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The Canadian Forces Lessons Learned Knowledge Warehouse: an Organizational Challenge to Share Knowledge

Social Domain Issues, Cognitive Domain Issues, Information Operations/Assurance

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1. Abstract:

The Canadian Forces Lessons Learned Knowledge Warehouse (CFLLKW) System is aimed at supporting the entire Knowledge Management Process linked to the Lessons Learned Process (LLP). The LL Process relates to the 'Best Practices' in Knowledge Management and is a strategy to elicit, retrieve and re-use lessons acquired from experiential knowledge. The Canadian Forces have agreed upon the structure of the LLP and they are currently pursuing the development of the CFLLKW[1].

Keywords: Knowledge management, Lessons Learned System, Corporate Knowledge, Knowledge Management System, Knowledge management process.

[1] The system is based on the Army Lessons Learned Knowledge Warehouse (ALLKW) deployed in April 2003, which won the highest Canadian recognition in Information Technology in Canada (November 2004). Canadian Information Productivity Awards (CIPA) awarded four prizes to the project, including the Canadian IT Project of the Year Prize, with the Diamond Award of Excellence, the Silver and the Gold in the Efficiency & Operational Improvements category as well as the CIO of the year Award to Lieutenant Colonel Jacques Hamel. The ALLKW had previously won an OCTAS (April 2004) from the Quebec Provincial IT industry in the E-learning and Knowledge Management category.

2. Introduction

The Army Lessons Learned Knowledge Warehouse (ALLKW) has evolved to become the Canadian Force Lessons Learned Knowledge Warehouse (CFLLKW) integrating the main Lessons Learned organizations (LLOs) from the Canadian Forces Elements (Sea, Air, Land and Joint) who all took part in the architecture and development phase. Since 2003, several activities have been undertaken to design the Canadian Forces Lessons Learned System taking into account organizational characteristics and issues as much as processes and technology [9]. The approach taken to elicit requirements and define processes with the participation of the leading LLO was accomplished primarily through workshops and prototyping techniques involving an ''intense and committed'' participation of all LLOs [2,7].

All LLOs agreed there should be one single system that allows Canadian military personnel to share their observations regarding activities (e.g. operations, exercises, experiments and trials) in order to provide feedback; identify issues and lessons during the analysis of the information gathered; to validate whether they were acted upon appropriately; to update and cross-reference knowledge; and to retrieve and exploit knowledge from past experiences [2,3].

The CFLLKW is part of a broader system called the Knowledge Management System (KMS) that will be deployed in June of 2006 for the Lessons Learned Community and for the Tactical Command and Control Information System TacC2IS (see Champoux and Dalkir, ICCRTS, 2006). The KMS assists the Canadian Forces/Department of National Defence (CF/DND) in improving their Knowledge Management Process through several **knowledge domains.** Each knowledge domain regroups sets of knowledge objects related to a sphere of activities (e.g. Lessons Learned), a field (e.g. Doctrine) or a function (e.g. Command and Control).

This paper will outline the main KMS concepts and functionalities that were added and modified in order to meet the Canadian Forces requirements, in particular, requirements for the Lessons Learned Domain and requirements to support organizations in the process of embedding the Lessons Learned process within their own business process.

3. KMS Overview

The broader scope of KMS within DND/CF necessitates the introduction of new concepts and functionalities that were not needed for the original Army Lessons Learned System in order to better manage, share and reuse knowledge.

This section will outline DND objectives pertaining to KM and the newly developed concepts and functionalities that were or are in the process of being created as a result of this application.

3. 1 KMS Objectives

Knowledge Management can fulfill different needs and objectives for any organization. Three different perspectives can be used in order to describe organizational KM needs: the organizational perspective, the process and assets perspective, and the system perspective.

Organizational Perspective

The organizational perspective focuses on improving the organization's business performance and overall capacity to capture, manage and rapidly exploit its body of knowledge to support individuals, groups and the organization itself. This perspective seeks to ascertain:

- What a person knows;
- What the others know;
- What does the organization know and how does it utilize and apply what it knows, simply and efficiently in the different contexts required.

The goal is to enable the organization to learn from past experiences, to avoid costly duplication of the same mistakes, and to improve training and the learning curve accordingly. The main organizational goal of such a Knowledge Management System is to improve the overall CF/DND business performance [4].

Process and Assets Perspective

This perspective focuses on how to support the DND/CF in the management of the entire KM Cycle which is comprised of four main processes: Knowledge Organization, Knowledge Gathering, Knowledge Analysis, and Knowledge Exploitation [2,3] of knowledge objects or assets (e.g. activities, issues lessons). The KM cycle is illustrated in Figure 1.

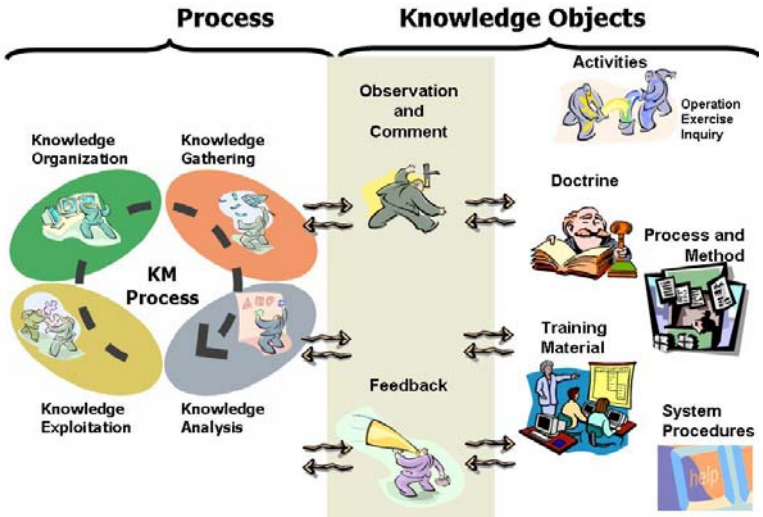

Figure 1 Knowledge Management from a process and object perspectives

System Perspective

This perspective is concerned with how to empower CF/DND with a bilingual web-based application that will:

- Structure and access their knowledge more efficiently;
- Reuse knowledge in different areas of expertise (e.g. operational, training);
- Facilitate sharing with one or more groups;
- Receive feedback from CF/DND personnel;
- Raise issues and act upon them;
- Identify requirements or lessons;
- Enables set-up of knowledge network (e.g. cross-references, search and navigation).

The KMS is a multi-element (e.g. Air, Land, Sea, Joint), multi domain (e.g. Lessons Learned, Command and Control), multi-workflow (e.g. reporting activities, issue tracking), and multi-user (e.g. Viewer, Analyst, OPI) tool whereby knowledge owned by a specific organization (within a specific element may be shared with all elements and seen within specific KMS Workspace.

3.2 KMS Concepts and Functionalities

The newly added concepts and functionalities within the KMS will be presented in the following section, which outlines a broad KM perspective as well as more specific concepts related to the management of knowledge within different organizations or groups. The main concepts and functionalities are:

- KMS Two main Interfaces
- Knowledge Domain
- Workspace
- Knowledge Assets (Objects)
- Knowledge Ownership and Sharing
- Knowledge Reuse Actions
- Feedback
- Knowledge Analysis Support

Two Main Interfaces

The first version of the Army Lessons Learned Knowledge Warehouse was entirely web based for all users (e.g. viewer, analyst, Post Operation Contributor). Meanwhile, a dedicated web application has also been implemented for the CFLLKW and is currently available for Viewers (for guests). During the architecture phase of the Canadian Forces Lessons Learned System, the organizations involved asked for more functionality to support them in their daily activities. For instance they wanted to support different workflows by having a Task List that presents what has to be done and by whom. They also requested more support for the analysis process to enable cross-referencing of objects (e.g. drag and drop) from results of searches through the KMS. All requirements

were studied and a second interface, the KMS Authoring and Analysis Workspace (figure 2) was specifically developed to support users such as knowledge workers (analysts) who use the KMS extensively. As a result, the KMS is now deployed with two main interfaces (see Figure 2): one that is still web based for users who want to access knowledge, submit feedback or report on an activity; and a second interface in MS Windows environment where analysts can create, update and delete knowledge such as activities (e.g. operation, exercise) questionnaires, issues, lessons, status reports [3].

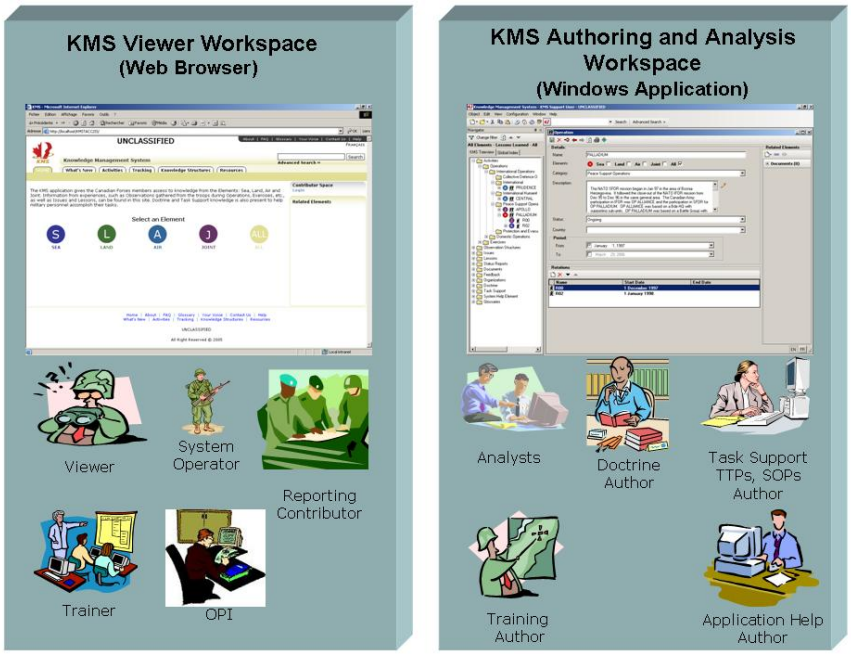

Figure 2 KMS' two main interfaces and the user roles involved

Knowledge Domain

There are numerous ways that corporate knowledge (e.g. Doctrine, processes, procedures, Lessons learned, Best Practices) can be organized, regrouped and accessed by Viewers or Knowledge Workers (e.g. analyst, report contributor, OPI). One of these ways is from an organizational perspective in which all knowledge related to a specific organization is structured so as to be easily managed within that context [6]. Such an approach brings up new challenges as knowledge that should be shared between organizations may become redundant when treated ''silo'' or vertical environment (top down as opposed to horizontal approach). Another way knowledge can be used is from a Knowledge domain's perspective in which a series of organizations are involved and interested in specific subjects within that domain. This is the case for the Lessons Learned domain whereby multiple groups from different organizations are involved in Lessons Learned Activities.

It is anticipated that in the near future more DND organizations will embed lessons learned activities within their own processes and take advantage of the functionality already available within KMS that supports their tasks and missions. The LL knowledge domain is expected to migrate from an activity-based domain (e.g. Lessons learned) to a function-based domain (e.g. Command) or a field-based domain (e.g. Doctrine, Training) where knowledge and related lessons can be simultaneously accessed and viewed.

The current literature on the subject confirms that benefits gained from the lessons learned process occur when the LL process is embedded within the business processes [11]. The KMS embeds the LL process through its knowledge domain concept, which is meant to both manage knowledge and to support the lessons learned process. In this way the corporate knowledge that outlines how things are done or what happened in specific activities and lessons learned can be seen simultaneously within the KMS.

Workspace

The KMS Workspace is a new concept that was put in place to facilitate access to specific sets of knowledge objects. The KMS Workspace allows a Viewer within the Web Based Interface to narrow down and filter knowledge from two different facets: the knowledge domain or sub-domain, and the element (Air, Sea, Land, Joint). Knowledge workers that use the KMS Authoring and Analysis Workspace can define their workspace with additional features required for their particular organization. Within that workspace, only knowledge objects either owned by that organization/group or shared by other organizations/groups will be seen (see Figure 3). The default Workspace is set to all domains and all elements for both interfaces.

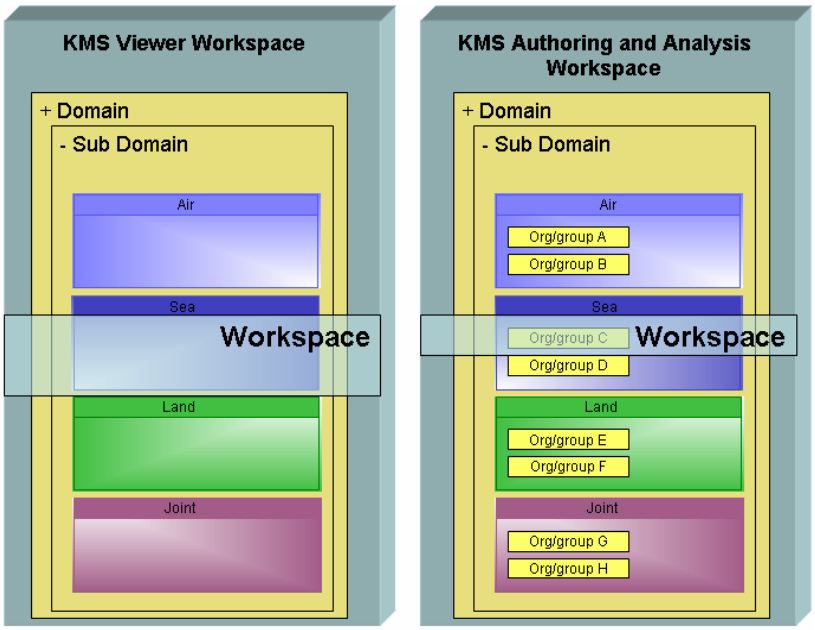

Figure 3 KMS Two Major Knowledge Workspace Facets

Knowledge Assets (Objects)

The KMS not only support assets (e.g. observations, issues, lessons) from the Lessons Learned process but also allows any organization to structure and manage its own knowledge either as separate objects (e.g. process, sub process, topics) or as documents (e.g. B-GL-331-001/FP-000). This is shown in Figure 4. The management of specific knowledge objects allows more flexibility to reuse them in different activities (operational or training) [1]. For instance, knowledge from doctrine, TTPs or SOPs that is managed as a distinct knowledge object for each topic can be shared and linked, as needed, thus reducing knowledge redundancies that create inconsistencies. As a result, a specific topic may be defined once and used repeatedly throughout the different Doctrine Knowledge Structures. The KMS manages knowledge objects instead of documents, however the concept of publications within the system provides the user the option to extract documents, as deemed appropriate.

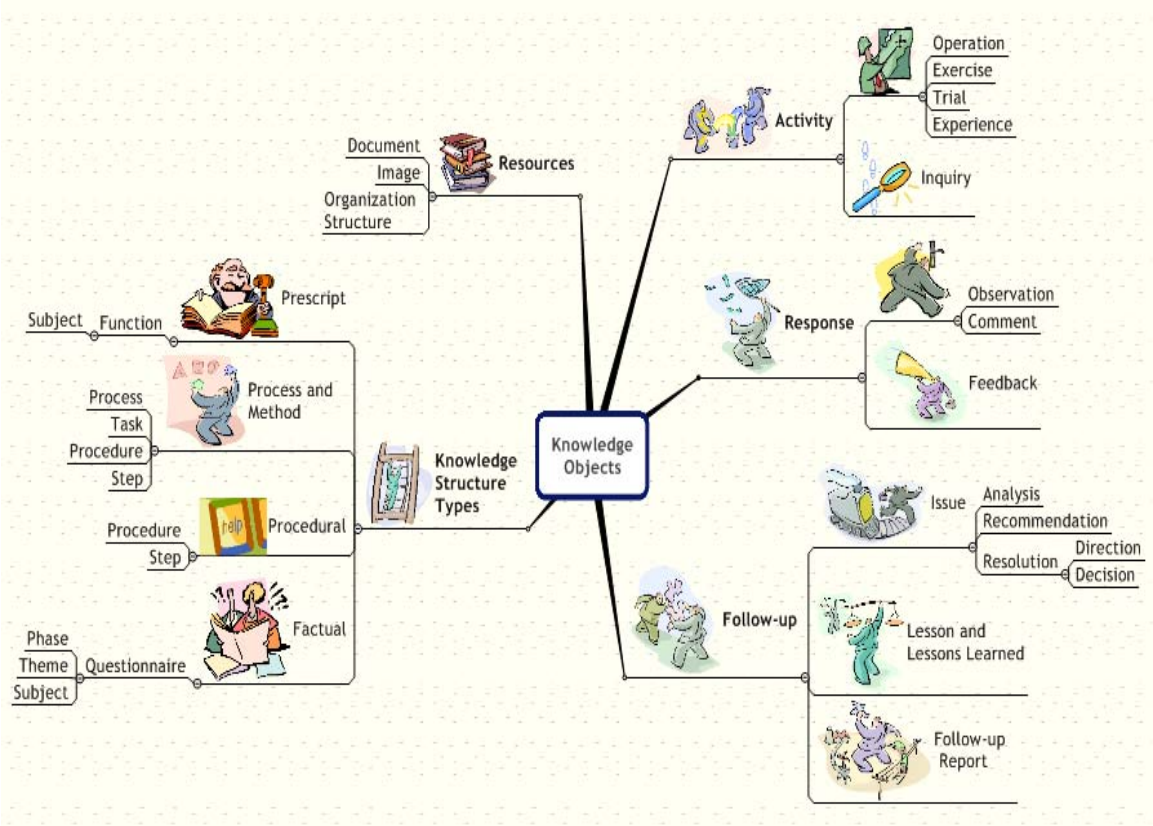

Figure 4 KMS Knowledge objects

Within each domain, knowledge objects are categorized using a controlled vocabulary that is predefined by those knowledge workers that have been granted the authority to do so. The list of terms may be the same (e.g. issue, lesson) or different from an object to the other (e.g. operation, reporting structure).

Knowledge Ownership and Sharing

Each knowledge object within KMS has an owner. Currently, the ownership rights are attached to an organization or group. These rights allow, among other things, the ability to create, modify and delete any objects, to use them as a cross-reference, to transfer ownership to another organization and to share them with other organizations (see Figure 5).

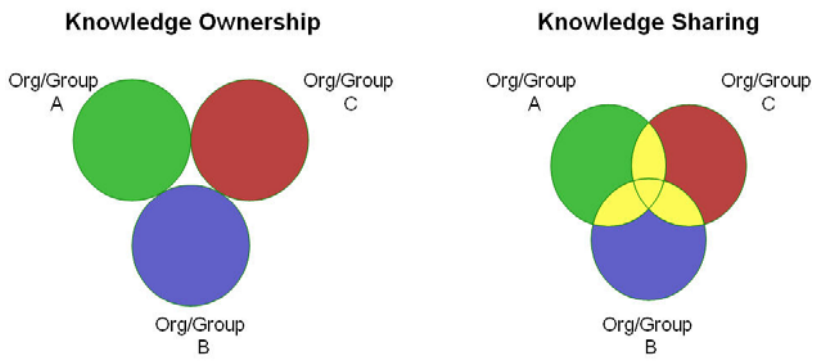

Figure 5 KMS Knowledge Ownership and Sharing Concepts

When a knowledge object is being shared with other organizations/groups, it can be viewed within any other Workspace and it can be used as a cross-reference by any organization.

Knowledge Reuse Actions

The KMS can also be thought of as an organizational memory system where the reuse of knowledge may take place as deemed appropriate by the knowledge re-user and in light of the identified organizational objectives [8].

There are three main actions that can be taken within the KMS that are directly related to the reuse of knowledge by the knowledge worker (authors, analyst and viewer): cross-referencing, importing and contextual mapping (see Figure 6).

Figure 6 KMS Knowledge Reuse Actions

A knowledge worker such as an analyst from a Lessons Learned organization may want to reuse an issue that has already been raised by another organization in support of their own issues or trends analysis. The Knowledge Analyst would than create a link between the two known objects, thus, forming a cross-reference. The KMS allows knowledge workers to cross-reference any knowledge object managed by the KMS.

An author responsible for describing a process such as the overall Battle procedure may want to reuse some parts of the Operational Planning Process (OPP) such as the War gaming process without changing anything. In that case the author can simply 'Import' the sub process to his own process. The ownership of the imported sub process will remain unchanged and the authority to edit the object will not be transferred. For any KMS object that has been reused in such a way, there is a section within the KMS that indicates to the knowledge worker (Viewer, authors, etc.) which object or group of objects have been imported.

Finally, the KMS can be used by the Land Element to standardize how task support and application help is to be provided to users in light of what they are currently pursuing within a whole body of systems (e.g. TacC2IS). This provides help in context to system operators who need to integrate declarative knowledge from Doctrine, Tactics, Techniques and Procedures (TTPs), as well as procedural knowledge from Standard Operating Procedures (SOPs) and Applications Help Procedures [1]. This type of contextual mapping defines what type of knowledge has to be provided to a system operator when he is performing certain tasks within the TacC2IS systems. Contextual mapping will typically be carried out by a group of persons who are involved in the production of knowledge related to training, doctrine, TTPs, SOPs, Application help, etc. as shown in Figure 7.

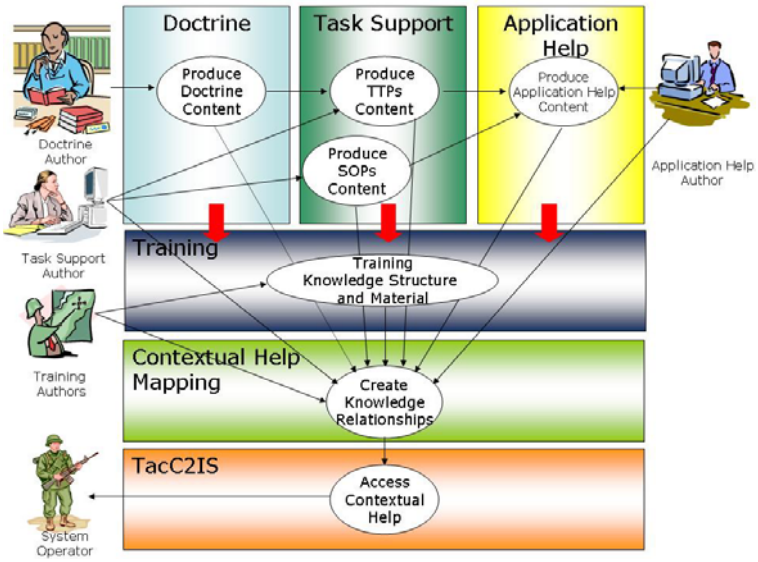

Figure 7 KMS Contextual Help Knowledge Model

Feedback

The concept of feedback has been introduced to allow any viewer or knowledge worker to provide feedback on any knowledge object within the KMS at any time. This feedback can serve to accelerate the knowledge learning curve and growth (e.g. a procedure that is not appropriate in a particular circumstance can be signaled), as well as help addressing specific issues that are raised. The appropriate organization can then take charge of the feedback and of the answer to be provided or follow up actions to be carried out (e.g. recommendation, decision) and make these responses available to all as soon as possible.

Workflow support

There will be a 'My tasks' functionality in the next release that will enable the knowledge worker to access a list of tasks assigned to them regarding KMS knowledge objects and to be informed of news or features related to the KMS. For instance, the task of a knowledge worker could be to manage a CFLLKW reporting structure by approving it, contributing to an issue by adding recommendations or by acting on feedback by identifying the OPI.

Knowledge Analysis Support

The KMS provides different tools to support the knowledge worker in the process of analyzing knowledge. The three main tools offered within the KMS are the following:

- The Knowledge Analysis Corner
- The Advanced Search tool
- The Activity Reporting History

The Knowledge Analysis Corner supports the knowledge worker in the building of his project analysis. This feature offers users a place where they can structure knowledge based on their analysis objectives, and where they can cross-reference them to all of the knowledge gathered within the KMS as well as from other sources (uploading or hyperlink). The report analysis can then be published in another format but all the supporting material for the analysis can be accessed by viewers and reused in future analyses. For example, the topic may be a trend to be monitored over time. What will be captured in the KMS is not only the final product of the analysis but the context within which such analyses has been performed. In the future more advanced functionality will be offered to the knowledge worker to enhance their capability to exploit the body of knowledge and to identify potential trends.

The Advanced search tool allows knowledge workers to search through the body of knowledge by narrowing down the search by identifying what to search for (e.g. subject), in which type of object (e.g. issue) and locations to search for (e.g. C2 Domain, specific TTPs).

The Activity Reporting History tools were previously developed within the ALLKW to manage questionnaires. These constituted the basis of the Post Operation Report or the Post Exercise Report. Viewers could access knowledge from a questionnaire perspective where, under a hierarchy of topics and/or questions, they could find observations or comments that related to all previous operations or exercises. This enabled the knowledge worker to view knowledge from a topic perspective instead of an activity perspective in order to support topic-based analyses. Knowledge workers could also access observations and comments from previous KMS questionnaires or reporting structures that evolved over the years.

All lessons learned organizations agreed that such a structure should be common within the lessons learned domains in order to avoid duplication and to limit the number of questions posed to the troops. However, although all Elements share a common reporting structure, there will always be a need to have specific topics that are Element-oriented (e.g. equipment from a ship).

4. Discussion

A number of choices were made regarding requirements, functionality and priorities by the Lessons Learned organization during the architecture and the development phase. These choices were based on available budget and resources as well as the delivery plan.

The main objective was to avoid postponing the delivery dates, thus enabling the knowledge worker to experiment more with the system. This in turn allows users to better define their future requirements and identify what they required in the short term to support them in their tasks.

These requirements were framed in a broader context to allow more organizations to get on board, to take advantage of the system to improve their own business processes by embedding the lessons learned (e.g. embedding LLs within the Capability Development, the OPP Mission Analysis, the Individual an Collective Training Processes to name a few).

The fact that in KMS a lesson is directly cross-referenced to its object (e.g. issue or lesson regarding Warning order within the Battle Procedure process definition) enables the KMS to overcome what most organizations complain about with Lessons Learned Systems: namely, that they cannot have access to lessons learned in a timely manner or that they have difficulty finding relevant issues [10]. The main advantage of our approach is that it facilitates access to a lesson from the object that it is related to and it enables you to view lessons by categories.

In the actual context of the CF/DND transformation we foresee that business processes will have to be adjusted to meet the changing CF/DND orientation. The Lessons Learned community could very well be transformed and become embedded within different organizations. Therefore, new roles and responsibilities will have to be defined to ensure that they meet organizational objectives such as the need to better manage knowledge in such a way that it becomes useful to a broader audience within their own contexts. Proper resources will need to be allocated to maintain the system (Snider 2002) and also to maintain the integrity of the knowledge.

Any technology can be misused and lose its purpose and benefits if organizations do not put together a set of golden rules or guidelines. These guidelines ensure that proper procedures are used in the long run and that the knowledge structure remains orderly. KMS gives the CF/DND the flexibility to structure their knowledge, while at the same time, allowing any Element or a organization to replicate its 'old way' of managing knowledge (in silos).

Thus, the implementation strategy becomes our first priority. It also becomes important to have a restricted group of organizations using the system that will provide feedback on the processes and functionalities. This feedback will allow us to fine tune how users interact with the system initially and over within the context of the CF Lessons Learned and the Command and Control (TacC2IS) [1].

5. Conclusion

From an organizational perspective, current work is aimed at guiding the CF/DND to develop and maintain proper resources with specialized and adequate skills to leverage the use of such a system within their own organization. The impact on their own process can only be felt if there is a firm commitment to do so.

From a process perspective, experimentation of the KMS by a group of users will take place to highlight subjects of interest regarding the overall lessons learned process that the group will have to take into account prior to delivery.

From a system point of view, we foresee that the direction of the system in the short term will be to offer increasing support to the viewer and to the Knowledge Analyst in the building and use of 'Topic maps' to facilitate information retrieval and reuse of knowledge thus reinforcing interoperability with other resources or systems. Further discussions on this matter will be presented in a subsequent paper.

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