

The Knowledge Base and KM Toolkit

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Introduction

- Aims and boundary conditions highlighted in the previous presentation by Umeki-san
- The Knowledge Base (KB) is a highly dynamic entity which is intended to be a fundamental resource for implementers, regulators and other stakeholders
- The KM toolkit provides access to the KB and allows it to be
 - extended - by adding input from relevant sources
 - modified - integration & synthesis
 - reviewed - autonomous or focused QA
 - utilised - by all interested parties

KMS user interface

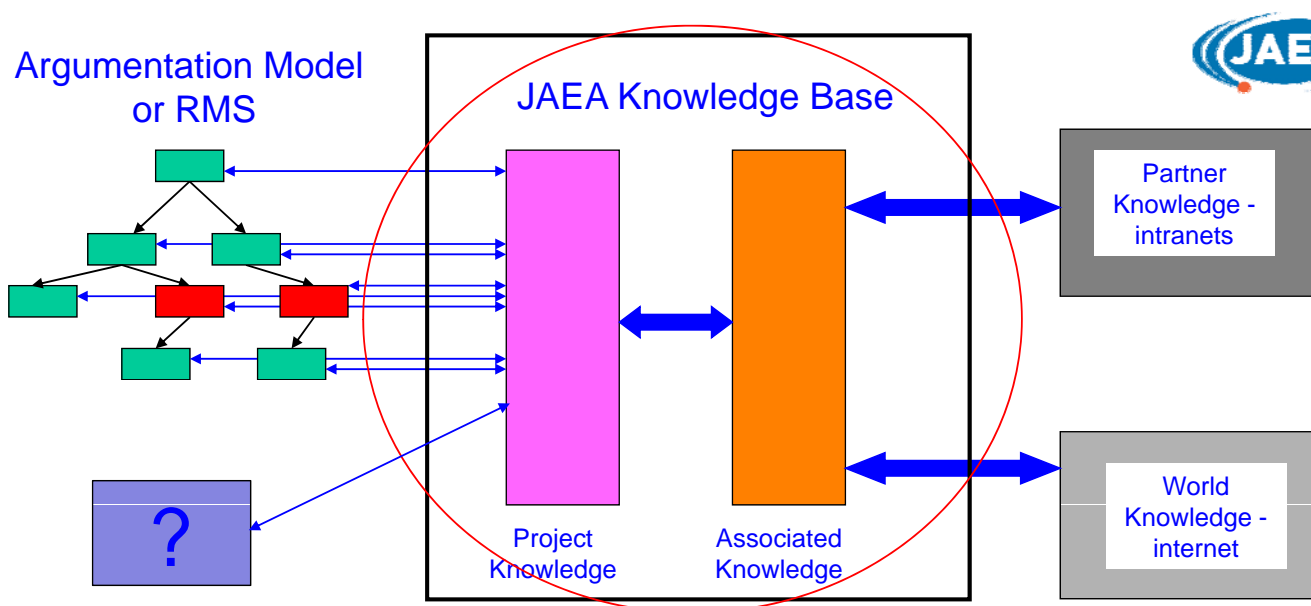
This website is presently a test bed and status of the development approach and is continuously improving and expanding.

JAEA KMS Login

Basic Concept of JAEA KMS

The Geological Isolation Research and Development Directorate (GIRDD) has been developing a Knowledge Management System (called the JAEA KMS) since 2005, aiming to :

- Systematically organize the knowledge obtained through research and development in geological disposal technology. Facilitate use of such knowledge by a wide range of users including the implementer and the safety regulation agency. Ensure that new knowledge required by the user is provided in a timely fashion.



- The JAEA KB is the subset of world knowledge that contributes to development of geological disposal projects in Japan. Because of the wide definition of the “safety case”, most of this can be structured by associated argumentation models or requirements management systems (RMS): however, closer to implementation a wider Strategic Environmental Assessment (SEA) may be considered (http://www.jaea.go.jp/04/tisou/kms/pdf/sc_ws_02.pdf)

Content of a radioactive waste KB



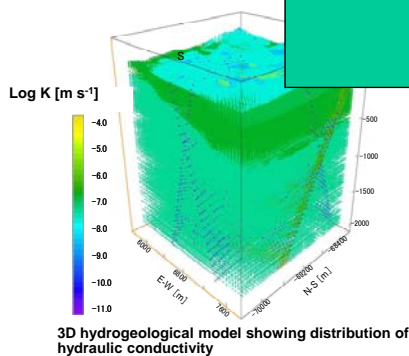
Processed data

Synthesis reports



Model output

Expert teams



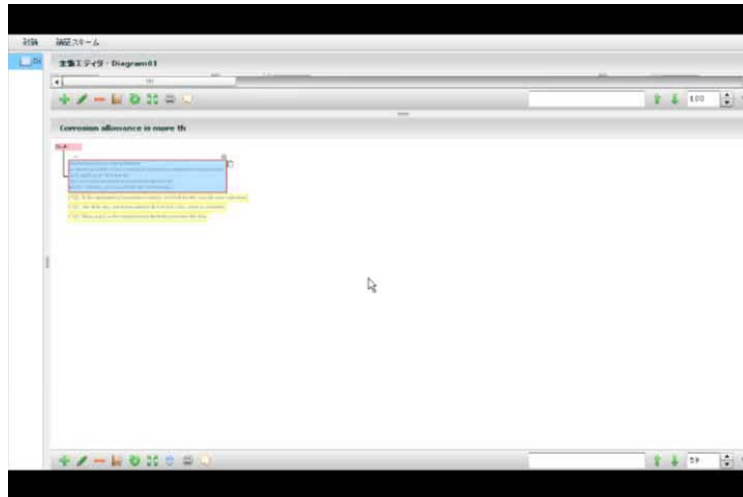
KB management issues

- KB structuring
 - Maintaining an overview of a constantly evolving system - rigorous change management
 - Freezing the KB at key milestones
 - Archiving and database security
 - User-friendly interface
 - Integrated QA
- } Future priorities
- Covered in Umeki-san's final presentation

KB structuring



- Unlike traditional approaches, the database has no inherent structure: application-specific structures are imposed on the database - e.g. using hyperlinks to argumentation models
- Using expandable argumentation models and hyperlinks to full documents (focused on relevant sections), models, databases, videos, animations, etc., a comprehensive KB is generated, which can then be frozen at project milestones

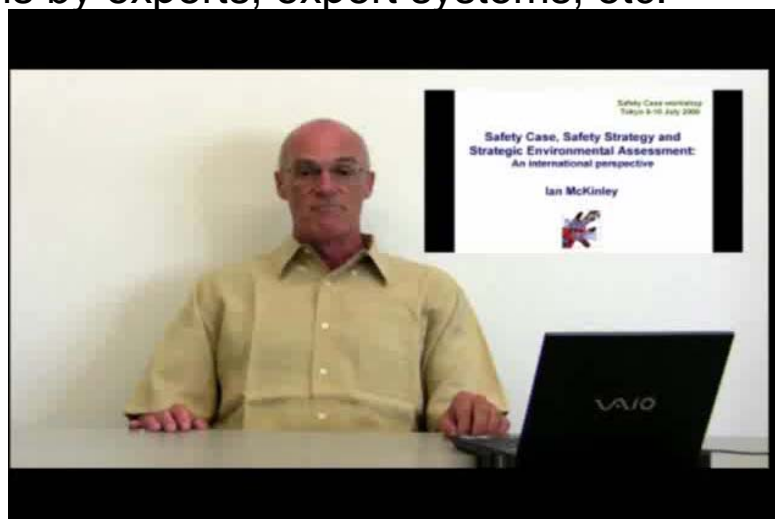


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Tacit knowledge



- Note that the KB also includes **tacit** knowledge - information and experience which is contained in the heads of senior staff and plays a key role in planning and decision making
- For the purpose of specific applications, such tacit knowledge may be represented by the argumentation model itself, video presentations by experts, expert systems, etc.



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Tacit knowledge capture



Formal methods of capturing tacit knowledge are a cornerstone of Knowledge Engineering. Various approaches (e.g. Common KADS) and tools (e.g. Protégé) have been investigated for this purpose, with the aim of building expert system (ES) modules

...this process will be illustrated in the later presentation by Semba-san

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Tacit knowledge preservation



- Tacit knowledge has tended to be managed in the past via training / apprenticeships / on-the-job experience transfer, but this is now critical in many programmes due to retirement of staff who played unique development roles
- Special training and mentoring projects have been initiated (e.g. think-tanks, mentored development of next generation repository designs); in the future this may be combined with more speculative, novel approaches (e.g. based on e-learning supported by expert systems)



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Managing changes

- The KB continually expands and new knowledge may contribute (positively or negatively) to specific applications
- Important feature of NUMO's RMS, which is now under development (e.g. NUMO-TR-07-02)
- Might be implemented via the "alerting (notification)" function of a smart search engine

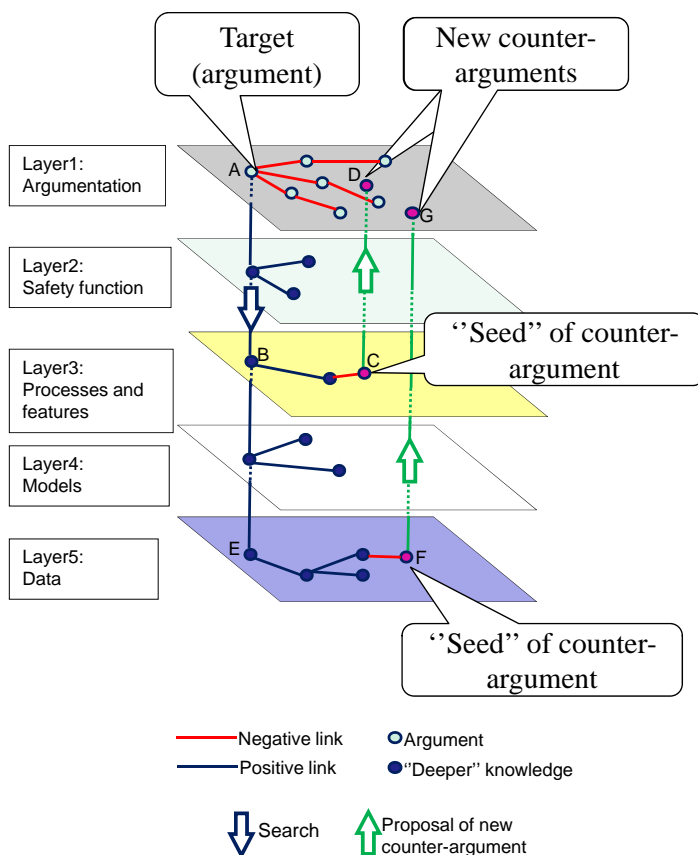
Change management via KNetwork 2 (knowledge-base)

KNetwork 2 knowledge base

- Knowledge network consists of nodal points (knowledge elements) and links
- Knowledge elements are classified into five categories, i.e. arguments, safety functions, process and features, models, data
- Links can take either positive ('supports', 'explains', 'is consistent with', etc.) or negative ('contradicts', 'denies', 'is not consistent with', etc.) form

Example of change management, *proposal of a new counter-argument*

- Step 1: A cluster of knowledge elements positively linked with the target argument in 'Layer 1' is identified by KNetwork 2 search function
- Step 2: Knowledge elements that are negatively linked with a node in the cluster identified in Step 1 are searched and recognized as 'seeds' of counter-argument
- Step 3: New potential counter-arguments are then proposed based on their seeds, e.g. 'The argument contradicts other data.', 'There is a detrimental feature not considered in the argument.', 'Model supporting the argument is not consistent with observed data.'

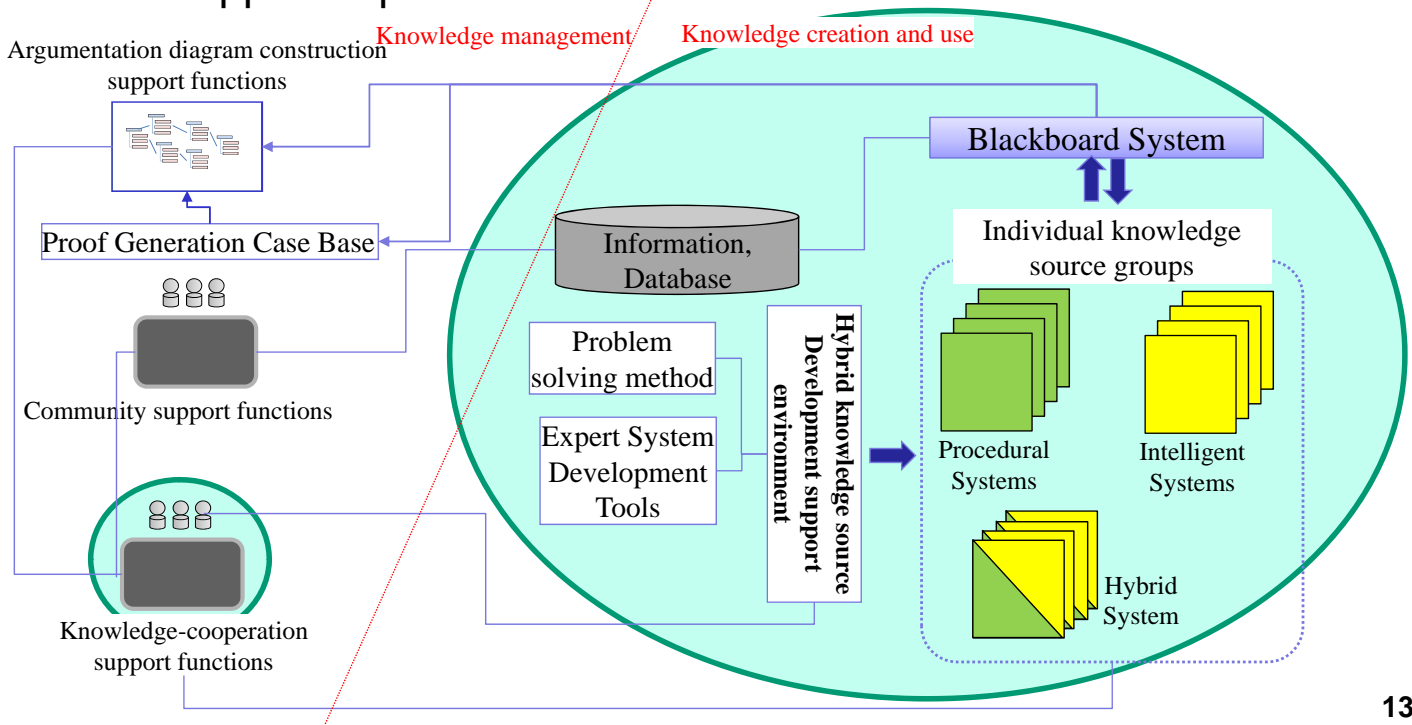


Accessing the KB

- Access via:
 - CoolRep / H22 report (to be frozen) - to be illustrated by Umeki-san
 - Argumentation models - shown previously
 - Smart search engine (planned development)
 - integrates focused electronic search with functionality such as:
 - automated translation
 - automated summarisation / quality checks
 - initial attempt to develop system from scratch failed
 - better approach seems to be tailoring existing specialist search engines (e.g. FAST ESP, Autonomy IDOL)
 - features include: connectivity, data cleansing & linguistic analysis, federated search, entity extraction, faceted search, contextual search, relevance & ranking, scalability, security and alerting
 - “alerting” - autonomous identification of new material on a topic - could be the basis for a change management function
 - **Could be a suitable international collaboration topic!**

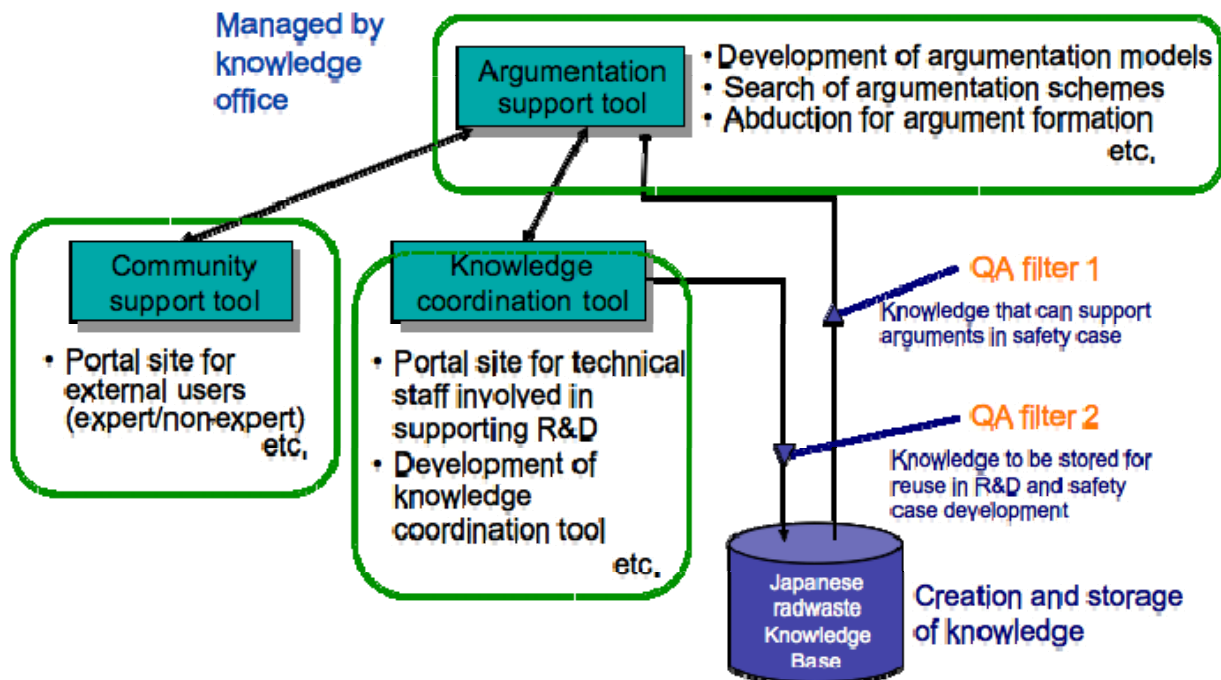
Utilising the KB

- In the foreseeable future, the extent of autonomous operation is limited - focus is thus on a hybrid approach in which electronic KE tools support expert teams

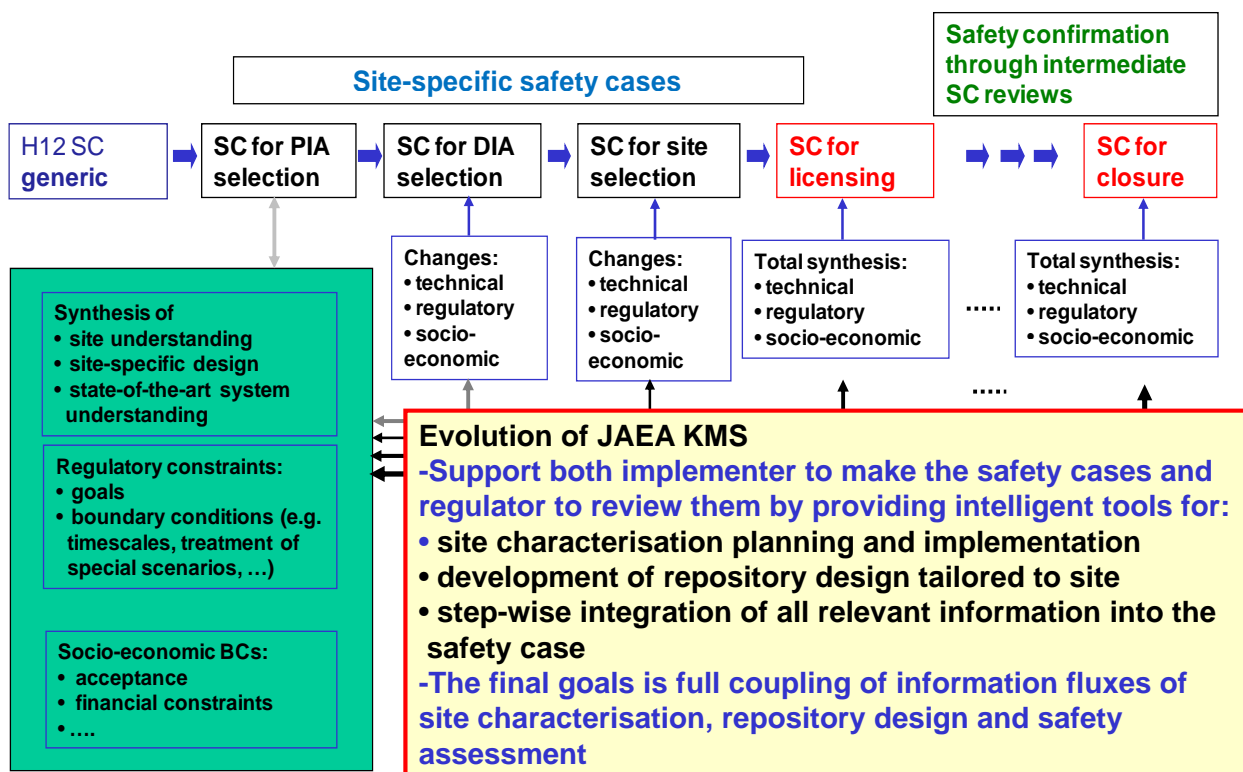


Application - focused by argumentation models

- Examples of practical application will be provided in the following presentations



Expected evolution of the KMS toolkit



Conclusions and future perspectives

- Significant progress has been made in establishing the KB to support the H22 project and the tools that provide access to it
- A number of different approaches have been examined but, to date, those based on argumentation models appear most generally useful
- Effort is focused on establishing as much automatic functionality as possible, but it is accepted that practical application requires a hybrid approach - facilitating the work of project teams is the main goal
- Some major challenges have not yet been addressed
 - KB freezing, archiving and security
 - Smart search engine development
 - Development of interface with knowledge producers

...which could be topics for future collaboration