long-term success. Kikoski and Kikoski saw knowledge proceeding in stages from the physical to physical and intellectual, to intellectual and ultimately to discovery (see their Figure 1, p. 78). As knowledge proceeds through these stages the type of level of performance changes as well. We believe tacit knowledge is crucial for success in HVTes.

Literature review

It is not our purpose here, nor will space permit, a review of the literature in knowledge management – a literature that continues to grow both in breadth and depth. Instead we would like to look briefly at the following areas: knowledge management principles,

Figure 1 Knowledge management in high velocity/turbulent environments



organizational learning, information systems and technologies, leadership, communications and organizational culture and decision making and crisis management as they impact on or are impacted by knowledge management.

Knowledge management principles

It is well documented that knowledge represents perhaps the most crucial asset within any organization. It serves as the source of continual innovation via new ideas, process improvement and arguably the true source of sustainable competitive advantage. Thus, the ability to effectively harness knowledge as well as create new knowledge and share it within an organization essentially constitutes the field of knowledge management.

While there is no “silver bullet” in this field, knowledge management has been studied for many years in the areas of knowledge creation, knowledge transfer, and knowledge storage and access (see, for example Chen *et al.*, 2011; Zheng *et al.*, 2010). It is well documented that explicit knowledge, which is codified into reports or processes like “Turbo Tax” software represents the easy part of explicit knowledge management. This codified knowledge can be easily stored in databases, easily queried and transferred across the building or across the globe via the internet or intranets. Knowledge bases that are well managed, filtered for relevancy and recency and monitored by subject matter experts have been found effective for knowledge transfer across organizations, especially in placid and low velocity environments. Knowledge maps showing where crucial expertise is located within an organization is similarly useful and relatively easy to administer (Wang and Belardo, 2005).

Tacit knowledge, on the other hand, remains more elusive. This type of knowledge resides with-in the individual in “the little grey cells” (Agatha Christie’s Poirot) and results from cumulative experiences, learning, and reflection. It is difficult to codify and transfer for many reasons (Nonaka *et al.*, 2000; de-Alwis-Seidler and Hartmann, 2008; Kikoski and Kikoski, 2004). Many people have vast knowledge in different areas, but do not know how to articulate and communicate it. They may not know that their knowledge is important or relevant in different situations, or may not even be aware of the depth of their knowledge. People may also not want to share their knowledge if it represents a source of power or job security.

Collectively, knowledge across departments or teams can represent a huge source of competitive advantage such as when a marketing department has vast cumulative knowledge of many clients, competitors and the industry based on years of experience “in the trenches”. Knowledge may also be accumulated by the many deep personal relationships developed over the years by both individuals and by individual units within a geographically dispersed organization.

According to a study by Emelo (2009), about 88 percent of people interviewed in different organizations viewed tacit knowledge exchange via mechanisms such as direct training and mentoring as crucial to understanding transferred knowledge as well as its context and meaning. A crucial aspect of tacit knowledge is the context in which the knowledge is developed, understood, transferred and applied. The ability to reuse and reframe knowledge is also crucial for future decision-making and strategic actions. Since tacit knowledge is so difficult to transfer, many people in organizations view relationships and social networks as a vital source of reliable, trusted knowledge (Emelo, 2009; Chua, 2007). This concept of social networks can be extended to online communities where “after action reviews” such as those conducted routinely in the military can transform tacit knowledge from experiences into understandable knowledge bases (Lamont, 2010).

Organizational learning

Given the increasing nature of competitive intensity as well as the rapid evolution of military tactics in the recent gulf wars, the ability for people and organizations to learn and adapt quickly is becoming more crucial to competitive advantage and survival.

The military has used After-Action reviews (AAR) for many years to extract lessons learned on the battlefield and apply them to improve their strategies and tactics. One of the key

features in the AAR is the ability for the military to debrief their Troops quickly. Perhaps more important in this process is that they challenge their people to reflect and analyze the situations they have encountered to consider the lessons learned and what could be improved on. This validation of the learning experience adds a dimension of review and reflection to the learning process that makes the knowledge more valuable to the next people who can use it and learn from it (Darling *et al.*, 2005). Yet the challenge remains in the ability to transfer “tacit” knowledge quickly and effectively across the organization. To be specific, how can the army transfer tacit knowledge learned in the foothills of Afghanistan to a street-by-street conflict situation in a city like Kabul or as reflected in the Black Hawk Down events in 1993 in Mogadishu, Somalia or back to the foothills of Afghanistan? Businesses could benefit from this rapid continual learning process to improve their agility in the face of changing turbulent environments and increasing competitive and economics pressures.

Information systems and technologies

Information overload is rampant. There is so much data and information within almost all organizations, that the challenge of capturing relevant information and knowledge, getting it to the right people at the right time remains a challenge.

However, information systems and technologies, which continue to evolve and improve, make this process easier. According to Malhotra (2005), an agile organization devotes time and resources to identifying what information and knowledge is most crucial to their competitive advantage and success and similarly identifies the technologies to help them capture and distribute it effectively.

However, a “build it and they will come” mentality will not magically create a utopian know-ledge management system. Information systems and technologies need to meet the needs of the users and provide easy access to relevant and timely knowledge, divergent views and needed expertise (Nunamaker *et al.*, 1989). This demands that the development of knowledge management systems not be left in the hands of the very capable MIS personnel alone – managers must make contributions to shape the system to THEIR NEEDS – and this shaping and adaptation is a continuous process.

Databases are wonderful tools for collecting and storing explicit information and knowledge. A good database system can be queried in real time to provide needed information and knowledge. Web-accessible database systems add to the ability to find information and knowledge when needed. However, in high velocity environments, such as on a battlefield, when Troops need contextual knowledge from people with great experience, these more static systems will not provide them with the tacit knowledge and expertise they so vitally need at a given moment.

With the evolution of Web 2.0 technologies, online communities and social networks have improved the ability to share knowledge and expertise in more relationship-oriented contextual ways. Real time social networks can help employees reach out to colleagues within and outside an organization to understand problems, share solutions, and reach better decisions. However, that is more feasible in more static environments where people have the luxury of time to reach out across cyber space to find different perspectives and needed knowledge.

Technologies including databases, networks, social media and even telepresence facilitated by mobile devices and satellite phones have limited application in dynamic high velocity/turbulent environments.

Leadership

In the development of any effective knowledge management capability, leadership is important. As we have noted several times, the development of tacit knowledge relies on strong relationships and networks (Weiss *et al.*, 2010). It is the leadership team that needs to keep the flexibility and relevance of tacit knowledge processes alive in the organization and to demonstrate by their own actions that tacit knowledge and its transfer is important (however see Erhardt, 2011 for a different view).

One of the challenges of management is to recognize that decisions in high velocity/turbulent environments cannot wait for complete information and knowledge – it is the ability to combine explicit knowledge and limited information with tacit knowledge that yields unique breakthrough solutions (Chen *et al.*, 2011; Eisenhardt, 1989; Smith-Easterby *et al.*, 2008).

Communication and organizational culture

Even in more static environments, communication is crucial to effective knowledge transfer. With moderating variables of trust, relationships and cultural elements, effective communication represents a key driver of effective knowledge transfer. In real time face-to-face interactions, people can theoretically gain the rich contextual communication necessary to transfer needed knowledge and expertise to problems if the moderating factors mentioned are optimal. However, in a global distributed environment, the need to use technologies makes communication more challenging, and the rapid and effective transfer of tacit knowledge more daunting.

As organizations grow, their constituencies become more diverse, they have different cultures with different communication channels, norms and expectations (Argenti *et al.*, 2005). Technologies can become impediments to shared meaning and understanding in communication. As discussed earlier, social networks, databases and online communities can provide some methods to close the gap in distributed environments and allow people to communicate more effectively. However, even with the best technologies, the moderating variables of culture, relationships and trust are still crucial to effective communication in both static and high velocity environments.

An interesting example can be found in the different branches of the Military where the cultures, while relatively homogenous within each branch of the service, can be vastly different between them, creating major communication gaps. The Navy and Air Force tend to have process driven cultures, where communication follows standard procedures and line of command. The organization and information dissemination tend to be centralized and regulated. This would be more conducive to explicit knowledge exchange in static environments where a bureaucracy dictates the lines and processes of communication. In contrast, the Marine and Army cultures tend to be more flexible to adapt to changing environments quickly because the context of their operations demands tacit knowledge. The resulting communication patterns would be more dynamic, more innovative and more adaptive to the environment (Groysberg *et al.*, 2010). These methods of communication for tacit knowledge transfer would be more suited to dynamic high velocity environments. As organizations become more globalized, they will face challenges in integration of explicit versus tacit knowledge based systems and cultures – and it is the ability to successfully manage this interface that will lead to organizational success. For example, it would be interesting, from a knowledge management transfer perspective, to engage in a deep case study of a joint Navy-Army or Air Force-Marine operation to ascertain how a more explicit knowledge based organization interfaces over time (and in real time) with a more tacit knowledge based organization.

Decision-making and crisis management

Whether managers are working in more stable environments or high velocity ones, the principles of effective decision-making have some commonalities. Organizations that invest in sophisticated information systems that can acquire and store relevant information in real time and make them accessible to decision makers in real time can help managers make better decisions. However, an effective knowledge base is only valuable if the decision maker has access to it.

Therefore, in high velocity/turbulent environments, another approach is needed. Decision makers require extensive training in different situations, core knowledge, practice in the situations they are likely to encounter, simulations, and the ability to learn, adapt, thinking different and work collaboratively (Lowell, 2009; Nunamaker *et al.*, 1989). This can be exemplified with the intense training that Marines undergo to prepare them with knowledge

of almost any situation they may encounter and how to best overcome challenges in different environments.

This brief review of more narrow aspects of elements of knowledge management lays the foundation for us to build a model and offer propositions for consideration.

Propositions and model

What have we learned from prior research in the literature review? In high velocity/turbulent environments, decision makers need access to real time information and knowledge that is recent, contextual, relevant and trustworthy. This involves several dimensions, which are important components of the proposed model:

Communications: Organizations need to develop strategic communications plans with multiple communications channels that allow people to access information and knowledge when needed, even in real time. Other communication parameters include effective flow, redundancy, transparency, the right channel and the right message, use of multiple channels, social media to clearly communicate, vision, goals, strategies, processes and implementation expectations. The explosion of social media and technological advances such as Skype, allow for more face-to-face interactions around the world and for a more rapid development and deployment of tacit knowledge.

Cultural aspects and mechanisms: There are two components here that are equally important – people and organizational culture. In regards to people it is necessary to effectively communicate with shared meaning, and to develop mechanisms and processes to establish trust and strong relationships. To do this, the culture must nurture open minds, accept differences in perspectives, understand mental models for shared meaning, develop relationships, collaboration, common goals, shared strategic thinking, caring, connecting, committing, communicating, celebrating, networking, team building, plus have shared focus on the mission, vision and goals. Strengthening social ties using social networks and making vital knowledge transfer easy represents another part of the puzzle.

Organizational culture can be defined as “a set of rules, values, and beliefs that are shared by a firm’s members and which conditions their behaviors, along with the configuration of the firm’s image and identity in relation to its environment” (Donate and Guadamillas, 2010, p. 86). While there is a vast amount of research in this area, the knowledge management literature tends to support a view that a collaborative organizational culture, which promotes trust and relationship building, would facilitate knowledge sharing (Donate and Guadamillas, 2010).

Hofstede is often considered a “father of organizational culture” research due to his extensive studies on different forms of organizational and national cultures. In a 1990 paper, he explored the relationship between organizational culture and knowledge management with 3 major elements. He first suggested that process-oriented individuals perceive themselves as risk-averse and tend to work in stable environments. Results-oriented individuals, however, are comfortable in unknown situations, give their best effort, and are motivated by new, continual challenges and change.

The second element explores people who show a concern for people (people-oriented) versus a concern for job (task) completion (task-oriented). Individuals who tend to be people-oriented work best in environments where they feel valued, where they can communicate and collaborate in a collaborative manner. In contrast, individuals who tend to be task-oriented work best in dynamic, changing environments and perhaps tend to be more individualistic. Thus, it would seem intuitive that knowledge sharing would work better in a more collectivist organizational culture with people who work better in those stable environments. The last element explores open and closed communication systems. An organizational culture that promotes open communication would share knowledge easily. In contrast, an organizational culture that promoted closed communication would demonstrate secrecy and value power in knowledge. (Hofstede *et al.*, 1990).

Therefore, we suggest that the organizational culture should be aligned with the amount of stability or turbulence that a company is in and that the major players should be similarly aligned with the appropriate situation. For example, in more mature, stable business environments, the process-oriented people and culture would support the systematic creation, transfer and storing of more explicit knowledge. In contrast, in high velocity turbulent environments, such as in the battlefield or in dynamic industries such as high technology, pharmaceuticals, the organizational culture that is more task oriented with an intense focus on the mission would seem more appropriate. However, in both cases, an open communication culture would promote effective knowledge transfer.

One person cannot have enough knowledge for most situations. Therefore, it is important to have access to the needed knowledge: fast creation of knowledge teams for particular situations; live or via social networks, and a command center to manage the needed knowledge transfer rapidly and effectively.

Then, there should be an institutionalized learning phase like the Army's AAR (after action reviews) for a continuous learning loop.

Training: In high velocity environments, good training helps people work with ambiguity in rapidly changing environments as well as how to access the information and knowledge needed in real time with different communication methods. Training also helps people adapt in many different situations, with contingency planning, shared processes, shared understanding of situation and outcomes. Continual training and simulation also helps people to anticipate, and share knowledge. Other dimensions include the need to create social networks, develop a learning organization, develop knowledge maps to find the expertise needed plus mentoring programs and understand social networks where the culture supports and facilitates multiple learning in collaborative social networks. For example, Marines engage in intense pre-deployment training in basic military operations and strategies. They receive further combat training on arrival in the war zone to provide more realistic training in the actual environment and conditions. A crucial part of this training is the availability of combat expertise that can be shared in the contextual situation of the war zone as well as the ability of these soldiers to access the critical combat expertise, usually via mobile devices, when engaged in combat (GAO, 2011).

Technologies: social networks, multiple communications channels, a database of information, knowledge and expertise, as well as past solutions, make real time information available, ability to contact people who have critical insights and knowledge. A central collection portal for information, lessons learned, common cognitive map; where to find the information and knowledge when needed is beneficial. Related technologies include digital dashboards, intelligent systems, Decision Support Systems; easy ways to find knowledge and expertise; judgment. A dedicated knowledge base represents the heart of this system, providing real-time access to explicit and tacit knowledge – recognizing, however, that the development and maintenance of “tacit” knowledge is an ongoing challenge for all organizations.

Organizational structure: In high velocity/turbulent environments, it is important to have a central command area, with the involvement of leaders, preparation and anticipation plus a structure that facilitates the flow of information and knowledge. The structure should also integrate knowledge into business processes; for example: Wal-Mart integrating real time information into their distribution systems or software where patients can navigate through complex health insurance plans using intelligent systems. Wal-Mart's early use of 360 degree online, visual communications with all store managers simultaneously, allowed for the development of context, a shared culture and rapid dissemination of tacit knowledge in real time. We need to create effective knowledge transfer systems where subject matter experts create keywords for a database of knowledge and access to their expertise. The military has battle command knowledge systems where people in different areas provide feedback quickly after different situations in the battlefield; fast After-Action Reviews; AAR. This results in better training afterwards; a continuous virtual cycle. We also need to create a system where divergent views are encouraged and can be shared. Proactive monitoring of

the environment for quicker adaptation, and for recognition that the context has changed is important for relevance and success of knowledge based systems. Processes and protocols must be in place and people must be well trained to react quickly and effectively in times of crisis.

However, after reflecting on these components and principles, we are still left with some questions. In high velocity/turbulent environments, knowledge changes quickly. How do we know that our knowledge base will provide optimal information and knowledge? Furthermore, for different situations, do we need optimal knowledge or just satisfactory knowledge? Based on these premises, we proposed the following model as shown in Figure 1.

This model proposes that there are two basic environments: a high velocity/turbulent environment and a more stable (placid) environment.

For the high velocity/turbulent environment, individuals who have the capacity for rapid, change and adaptation would receive intense training to absorb and learn contextual tacit knowledge. There are a variety of methods to identify such individuals, including past experience in HVTE environments and various psychological and mental tests to assess the ability to deal with change and ambiguous situations. In the action phase, such as in a battlefield situation, these individuals would need access to real-time tacit knowledge, which could involve social networks with a vast amount of readily available expertise. A "central command" for the search and development of crucial needed knowledge would provide the necessary support for this knowledge search, retrieval and efficient transfer. If the search for knowledge is not sufficient, then the quest continues to provide that knowledge that can potentially result in a life or death situation. After the crisis situations is over, the after-action review represents a way to reflect on the knowledge in order to discover the most valuable knowledge that should be remembered and stored both as codified knowledge in the knowledge repository or to train other people with valuable tacit knowledge.

In more stable, placid or low velocity environments, individuals could still receive training, but they would be able to use explicit knowledge from embedded knowledge bases. There would not be the urgency of real-time tacit knowledge exchange, but rather a slower, more methodical search for both explicit and tacit knowledge with the luxury of time to reflect and codify this knowledge. While an after action type review should be part of an organizational process for major business learning and improvement, this represents an area where many businesses fail. In order for continual organizational development and learning to occur, there must be a systematic process to share, codify and store this new knowledge via the organizational knowledge repository and make it easily available to people throughout the organization. This continual knowledge transfer in stable environments may not be as rapid, but continual knowledge sharing is just as important to innovation and problem solving in stable environments.

The two models offered herein lead to the following propositions:

- P1.* The greater the skills in dealing with execution/implementation in HVTE's, the less important the embedded knowledge base.

Therefore, individuals who are able to adapt and develop tacit knowledge on the spot; can quickly assimilate knowledge and have the ability to improve and adapt, have knowledge flexibility, are not as dependent on the embedded knowledge base. Training and/or development may be important in developing these skills to retain tacit knowledge and to transfer this to different environments and situations.

- P2.* HVTE require people who have the ability to absorb and adapt tacit knowledge on the fly. Stable environments favor individuals who know how to use and access the embedded knowledge base.

Therefore, a key component of who you use in HVTE's depends on the response required. Strategically, people skilled in tacit knowledge can buy time for those skilled in explicit knowledge to develop better plans/strategies. See Nag and Gioia (forthcoming 2012) for

how executives transform knowledge into what they term “knowledge adaptation” and “knowledge augmentation.”

Moderating variable: TRUST and wanting to share knowledge and expertise. A foundation of knowledge serves as the initial basis for action.

- P3.* The greater the embedded knowledge base (e.g. the absorptive capacity of people via intense training), the more relevant it is to people in high velocity/turbulent environments. This assumes that people in the field have the ability to access tacit knowledge via something like a real time command center.

New technologies like Twitter/Skype also impact this in providing rapid diffusion or information and knowledge.

In these high velocity/turbulent environments, a real-time expertise command center is required; one that has the most recent knowledge, incorporating the best and most recent tacit knowledge. Therefore, we need good communication systems and filtering mechanisms for relevant knowledge. The communication of knowledge improves with clear, unambiguous knowledge that is not overloaded. And, are we still able to access information and knowledge that is OLDER, but still relevant?

- P4.* In stable industries (or peacetime military), where change is slow (placid or low velocity environments), explicit knowledge bases are more useful.
- P5.* In dynamic industries (HVTE's) (or war-time military), where change is rapid, real-time command centers, representing access to real-time tacit knowledge and intensive training are more useful.

These propositions infer that while people in HVTE's, such as Marines in combat, encounter crisis situations and may need to access a real-time tacit knowledge command center, they are simultaneously learning. This learning results in tacit knowledge creation and also tacit knowledge implementation as they are forced to apply the knowledge learned in training in unique, creative ways, often to survive the experience. The new knowledge that they create would be harvested via the AAR (after action review) and communicated to the command centers and the databases to continue this cycle.

Prior research showed that in mature, stable industries, boards of directors were better with long experience in the business. In contrast, in HVTE's, BOD's were better with experience in multiple industries, younger and well educated.

Conclusions

We have argued for a reconsideration of knowledge management in relation to the environment faced by the organization. The proposed model and propositions suggest a new way for organizations to train managers in the use of knowledge and develop decision-making strategies that places more emphasis on the development of tacit knowledge and potential approaches to dealing with HVTEs.

In high velocity/turbulent environments, such as in a battlefield situation in the military or in very dynamic, rapidly changing business environments, we propose a tacit-knowledge based approach. This involves intensive training for individuals who have the ability to absorb know-ledge and use knowledge to adapt quickly on the fly. In the military, training with experienced commanders usually involves intensive field environments that expose these people to many different situations who help them absorb crucial knowledge in how to adapt and succeed. Providing these people with multiple channels of communication with access to expertise needed in crisis situations when possible represents another part of this model. The last piece involves the After-Action review (AAR) process to continually improve the tacit knowledge, learning and update the embedded knowledge base.

In contract, in more stable, placid, low velocity environments such as a peacetime military or a more stable business environment, we propose a more explicit knowledge base for

information and knowledge transfer. In this environment, people have more time to access and absorb both tacit and explicit knowledge. Thus, a knowledge base with a rich library of easily accessible explicit knowledge can provide needed knowledge in a timely manner for effective decision-making. For tacit knowledge, an easily accessible knowledge map system coupled with a culture that promotes knowledge sharing represents a model for effective decision-making. Incorporation of an AAR system similarly promotes continual learning and improvement throughout the organization.

A major challenge for organizations is to recognize when the context has moved from a stable predictable environment to a more chaotic environment, where the demands of tacit knowledge and skills increase in importance and the expertise in explicit knowledge becomes of secondary importance. In the military we saw this occur as we moved from planning for large-scale military operations to multi-front small-scale engagements. In the business world, an example would be the movement to online publication of newspapers, which has had significant impacts on the printed options.

Our model and propositions infer some influences from moderating variables including trust and strong relationships among key players, and a culture that promotes collaboration and sharing valuable knowledge. It also infers that tacit knowledge transfer involves multiple communication mechanisms including personal communication, use of social networks, use of embedded knowledge bases and other evolving technologies such as mobile communications. It infers a focus on continual learning and improvement and a desire to keep the knowledge base as current and trustworthy as possible using continual reviews (AAR) and filtering mechanisms.

Implications for researchers and practitioners

As researchers, we believe that the distinctions among environments (stable, high velocity, turbulent) are important. What we need to do is provide practitioners with cues/clues as to when their environments are shifting to different states so that they can adjust their knowledge management and communications systems appropriately. We have argued in this analysis that in HVTEs knowledge management must be refined, developed and communicated in simultaneously in real time. As such, we need to develop the processes, training, and capabilities that will allow this to happen.

The military has refined its practices and methodologies over the years, especially given the wars in Iraq and Afghanistan over the past decade. What we have learned from them is presented in this paper and can serve as lessons for businesses to improve their agility in high velocity/turbulent environments. One reviewer of this paper noted that "he worked in a high velocity/turbulent environment" and that based on this analysis he would not have spent "[. . .] time investing in explicit knowledge in this environment." However this requires businesses to:

- recognize what environment they are currently in (stable, high velocity, turbulent);
- to recognize when the environment is changing; and
- to adapt knowledge management systems and communication systems that are appropriate for their current environment.

Businesses can apply this knowledge in considering the types of environments they operate in and which methods of knowledge transfer would serve them best to remain competitive.

Research limitations

The complexity of knowledge management is enormous. While we considered several major modifying variables, including trust, efficient knowledge distribution systems, effective social systems among others, in our propositions and models, this may still not be reflective of all the continually unfolding components of knowledge management. Similarly, the complexities involved with effective training to prepare people in the military or business to deal most effectively with complex situations in high velocity/turbulent environments may require further development and adaptation. Indeed, that is the crux of the argument herein,

that in HVTEs the dynamics of the unfolding relationships and situations demand an equally dynamic, responsive and innovative knowledge management capability.

Future research

This model and propositions represent a new way of looking at decision-making and knowledge transfer in high velocity/turbulent environments. The next step for future research involves primary research to test the propositions. As a first step, we would suggest investigating those competitive environments where there have been major shifts in the elements of success. We have noted the changes in book and newspaper publishing. We see similar changes in access to news (24 hour channels, online abilities) and in how individuals and corporations communicate with one another. We believe that the importance of developing, maintaining and transferring tacit knowledge will only grow in importance in the future.

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Further reading

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