



Knowledge Management as a Supporting Concept to Effects-Based Operations

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Outline

- MNE 4 Overview
- Knowledge Management Concepts
- KM Settings MNE 4
- Experimental Results
- Conclusion



MNE4 Overview



MNE 4 Overview

- Part of a series of multi-national experiments to explore the **Effects-Based Approach to Operations**.
- Aim of MNE 4:
 - To explore **concepts** and **supporting tools** for effects-based operations within a **coalition environment** involving **stability operations** with increasing levels of violence in order to assist the development of future **processes, organizations** and **technologies** at the operational level of command.



MNE 4 Overview (Cont'd)

- Men-in-the-loop distributed experiment.
- 8 participating countries + NATO.
- Staff distributed at 5 sites: Canada, France, Germany, UK, US.
- The HQ staff are to plan, implement and assess an operational plan following the developed EBO CONOPS.
- The distributed staff performed meetings and did joint work using collaborative tools:
 - Info Work Space (IWS)
 - Portal to access databases and share documents
 - War-gaming and planning tools



MNE4 Analysis

- Team of 95 analysts and observers.
- Analysis was based on staff survey responses, observations of meetings and discussions, IT data.
- MNE4 analysis included:
 - Analysis of the HQ organizational structure (SNA)
 - Ability to perform EBAO CONOPS
 - Situational Awareness, Common Intent
 - CFEC volunteered to analyze the Knowledge Management support.



Knowledge Concepts



Knowledge vs Information

- **Information:** Processed and organized data in a way that adds to the knowledge of the person receiving it.
- **Knowledge:** Knowledge results from the interpretation of a proposition (P) regarding a subject *S* in a given context (\aleph) and to which is associated a degree of belief (μ):

$$K(P, \aleph) = \langle P(S) \rangle_{\mu}$$



Knowledge Definition

- **Degree of belief:** A single number is both necessary and sufficient for its representation. [Cox '46]
- **Interpretation:** Depends on the individual's mental representation (or sense-making) of the proposition, which depends on *a priori* knowledge and context \aleph .
- The dependence of interpretation on knowledge agrees with von Krogh's self-constructionist view, called autopoiesis.



Knowledge Set

- Autopoiesis implies that the modeling of an individual's knowledge requires ordered sets of knowledge elements. NOT a simple union of knowledge elements.

Individual's Knowledge = $(\langle P_1 \rangle, \langle P_2 \rangle, \dots, \langle P_n \rangle)$

Computer scientist differentiate between sets, noted by curled braces $\{\}$, and n-tuple or ordered sets, noted by parenthesis $()$.



Knowledge Activities

- Knowledge Creation
 - Interpretation of new received information.
 - Development of new elements of knowledge through reasoning process.
- Knowledge Elimination
 - Focusing the mind on a reduced number of knowledge elements.



Knowledge Activities (Cont'd)

- Modification of Knowledge Elements
 - Modification of the interpretation.
 - Modification of the degree of belief (formalization)
- Modification of the order of the knowledge elements:
 - Prioritization of some elements.
- These activities are **not all independent**. 4 mostly independent activities: creation, interpretation, formalization and prioritization.



Knowledge Concepts Remarks

- The introduced definition of knowledge provides:
 - Natural distinction between KM and IM
 - Cohesive approach for integrating sense-making (interpretation), attentional focus (prioritization) and belief revision (formalization) research.
- In practice, human activities cannot simply be categorized in the four introduced classes of activities.
 - Most activities will lead to a complex reorganization of the individual's knowledge set.

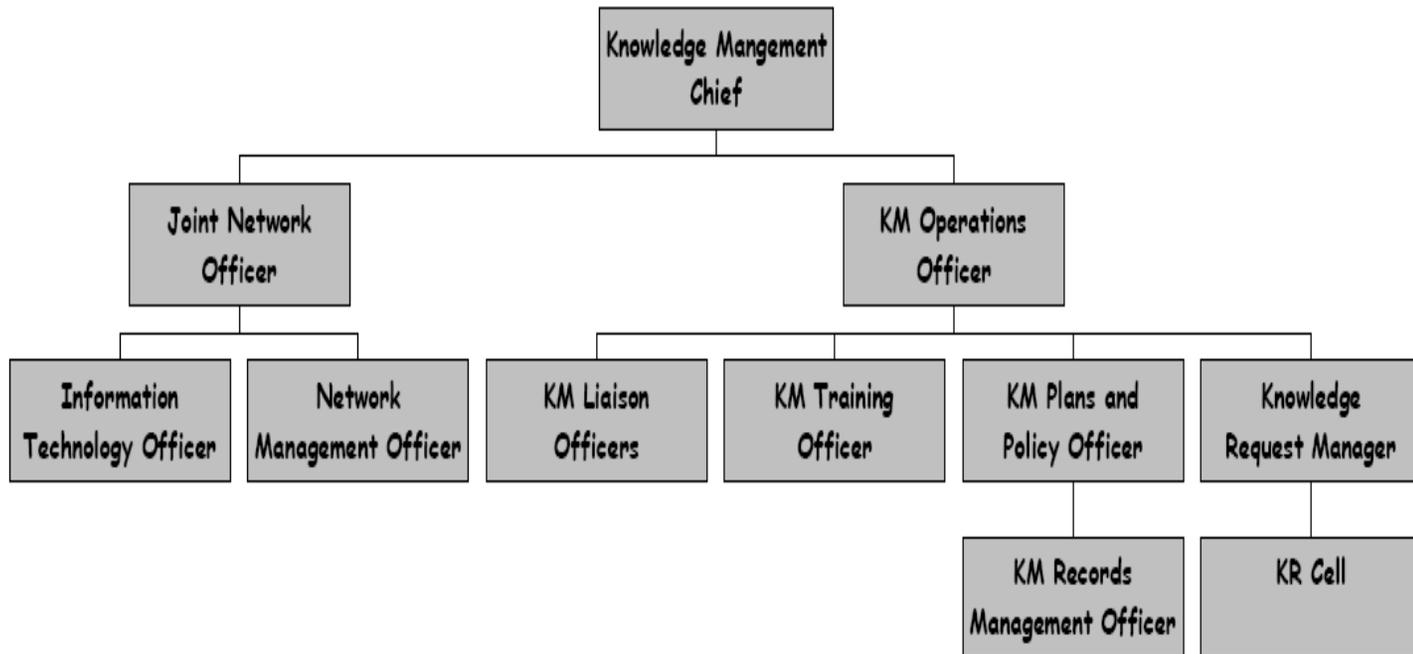


MNE4 KM Settings



Knowledge Management

- **Definition:** Govern and facilitate the knowledge activities.
- For MNE4: A KM team is dedicated to governing and facilitating the knowledge activities.



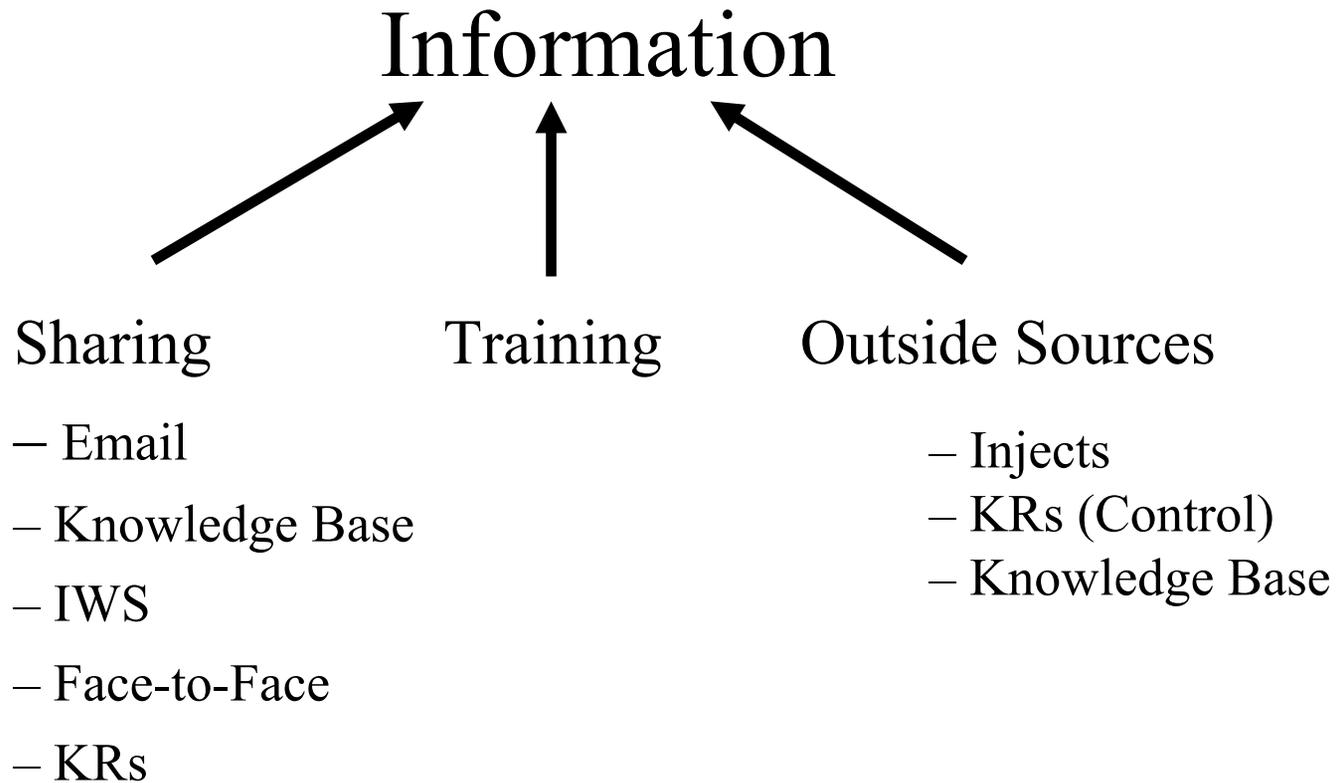


MNE 4 KM Plan

- Establish roles and responsibilities for the KM staff
- Main roles:
 - Maintain a Knowledge Request (KR) function.
 - Design and maintain the Collaborative Information Environment (Portal).
 - Develop and implement business rules.
 - Support the development and implementation of adequate information visualization.
 - Institute a training regime.
 - Facilitate linkages among CTF staff and information sources.
 - Ensure the good working conditions of the IT network.



Source of Information





KM Analysis Objectives

- Evaluate the Quality of the Knowledge Activities.
 - Creation: Info access, Info sharing, Decision-Making
 - Interpretation
 - Formalization
 - Prioritization
- Evaluate the Adherence to the KM Plan, in particular to the Business Rules.
- Evaluate the Quality of the Knowledge Management Support.

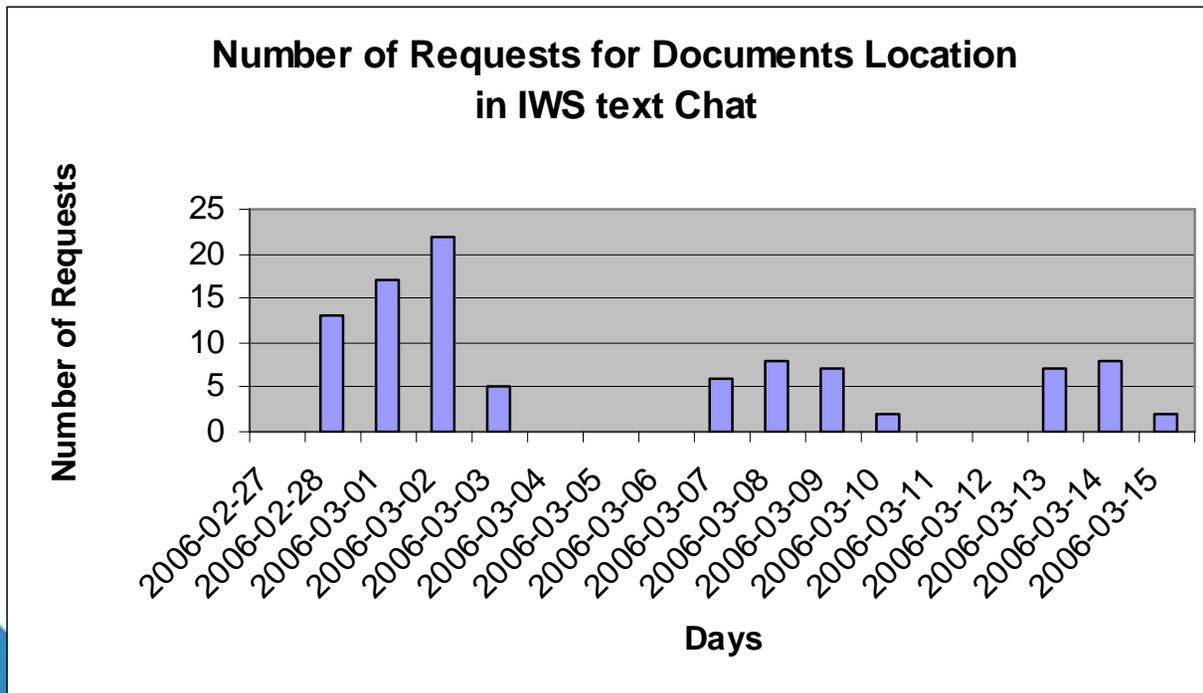


Results – Quality of Knowledge Activities



Results – Access to Information

- Findings:
 - Poor quality of the search engine hindered access to information.
 - Access improved as participants learned where to find the relevant information on the portal.
 - Players reported a lack of info including lack of a prioritized data collection plan.

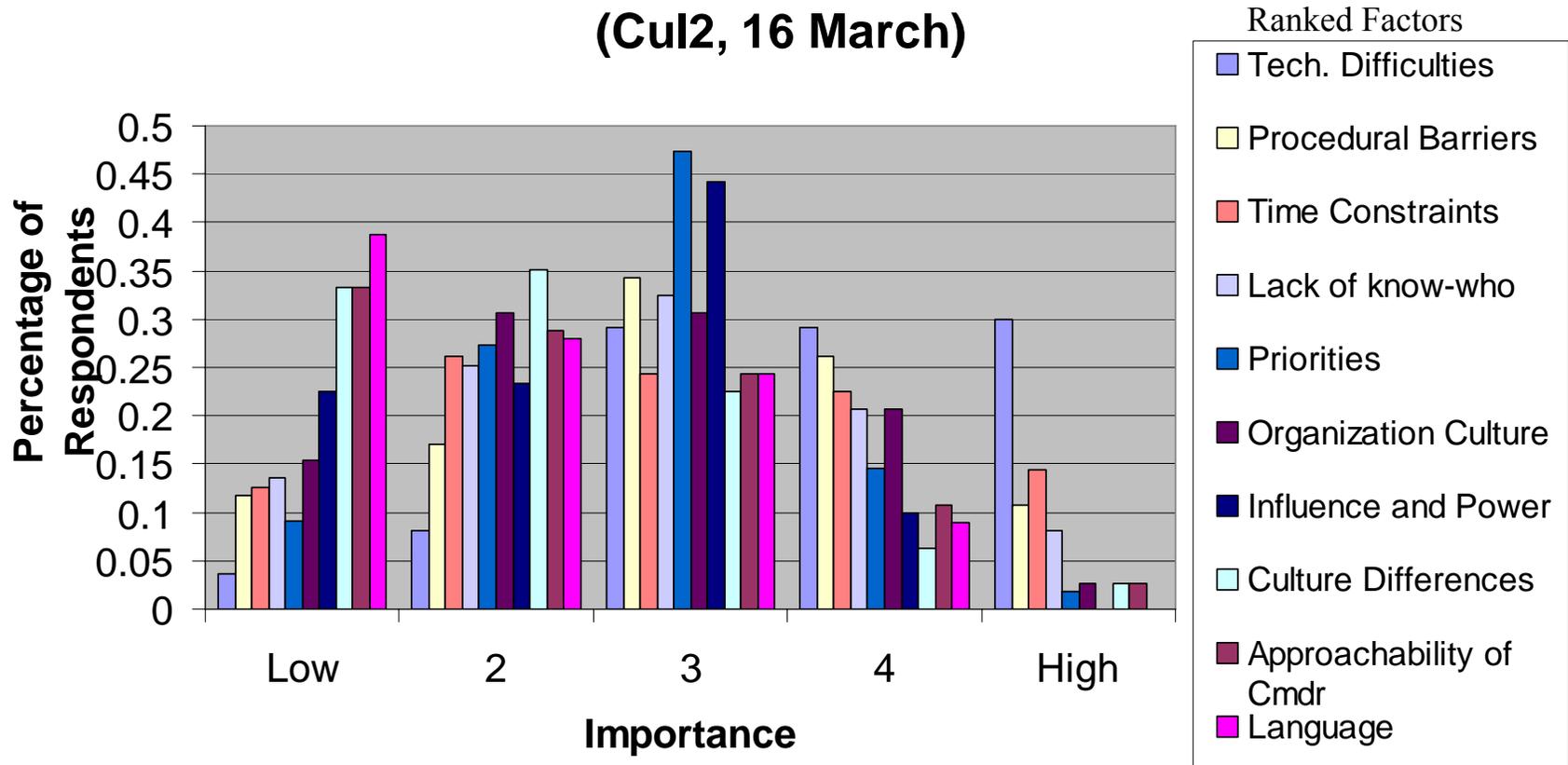




Results – Information Sharing

- Finding: Ranked consensus shows tech difficulties, procedures, time pressure and lack of knowledge of who needs info were main barriers to info sharing

**Importance of Factors in Hindering Information Sharing
(Cul2, 16 March)**





Results – Information Sharing (Cont'd)

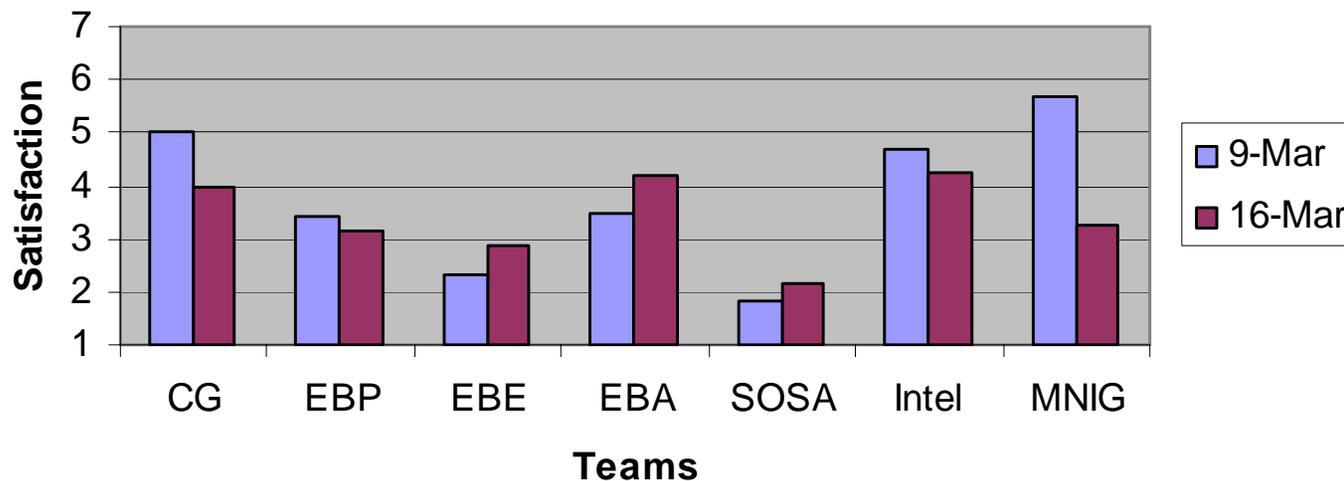
- Horizontal versus vertical competition:
 - Staff sharing more information with their superior were less connected (lower SNA centrality; $\tau_b = -0.287$)
 - Staff sharing more information with their superior had a higher Commander's Intent score ($\tau_b = 0.333$).



Results – Information Formalization

- Conflicting elements of information were shared among the CTF HQ staff (border crossing, imprisoned spokesperson...)
- A majority of players agree that there was a lack of certainty for KR answers provided.

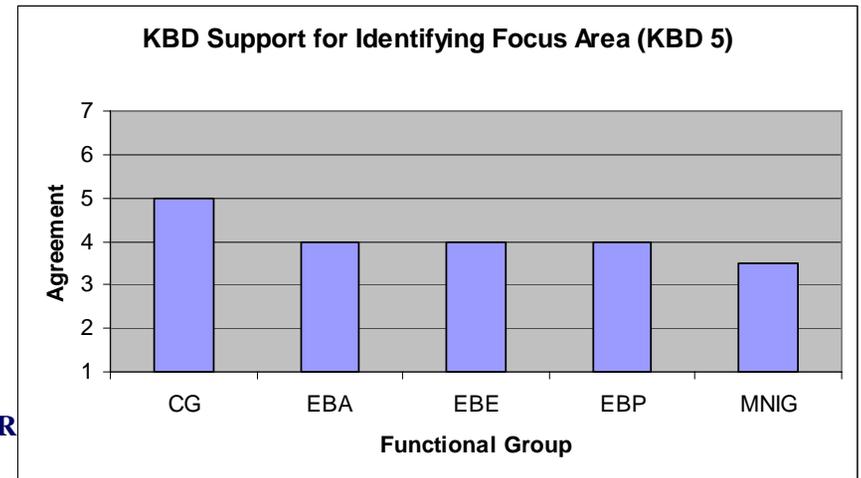
To what extent did the response satisfy you in terms of "Communicating to you the certainty of the response?"





Results – Information Prioritization

- Finding: Information prioritization was ad-hoc and distributed
- Main support for prioritization:
 - Portal Notepad: Group alert to display high priority documents.
 - Subscription: Personalized priority for documents update.
- Lack of prioritization procedure for KRs (based on originator!)
- Players overloaded with emails: lack of prioritization of information.
- Support for prioritization less adequate for MNIG.



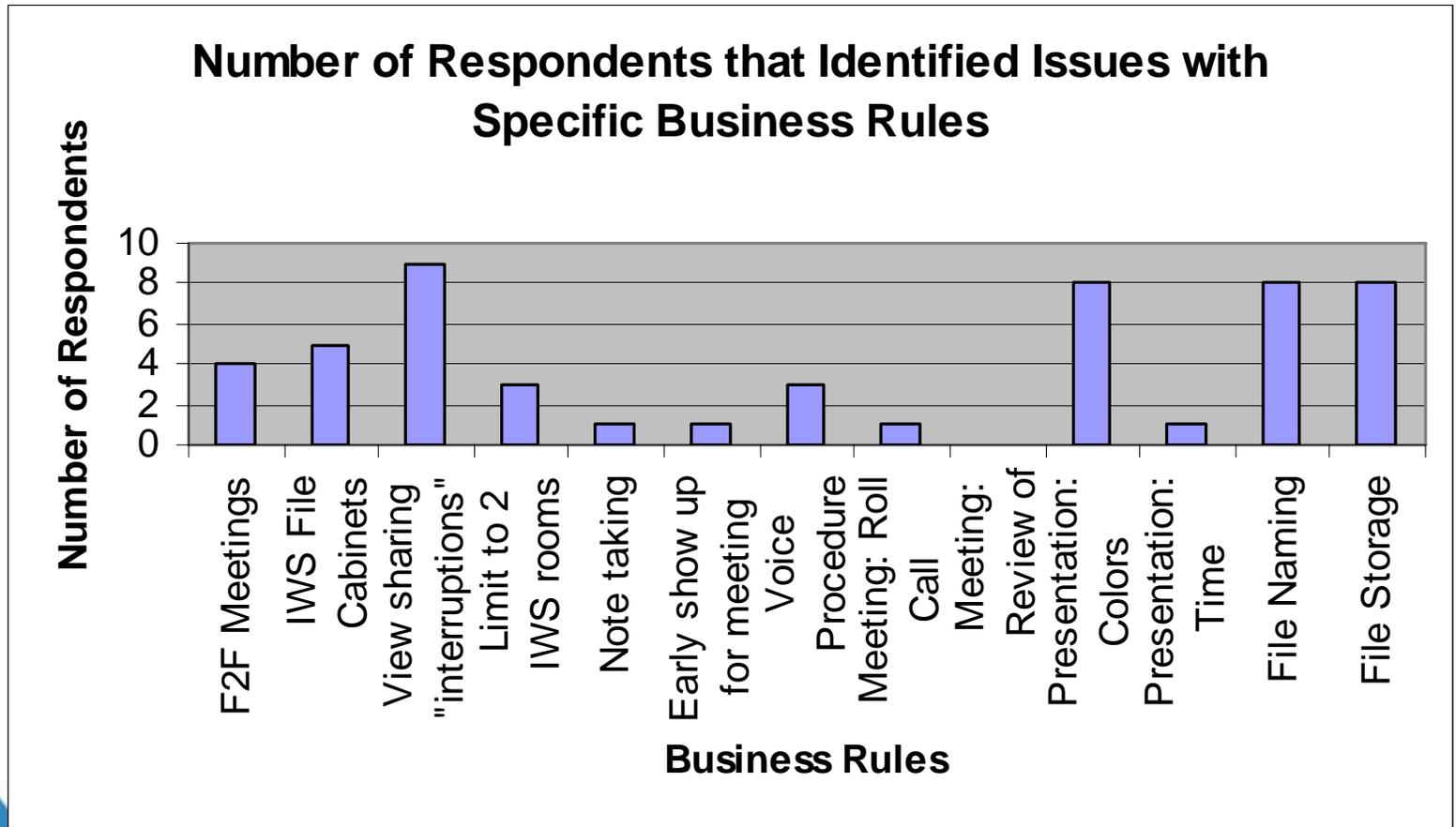


Results – Adherence to the KM Plan



Results – Adherence to the KM Plan

- Players perception of adherence to business rules.

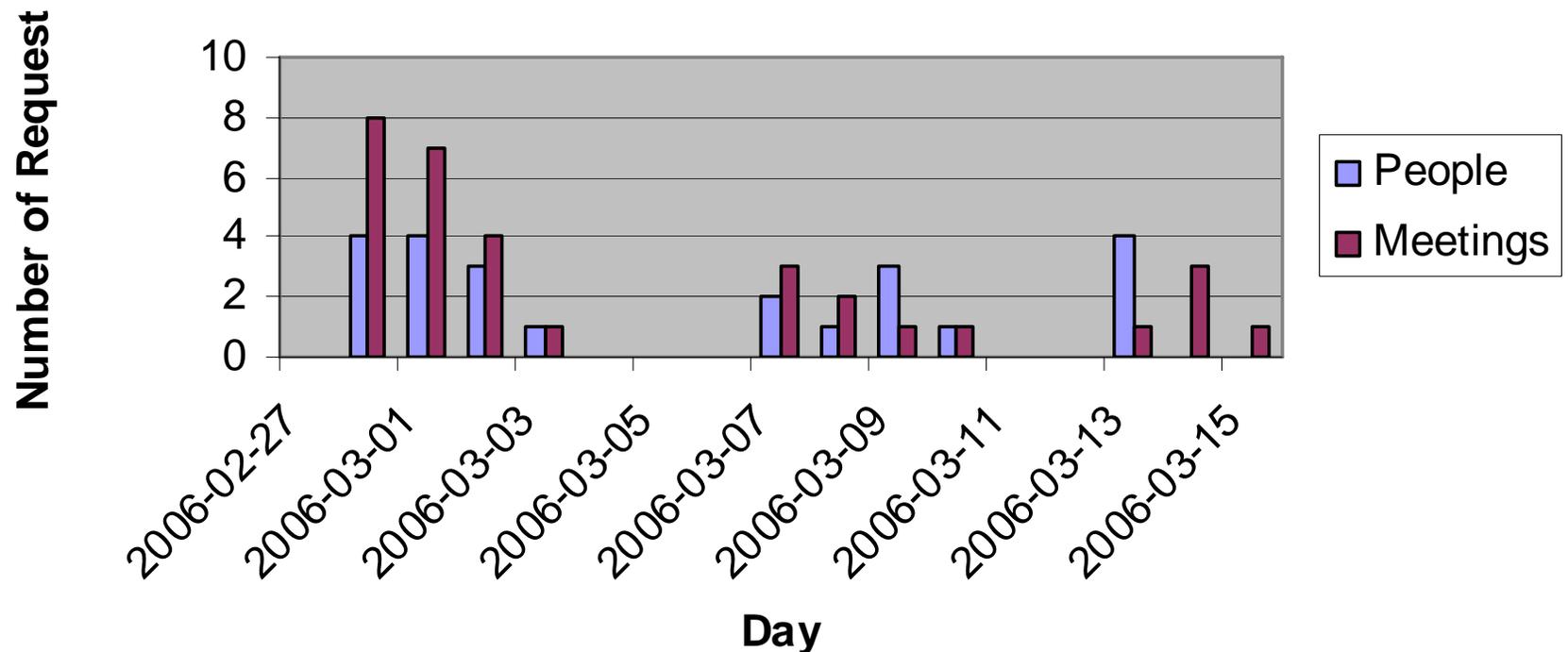




Implications of Lack of Adherence

- Finding: Lack of portal calendar use correlated to people looking for meeting locations

Number of Request for the Location of People and Meetings from IWS Chat logs





Implications of Lack of Adherence (Cont'd)

- Other possible consequences:
 - IWS Shared View Interruption → Unstable IWS
 - File Storage → Files not available on Portal, stored in IWS File Cabinets, lost data.
 - File Storage → files hard to find, for ex: Two folders 'JCO' caused confusion
 - Face-to-face meetings → Lower participation of remote participants

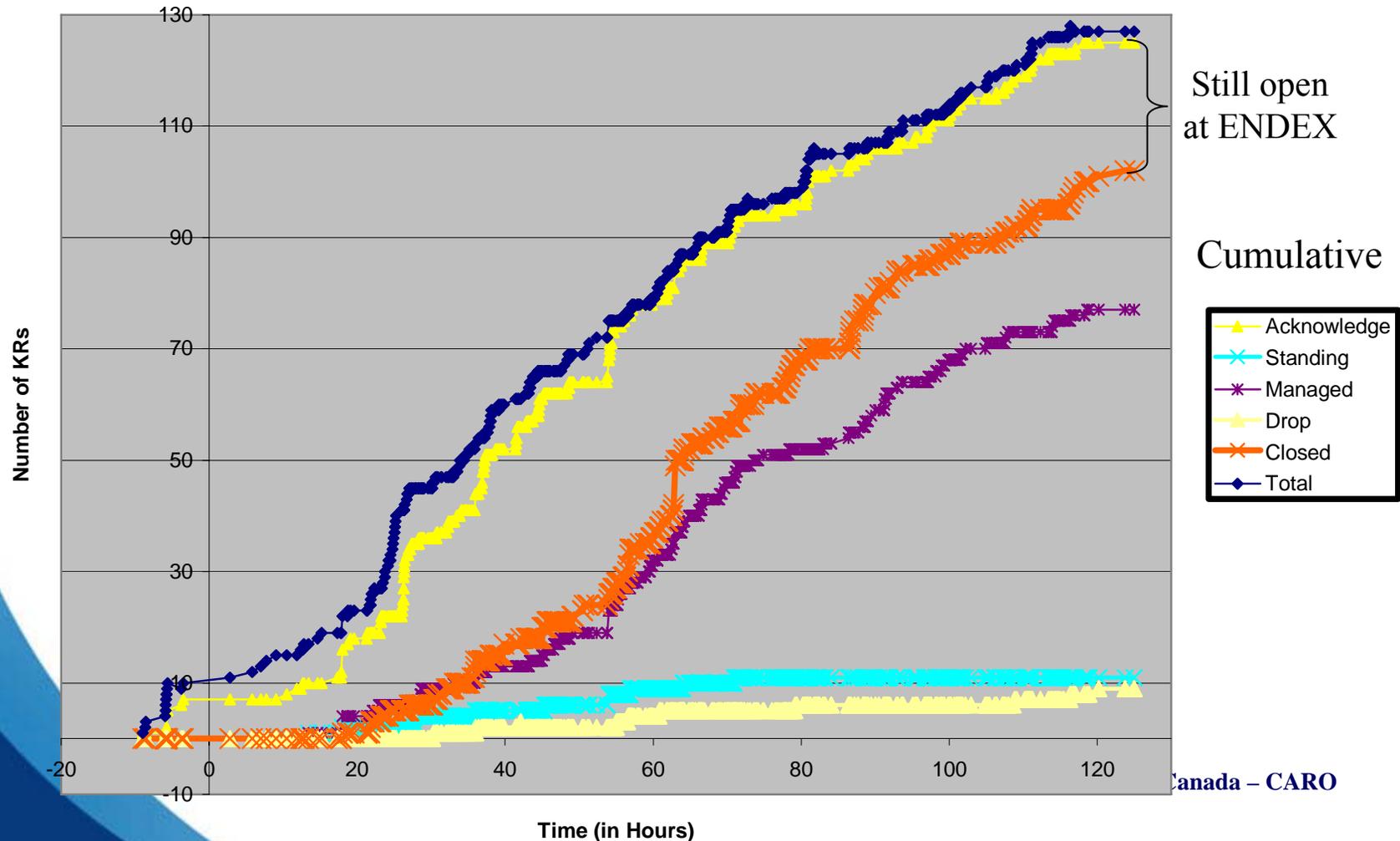


Results – Quality of KM Support



Results – Use of KR Function

- KR demand close to linear over time (Hausdorff dim = 0.9)
- Most KR's acknowledged quickly but slow to respond, 50% adequately responded, many dropped



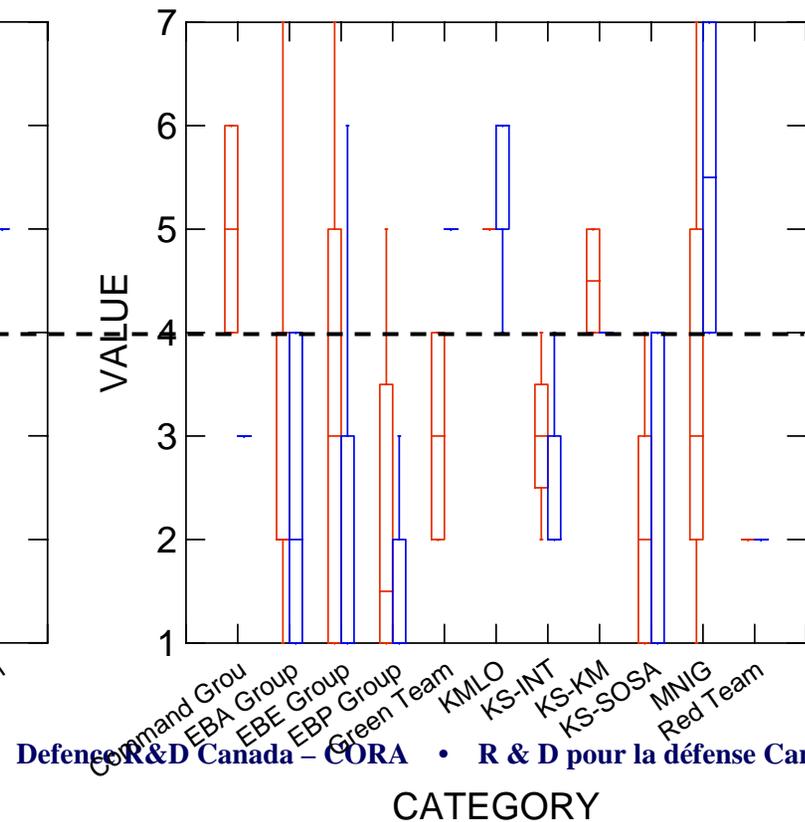
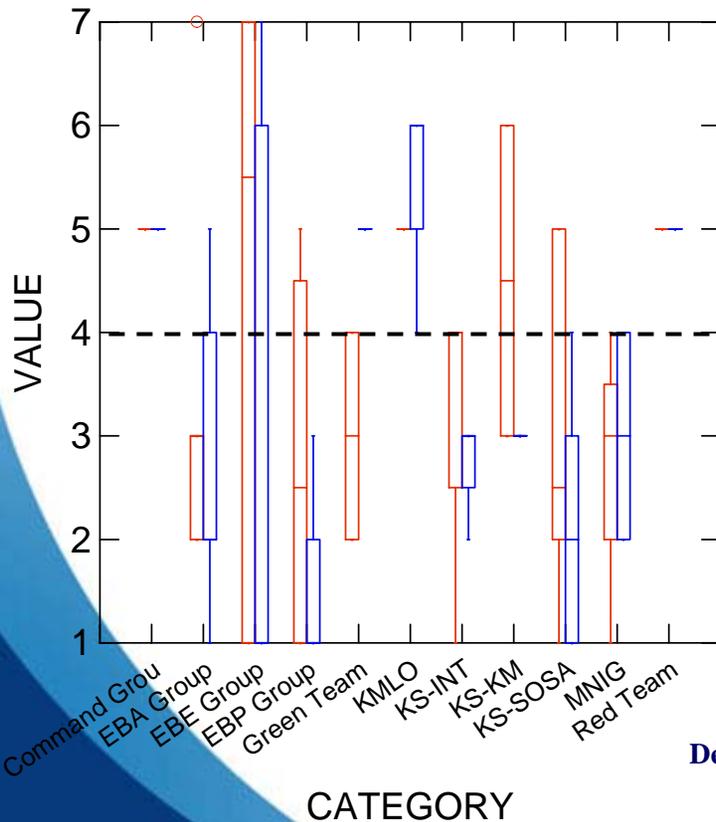


Results – Quality of KR Support

- Finding: Majority of players dissatisfied with both quality and timeliness of KR responses

KR Response Satisfaction

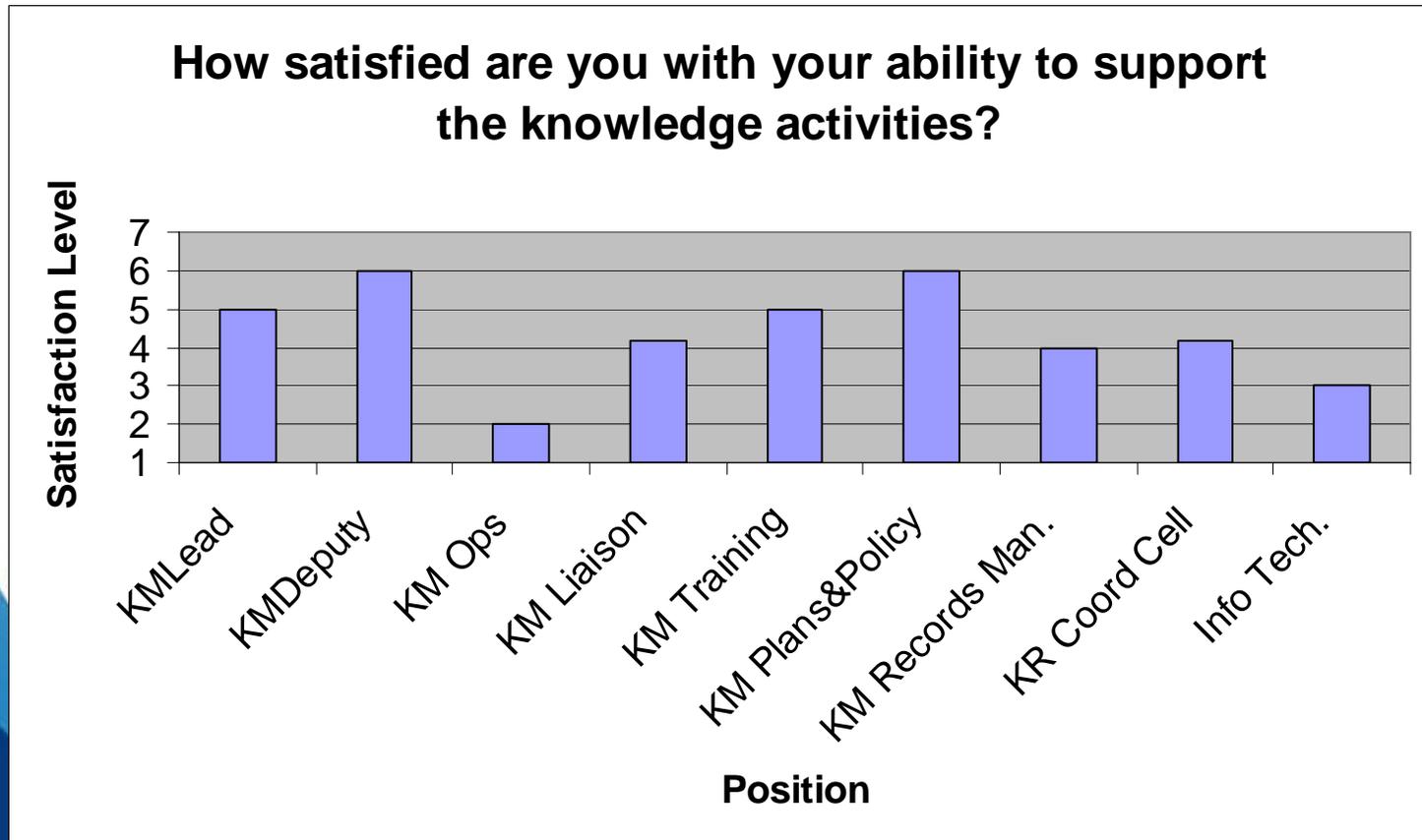
KR Response Timeliness





KM Staff Satisfaction

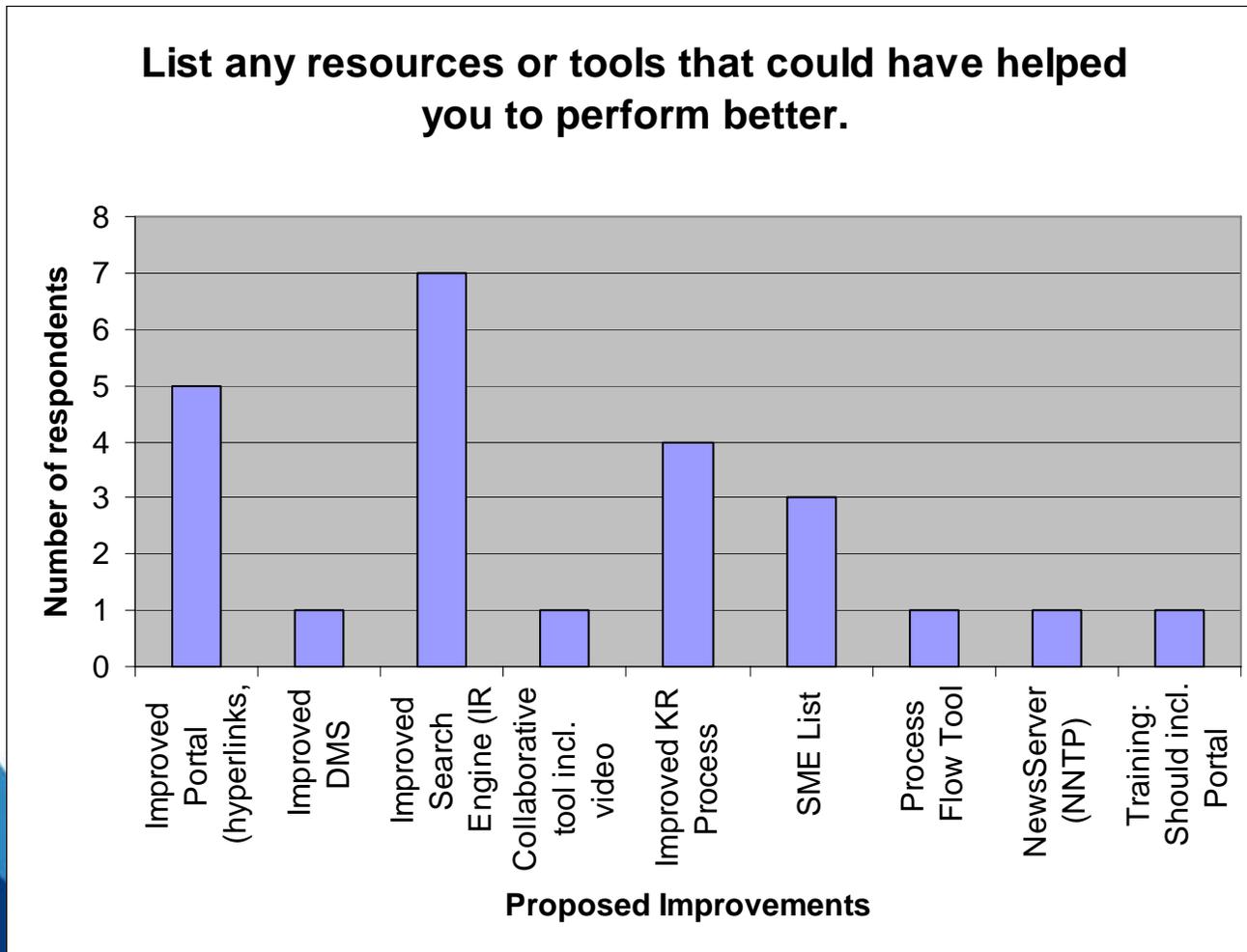
- Finding: Wide distribution of KM personal satisfaction with KM duties
- Recommendation: Clarify and review roles and responsibilities





Additional Resources Required for KM

- Finding: According to KM team, improved search engine, portal, KR tool and SME directory are top priorities to improve KM robustness.





Conclusions



General KM Conclusions

- The KM Plan requires more than KM concepts, organizational structure, roles & responsibilities and business rules: sound **KM principles** are needed.
- KM team challenged by an experiment simultaneously testing process, tools, and organization.
- Benefits of using CIE “business rules” need to be made explicit to users with leader support.
- KM is much more than IM
- Lack of facilitation of decision making process for complex situation with large uncertainties.
- Need for tools to support the monitoring of information flow (SNA)
- There is insufficient evidence to reject the null hypothesis (KM was not robust in the CIE) > therefore further concept development is required
- Sense-making theory should be used for modeling knowledge development within organizations.

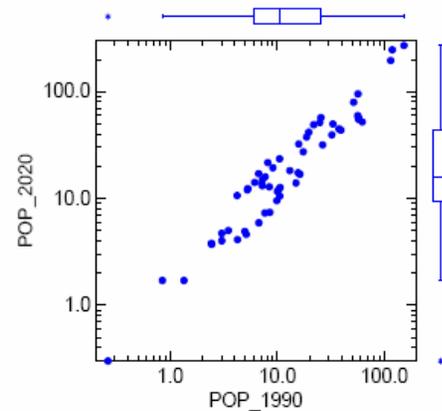
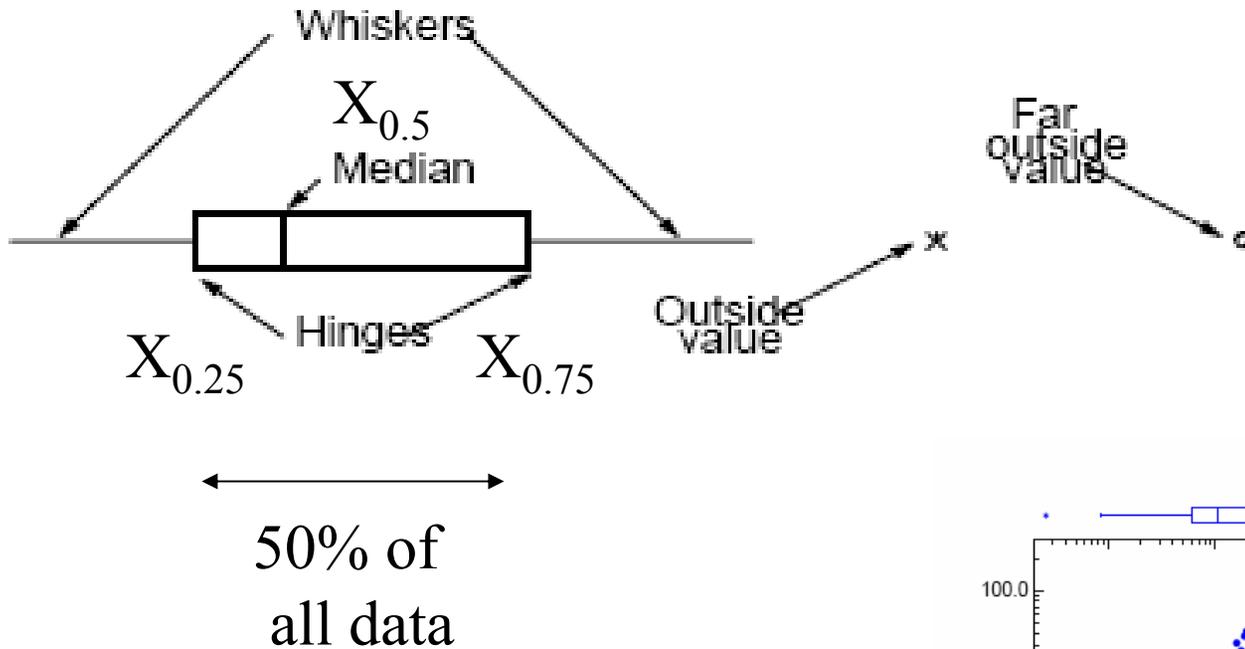


Questions?



How to Read a Box Plot

- Box plots show pictorial distribution of all data

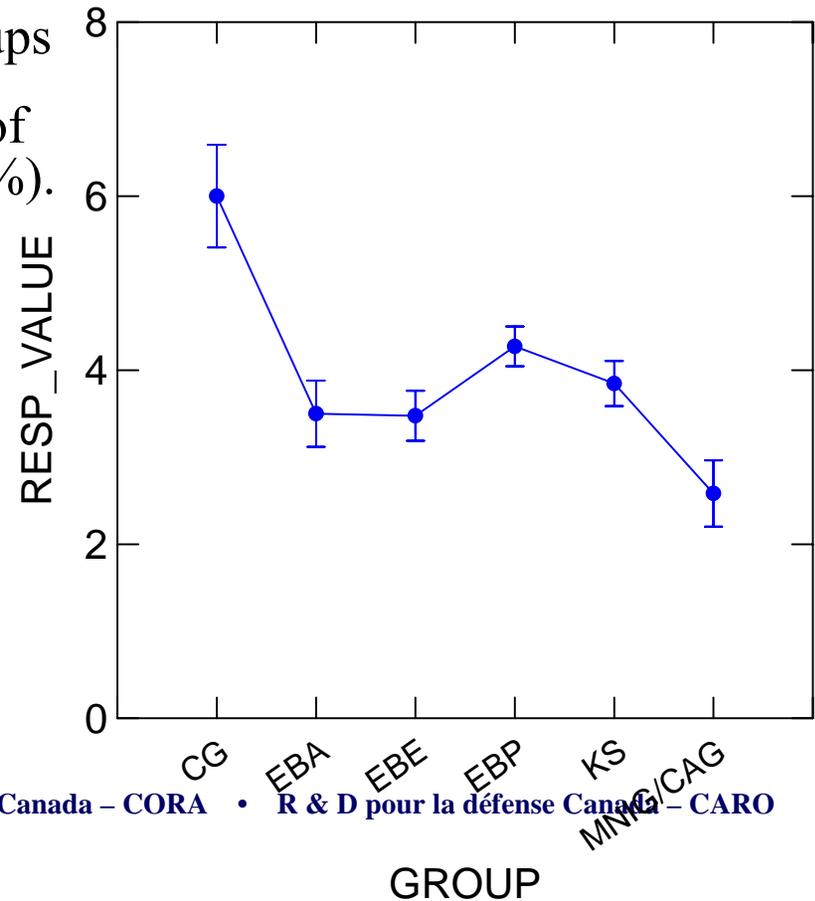




Results – Completeness of Information Available

- Finding:
 - Players reported a lack of info overall (average of 4 and below) for EBO;
 - MNIG reported lower level of info completeness of all groups
 - Staff had a limited knowledge of KB content (Average score 57%).

Information was Complete





Results – Information Interpretation

- Finding: MNIG rated information interpretation as neutral, significantly lower than CG, EBA and EBP ($p < 0.05$)
- Information interpretation was observed to be an issue in select instances.
- Culture, language and experience are factors impacting on the ability to interpret the information.

