Electronic Knowledge Management (EKM)

A Framework for Understanding EKM with Guidelines for Retaining Intellectual Capital and Addressing eDiscovery Requirements

Version 1.0

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Developed by:
Electronic Enterprise Integration Committee
Aerospace Industries Association, Inc.

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1 The Purpose of This Document

The goal of this document is to identify the business problems related to knowledge management. It explains that there are two types of knowledge: that defined as tacit knowledge (stored in people's heads), and explicit knowledge (printed matter and electronically stored Information (ESI)). It outlines a reference model for describing electronic knowledge management applicable to any industry. It provides several example business scenarios applicable to the aerospace industry, and a framework for consistently defining additional scenarios.

This document contains guidelines to assist any organization in developing an overall Electronic Knowledge Management (EKM) strategy. It addresses the challenges of capturing and retaining the tacit knowledge from members of a workforce so that it can be exploited across the organization, even after individuals are no longer present, and managing ESI and other forms of information.

The document serves as the basis for identifying industry-wide problems and providing best practice guidance to companies who are facing these problems throughout the supply chain. While many companies may have mature EKM processes within their own organizations, they need to ensure that their supply chain develops and maintains a viable electronic knowledge management capability as well. There is a growing need to ensure robust methods for discovering relevant knowledge throughout the supply chain. Therefore, an industry-wide collaborative electronic knowledge management capability is required.

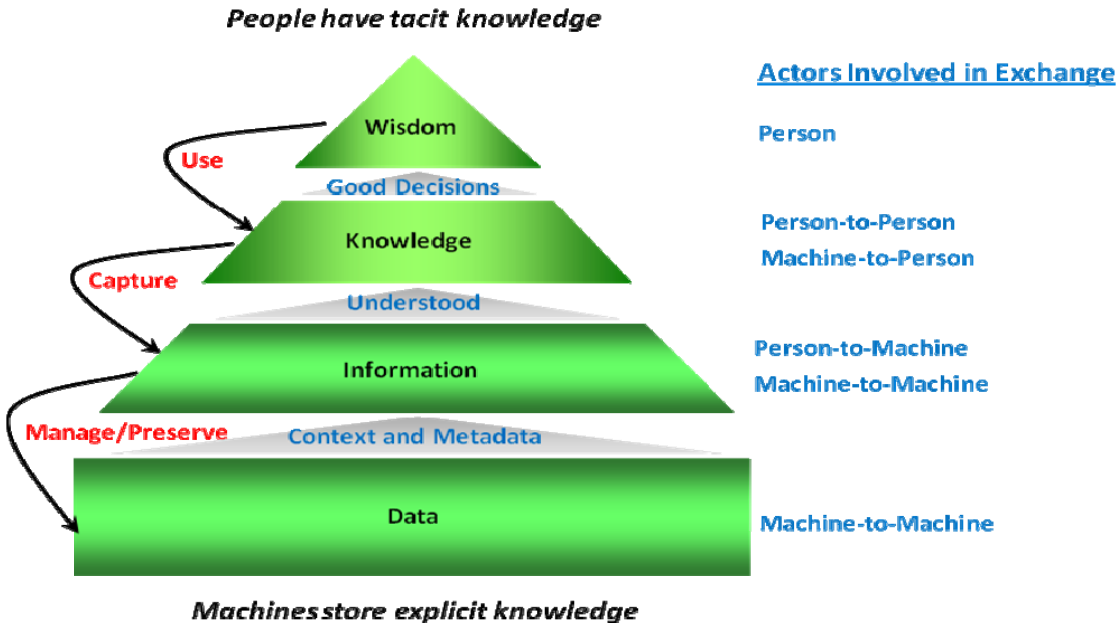


Figure 1 Knowledge Exchange Hierarchy

The sources of knowledge available to a company are:

- Explicit knowledge stored in data repositories
  - Internal Knowledge Base
    - Managed and unmanaged repositories within a company
  - External knowledge sources
    - Managed and unmanaged resources available such as those on the Internet
    - Supply chain repositories
- Tacit knowledge of one or more of its individual employees
  - Not explicitly stored in any physical or electronic form
  - Based on experiences and lifelong learning

One key element of the knowledge management process is to ensure that tacit knowledge is captured in explicit form and made available to the workforce in a timely and effective manner. This will, for example, facilitate and accelerate the education of the people needed to replenish a transitioning workforce, and preserve information that may be required by policy or for litigation.

The hierarchy referenced in Fig. 1 represents the enrichment of data in its simplest form to ultimately an individual's wisdom. This process interprets Data to Information, Information to Knowledge, and Knowledge into Wisdom. This is a recursive process where Wisdom requires the use of Knowledge. Knowledge requires the capture of Information, and finally Information is built upon the capture of managed Data. These elements which enable the transition from one level to the next are the foundations of the Knowledge Management Process.

"Knowledge Management is the discipline of enabling individuals, teams and entire organizations to collectively and systematically capture, store, create, share, and apply knowledge to better achieve their objectives." (Knowledge Management, Ron Young, Knowledge Associates International). EKM extends knowledge management to facilitate the capture and protection of an enterprise's critical knowledge retained by an individual via an electronic media.

Readers are encouraged to discover additional explicit knowledge related to knowledge management through Internet search.

2 Problem Statements

The AIA has identified the loss of intellectual capital caused by a retiring workforce as a critical issue for the future success of the industry, and a strategic priority for action. The following is a quote from "Launch into Aerospace: Industry's Response to the Workforce Challenge" – see http://www.aia-aerospace.org/assets/workforce_report_1_sept08.pdf

“The aerospace community risks the loss of intellectual capital and will be unable to meet the forecasted needs for business.”

“From the top of every organization, industry must embrace the systemic changes required to rebuild the foundation of America’s aerospace workforce.”

The problem has a number of inter-related aspects and causes:

- Gen-X tendency to switch jobs
- Alternative work strategies (mobile devices)
- Virtual work space inhibits mentoring
- Loss of critical skills
- Alternative sourcing strategies
- Immigration laws
- Binary event – loss of manpower to outsourcing
- Culture of knowledge hoarding

These can be addressed by a combination of cultural, business and technical solution components:

- Discovering lessons learned
- Knowing the business culture
- Knowing the business processes and information/data flow
- Knowing the social networks, knowledge sharing (person to person)
- Knowledge capture (tacit to explicit)
- Metadata standards and associated technologies

This document will help identify the needs and offer guidance for small to medium and larger enterprises, such as Aerospace and Defense (A&D) Original Equipment Manufacturers (OEM), prime contractors, and/or Large System Integrators (LSI).

The use of both tacit and explicit knowledge is often dependent on obtaining knowledge from two levels:

- From expertise and experience, based on the core competency associated with the products and processes delivered to customers
- Knowledge obtained from external sources - typically customers, but including suppliers and partners

Tacit and explicit knowledge obtained and used from external sources includes both the documentation and interpretation of technical information such as specific product requirements (e.g., drawings, CAD images) and general requirements that influence these specific requirements (e.g., specifications and related narrative documents). The ability to effectively use the knowledge implicit in these documents is dependent on the ability to both access them and to gain insight into the often subtle factors that influence their application as intended by the customer. Ease of access to the

customer-level source of such knowledge is “key” to the use of essential knowledge by the small to medium enterprise (SME) within the supply chain.

3 The AIA EEIC Approach

When the AIA’s Electronic Enterprise Integration Committee (EEIC) considered the original problem of workforce knowledge retention, it rapidly became apparent that it formed just one part of the overall consideration of knowledge management in an enterprise, with the proposed solution components offering additional business benefits beyond the original problem statement. In particular, there were considerable similarities with the requirements for preservation of information for purposes such as eDiscovery, and interrelationships with other data capture and management requirements. In order to avoid generating an expensive isolated solution, the EEIC therefore embarked on the preparation of a holistic view of knowledge management covering the key processes of knowledge capture, management, use and preservation, and the critical information flows between them. This global model of knowledge management processes (see section 5) provides an authoritative overview within which particular business scenarios can be identified, and the common components and information flows between scenarios can be recognized.

Section 6 of these guidelines contains four representative scenarios:

- Capture – Retaining Intellectual Capital
- Use – Discovering Field Failure Trends
- Manage – Managing Electronic Knowledge
- Preserve – Preserving Knowledge / eDiscovery Process

For each of the scenarios, the EEIC has developed detailed descriptions of the processes, actors, information flows, triggers and expected outcomes as the basis of identifying the necessary components and best practice to provide a workable solution. Each of the four representative scenarios is linked to the four main blocks of the quad chart and the associated icons shown in Figure 3 of Section 5.

4 Using These Guidelines

The standard EEIC approach is to document business scenarios and then to identify suitable components from the available business processes, standards and frameworks in order to produce solutions. These guidelines are designed to support the four representative scenarios, as well as the addition of further scenarios as they are identified within the overall model. They will help organizations identify topics and issues that should be considered as they define their requirements for Electronic Knowledge Management solutions. The following roadmap should assist the reader in understanding the overall framework described in section 5 and the individual use-case scenarios outlined in section 6, which in turn link to the approved AIA eBusiness guidelines that may be relevant to a particular scenario.

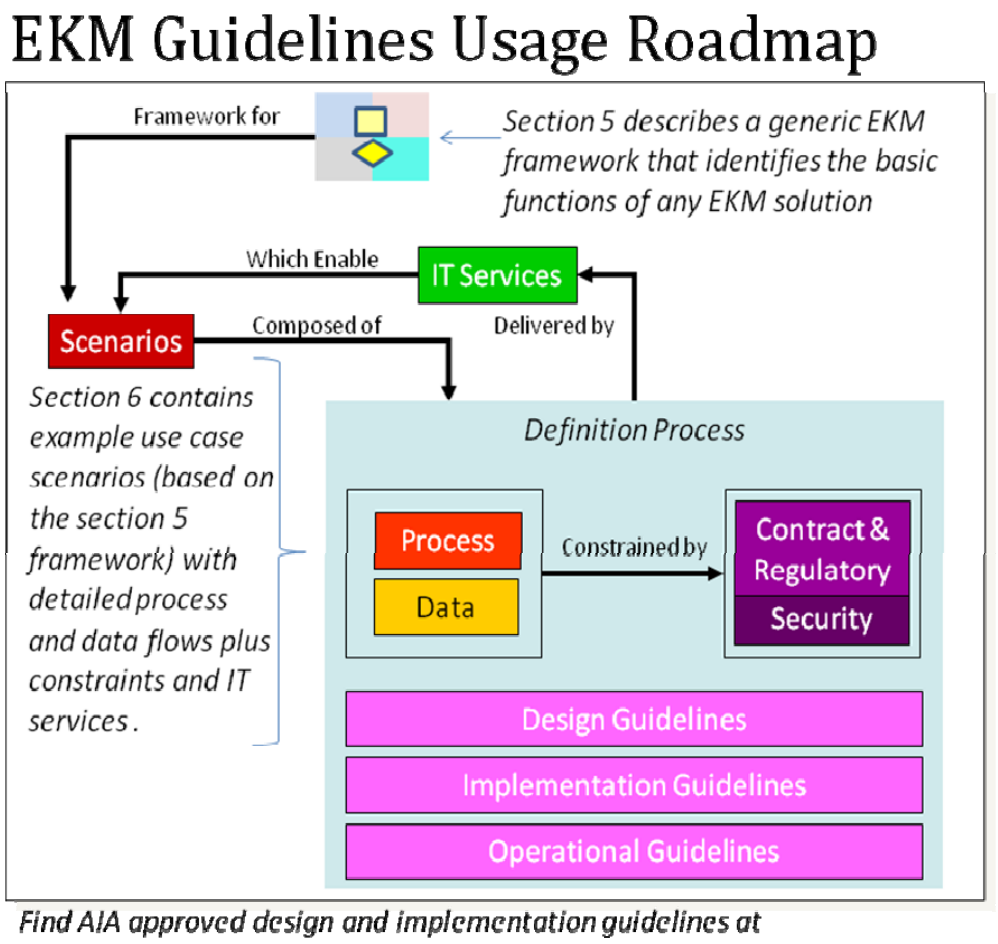


Figure 2 EKM Guidelines Usage Roadmap

The four representative use-case scenarios may be directly applicable to the requirements of the organization. The use-case scenario descriptions allow the organization to confirm that their requirements are covered, and hence that the recommendations and best practices can be applied.

For scenarios that are not covered by the four examples, organizations should develop their own use-case scenarios, using the same format as the examples, and selecting the processes and flows from the global model of Knowledge Management Processes in Section 5 wherever possible. This is in line with the EEIC concept of operations (see Appendix A). Using the global model will allow the relevant best practices to be identified and used in building solutions.

5 Knowledge Management Processes

The following knowledge management process descriptors and associated definitions identify Electronic Knowledge Management guidelines that correlate to Figure 3 and that are illustrated in greater detail by the example scenarios in Section 6.

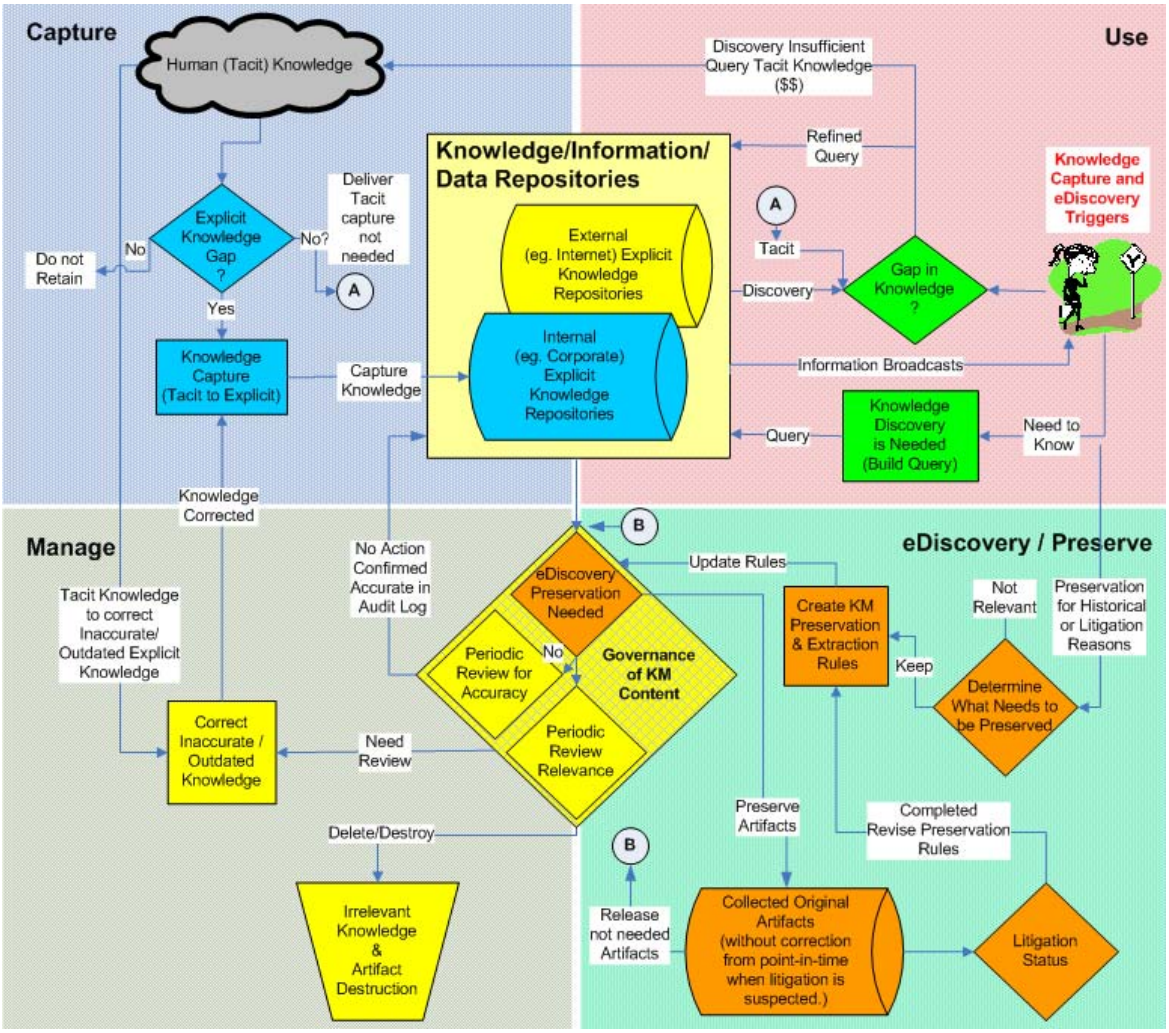


Figure 3 Knowledge Management and eDiscovery Processes

5.1 CAPTURE

5.1.1 Human (Tacit) Knowledge

Tacit Knowledge Definition: Tacit knowledge is the knowledge that is in people's heads based on their life experiences.

Life experiences that can contribute toward tacit knowledge may include but are not limited to:

- Formal education
  - All activities associated with the educational system from grade school through higher education
  - Technical and professional training
- Informal education
  - The lifelong process whereby every individual acquires attitudes, values, skills and knowledge from daily experience
  - Environmental influences from family and neighbors, from work and play, from the market place, the library, Internet, and the mass media

5.1.2 Explicit Knowledge Gap

Explicit Knowledge Definition: Explicit knowledge is knowledge that has been articulated, codified, and stored where it is available to others.

Explicit Knowledge Gap Definition: An explicit knowledge gap exists when a person or organization is unable to discover explicit information or knowledge needed to accomplish a task.

A person or organization can determine that an explicit knowledge gap exists when any of the following events occur (not intended to be an exhaustive list):

- Person wants to share knowledge that has not been explicitly captured
  - The person plans to retire or change jobs
  - The person will be unavailable in the near future
- Others recognize a person’s expertise that needs to be more widely shared and has not been explicitly captured
  - The person plans to retire or change jobs
  - The person will be unavailable in the near future
- Unplanned need
  - New contract requirements
  - Departure of critical person(s)
  - Loss of a knowledge capture system(s)
  - Legal requirements
  - Natural disaster

5.1.3 Knowledge Capture (Tacit to Explicit Knowledge)

Knowledge Capture Definition: Knowledge capture is the process of converting tacit knowledge to explicit knowledge. It is a best practice for this

process to be continuous and supported by effective training and mentoring, but additional capture requirements may be highlighted by events such as those above.

5.1.3.1 Methods for Capturing Tacit Knowledge and Converting to Explicit Knowledge in an Electronically Searchable Form

- Subject matter expert(s) publishing:
  - Presentation training sessions with notes
  - Wiki pages
  - Mentoring process and information exchange
  - Brainstorming sessions with consensus decisions
  - Books
  - Papers
  - Media articles
  - Process and data flow diagrams
- Interviewing the subject matter experts and electronically capturing the question and answer interchange
- Video and/or audio recording subject matter expert's presentations or specific events and activities while performing the job
- Creating training courses that are self-paced
- Publishing minutes and/transcripts of decision-making meetings

5.1.4 Knowledge / Information / Data Repositories

Knowledge / Information / Data Repository Definition: A knowledge / information / data repository is the component of an enterprise's knowledge management system where knowledge is developed, stored, organized, processed, and available for search and retrieval. A knowledge repository stores and manages captured data, information, and knowledge that help an enterprise leverage these intellectual assets. Knowledge / Information / Data Repositories may be external to the enterprise such as Internet-based information They can also be internal to the enterprise and specifically designed to host information that cannot be shared beyond the enterprise. The form of the data, information, or knowledge may be structured or un-structured; however, user friendly metadata is essential for successful discovery and retrieval.

Structured Data Definition: Data that resides in predefined fields within a record or file (typically stored within a database).

Unstructured Data Definition: Information stored as text or rich media objects. Examples of un-structured data include but are not limited to: a word processing document, graphics rich briefing, audio file, or email content.

Metadata Definition: Information covering who, what, when, why, where, and how associated with a unit of information or data. Effective metadata enables

both computers and people to organize and discover information and data. Metadata add context and therefore enables people to better understand the meaning of the information or data content.

5.2 USE

5.2.1 Knowledge Discovery is Needed (Build Query)

This step is initiated based on a triggering event that requires acquisition of knowledge. Knowledge can be acquired via pull and/or push methods.

Pull Method Definition: The pull method requires the person seeking knowledge to initiate the effort to discover the applicable data or information from the Knowledge/Information/Data Repositories.

Push Method Definition: The push method is initiated by a third party (someone other than the person seeking knowledge) resulting in the unsolicited receipt of the information. An example is a broadcast email announcing an emergency condition or a subject of interest to the person.

5.2.1.1 Pull Discovery Process

- Metadata provides the essential understanding of the data which enables the person to select the appropriate criteria for discovering the knowledge with minimal effort. The selected criteria determine the rules to build a query against the repositories.
- The query executes the defined rules against the Knowledge/Information/Data Repositories.
- A search engine is a specialized query tool that optimizes the search and retrieval of information from the Knowledge/Information/Data Repositories based on keyword criteria.
- A repository user interface provides common indexing across all accessible Knowledge/Information/Data Repositories and enhances the search process.
- Navigation is an interactive drill-down process that improves the search criteria to refine the query results. This process is repeated until the appropriate knowledge is discovered or a gap is identified.

5.2.1.2 Push – Information Broadcasts

- Information Broadcast Examples:
  - E-Mail – person-to-person exchange of information
  - Subscription – a specialized email service where the person subscribes to receive email broadcasts
  - List Service – a specialized email service that allows a single email address to broadcast email to a large number of targeted recipients

    - Really Simple Syndication (RSS) feeds – a browser or RSS reader configured to receive information from specific websites pre-determined by the user to be of interest
- The following are examples of the type of content a person might receive in a push - information broadcast:
    - Lessons Learned
    - Procedures
    - Rules
    - Regulations
    - Instructions
    - Emergency Conditions
    - Conference Announcements
    - Industry Specific News Items
    - Subject of Interest Announcements

5.2.2 Sufficient Knowledge to Act

Based on knowledge retrieved or discovered; no gap in knowledge exists. This step assumes that sufficient knowledge has been acquired to satisfy the triggering event.

5.2.3 Discovery Insufficient – Query Tacit Knowledge

- Query Tacit Knowledge – see Capture Process (5.1)
- Once Tacit Knowledge is discovered, it may be used, but may or may not be captured.
- Return to the Use Process (5.2) with the discovered knowledge.

5.3 MANAGE

5.3.1 Electronic Knowledge Management and Governance

This section describes the rule set that governs management of knowledge held as ESI. This rule set will be determined by company records management (Information and/or Data Management) policies and procedures which are heavily influenced by:

- Governmental legal rulings and law
- Contractual obligations
- Security and information protection requirements
- Information technology capability, resources and costs
- Facilities storage capacities

Procedural Considerations:

- Frequency of review will be defined by company records management policies and procedures
- Data Stewards manage information and data across the enterprise, while ensuring high levels of information and data availability. These individuals are responsible for activities such as standardizing data

naming, establishing consistent data definitions, and monitoring overall data quality.

- A business process is a collection of related, structured activities or tasks that produce a specific product or service which serves customer(s) goals. A Business Process Owner owns the design of the business process.
- Governance
  - Assigning Roles
    - Data Stewards
    - Librarians
    - Custodians
    - Data Owners
    - Process Owners
    - Process Facilitators
  - Retention Control
  - Access Control
    - Who Has Privileges?
    - What are the Privileges?
  - Reports (feedback loops)
- Repository Management

5.3.1.1 eDiscovery Preservation Needed

- Preservation Rule
- No Requirement to Preserve
- Delete (Digital)
- Destroy (Physical and Digital)
- No Action Required – Continue To Maintain
- Hint of Litigation
- Remove Preservation Rule

5.3.1.2 Periodic Review for Accuracy

- Review for Accuracy

5.3.1.3 Periodic Review for Relevancy

- Review for Relevancy

5.3.2 Correct Inaccurate / Outdated Knowledge

- Tacit Knowledge to Correct and/or Update Explicit Knowledge
- Currency and Accuracy of Knowledge
- Relevancy
- Corrected Knowledge by the Creator
- Configuration Management of copies

5.3.3 Irrelevant Knowledge and Artifact Destruction

- Deletion of Erasable Memory

- Destruction of Physical Media
- Destruction of originals and copies

5.4 eDISCOVERY / PRESERVE

eDiscovery Definition: eDiscovery (also called electronic discovery) refers to any process in which electronic data is sought, located, secured, and searched with the intent of using it as evidence in a civil or criminal legal case. This is an extension of the traditional use of the term "Discovery" for the initial phase of litigation where the parties in a dispute are required to provide each other relevant information and records, along with all other evidence related to the case. In 2006 amendments to the US Federal Rules of Civil Procedure codified the requirement to provide electronic information and records, referred to as electronically stored information (ESI). eDiscovery applies to all information and records created and stored in electronic form, typically held within the enterprise in an unstructured or structured format on network drives, personal computers and PDAs, including but not limited to the following:

- Text documents
- Spreadsheets
- Databases
- Email
- Calendars
- Audio and video
- Websites
- Web 2.0 Social Networking Technologies
  - Wikis
  - Blogs
  - Spaces
- Computer software

Note: Outsourcing of IT services means that information considered to be internal to the organization is now held externally introducing additional risks with regards to the eDiscovery/Preserve process. The risk of Software as a Service (SaaS), Cloud Computing, and external services within a Service Oriented Architecture (SOA) managed external to the enterprise will require additional and alternative management protocols.

5.4.1 Determine What Needs to be Preserved

- Select Artifacts that Require Preservation
- Identify categories of structured and unstructured data that must be preserved to support business needs for purposes of:
  - Regulatory
  - Contractual
  - Historical
  - eDiscovery
  - Other

5.4.2 Create Knowledge Management Preservation & Extraction Rules

- Standard rules for the review, preservation, extraction (reporting), and destruction to support business needs are required. Destruction rules will be overridden as needed for specific eDiscovery situations mitigating the risk of litigation for spoliation of evidence.
- **Spoliation of Evidence Definition:** The intentional or negligent withholding, hiding, alteration or destruction of evidence relevant to a legal proceeding.

5.4.3 Preserve Original Artifacts

- Capture and preserve artifacts that are subject to litigation without amendment from point-in-time when litigation is suspected. This prevents inadvertent spoliation of evidence due to normal information update processes and procedures.

5.4.4 Respond to Litigation Status Change

- Based on any change in the status of relevant litigation, the rules for preservation are changed so that future retention reviews do not cause documents relevant to the specific litigation to be preserved unnecessarily.
- Requires capability to amend and restore rules for preservation as needed.
- Also need to trigger removal of unwanted documents from the repository.

5.5 Knowledge Capture and eDiscovery Triggers

5.5.1 Capture

- A person's knowledge is recognized by the organization
- A person is leaving the organization
- A Subject Matter Expert is changing position or location within the organization

5.5.2 Use

- A decision requires additional information

5.5.3 Manage

- A retention and review period is expiring
- There is an inquiry regarding relevancy and or accuracy of an artifact

5.5.4 Preserve

- There is a hint of litigation

- Through either receipt of court documents or other form of communication the legal community is made cognizant of the potential litigation and initiates action(s) appropriate to the situation

5.6 Recommended approaches to implementing IT Services for Electronic Knowledge Management and eDiscovery

This section outlines recommended approaches to the four main processes within the framework of Electronic Knowledge Management.

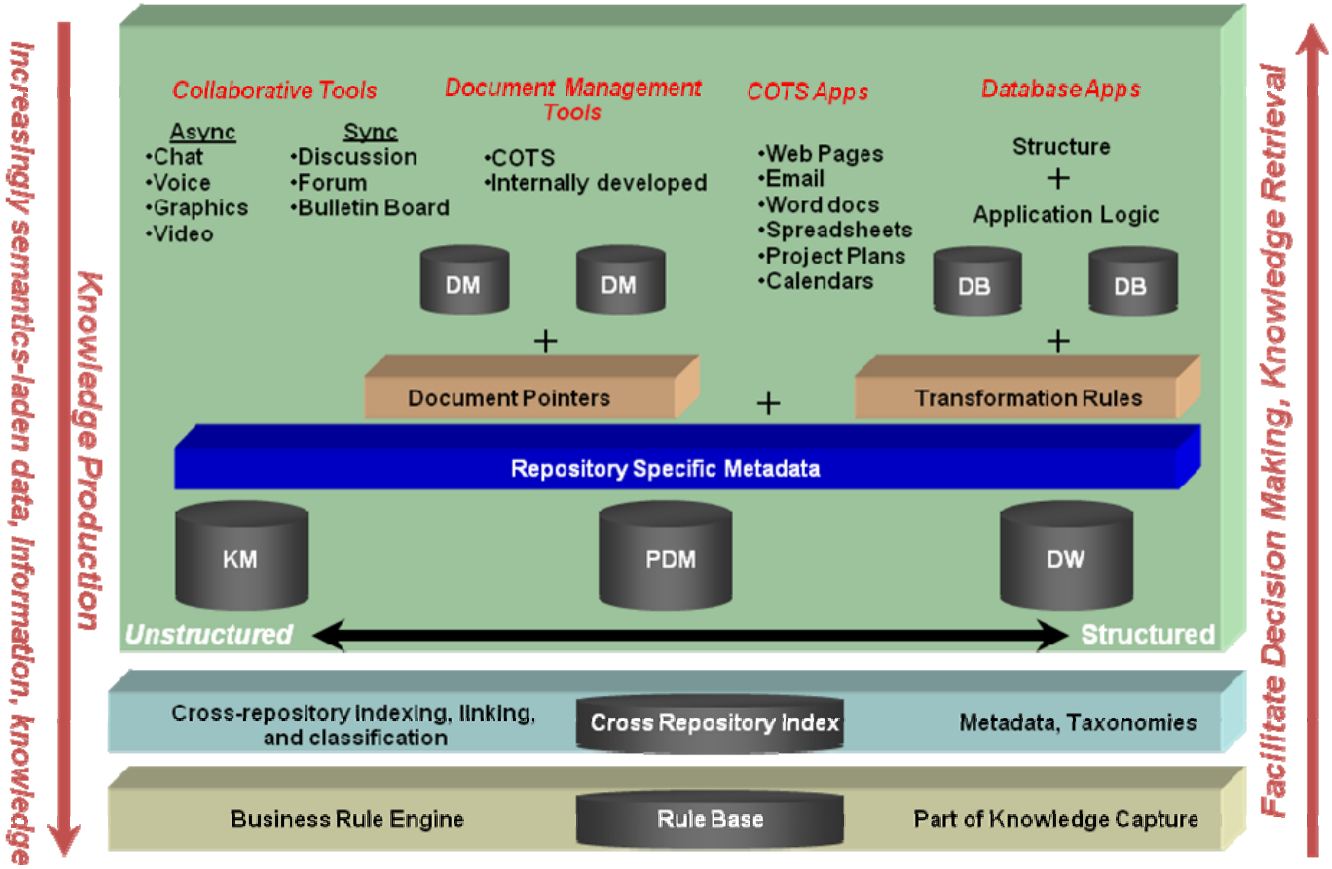


Figure 4 IT Services Landscape

5.6.1 Capture

- The large enterprise (e.g. Aerospace and Defense OEM, Prime Contractor, Large Integrator)
  - Capturing tacit knowledge tends to involve interactive dialogue and documentation. Occasionally, these are recorded using media services and technologies. IT services for managing these objects would be implemented in existing enterprise scale management systems for:

        - Electronic Document Management (EDM)
        - Master Data Management
        - Metadata Management
        - Electronic Content Management (ECM)
        - Knowledge Management Repositories
    - Recent maturing collaborative and social media tools, collectively known as Web 2.0 (or Enterprise 2.0) technologies allow for the dynamic and interactive collection of tacit knowledge using wiki services. It is suggested that these be part of the long term path to making tacit knowledge explicit.
- The small to medium size enterprise (SME)
    - Regardless of the size of a business, processes and procedures for managing electronic documents (and media) should be in place. It is expected that basic office, business, and technical applications are used to capture knowledge.
    - The IT services that support these processes will vary, but at a minimum should include the capability to capture and securely store the information in an organized manner.
    - These should be accessible to those responsible for configuration and document management (CM/DM), whether manual or automated.

5.6.2 Use

- The large enterprise
    - Use of knowledge systems is largely accomplished by “pull” technologies such as search engines or navigation practices (as opposed to “push” which includes IT services such as e-mail or Really Simple Syndication (RSS) information feeds).
    - Pulling information typically requires knowing how to navigate the schemes used to store the documents in file structures or taxonomies. If the user is unfamiliar with this structure, or doesn’t know the location, or whether the source exists; the alternative method is to query those repositories with an automated search.
        - Query of structured sources (eg. Relational Databases (DBs) is typically done by SQL query using client/server technology or Business Intelligence (BI) / Data Warehouse (DW) technologies from the browser.
        - Query of unstructured “documents” or media objects may be accomplished by comprehensive enterprise scale search engine(s). These are typically browser based text queries initiated on data “crawled and indexed” from across the enterprise.
    - Wiki technology does provide searchable content within the wiki based on words and metadata tags.
- The small to medium size enterprise (SME)

- Systematic query of explicit information sources is more problematic for the SME. Even with affordable or even Free / Open Source Software (FOSS), building automated systems that are easy to use may be beyond the reach of the organization.
- Desktop search tools can be used to provide no/low cost capability for knowledge discovery.
- It is critical to have well organized and rigorously managed structures and procedures for storing and finding relevant documents and media.
- Documentation of the structures (taxonomies) for storing and locating information should be in the form of metadata, keywords and/or tags for the subject matter being collected.
- Access is typically from shared file directories and/or web browsers if Commercial, off-the-shelf (COTS) EDM/ECM systems are not available.
- Support from an SME's customers in making important knowledge accessible is a key feature of knowledge use in the extended enterprise.

5.6.3 Manage

- The large enterprise
  - As mentioned above, the use of EDM/ECM systems is recommended for the efficient large scale storage of enterprise knowledge objects (documents and media).
- The small to medium size enterprise (SME)
  - More manual methods for the SME may be required due to the potential cost and IT infrastructure resources needed.
  - Managing knowledge within the supply chain at the SME level is often dependent on the relationship between the SME and its customer, because the ultimate product or service to be delivered is frequently a factor of the customer's knowledge, imbedded in the product or service requirements. It for this reason that the methods and tools associated with use of knowledge by the SME are fundamental to effective business operations.

5.6.4 Preserve

- The large enterprise
  - Long Term Archive and Storage (LOTAR) strategies are critical for the large enterprise. These include data backup, offsite storage, and data migration strategies.
  - The volumes of information to be stored for the life of the company, the products, or the litigation hold rules can be burdensome. Outsourcing this to reliable service providers can

relieve some of the burden (but not the cost) of this non-core activity.

- The small to medium size enterprise (SME)
  - Backup and secure offsite storage of critical information is a must for the SME. Ensuring this requires developing and following reliable and secure backup procedures.
  - Storing content on “spinning disk” is convenient and can be cost effective.

6 Business Scenario Description

A business scenario defines a required capability in terms of process, information flow, IT services, with commercial, legal or other constraints. The diagram in Figure 3 and subsequent model described in Section 5 provide an integrated framework view of many scenarios for Electronic Knowledge Management and eDiscovery. This section provides a representative set of scenarios.

6.1 “Capture” Use-Case Scenario - Title: “Retaining Intellectual Capital”

6.1.1 Description

This “Capture” Use-Case scenario is summarized by the following exclamation and associated question that highlights a major problem across the aerospace industry. **“We’re losing people in our workforce at a rate that far exceeds our replacement rate!! How can an organization capture and make available the knowledge from employees while they are still part of the workforce?”** This problem has implications for Human Resources, retention of Intellectual Property and sustainment of Engineering capability.

This scenario highlights the key processes for capturing tacit knowledge from individuals and converting it to an explicit form before the knowledge leaves the workforce.

6.1.2 Justification

According to AIA report titled “Aerospace Workforce Renewal”, “… **Our nation’s greatest aerospace challenge for the next decade or two** … begins with the critical fact that 27 percent of America’s aerospace technical workforce will be eligible to retire by the end of 2008. That number isn’t an anomaly - it represents a wave of retirements that began in recent years with the crest to come in years ahead”.

In order to sustain the capability of the industry, the knowledge of retiring employees will need to be transferred to the entire workforce in a timely and efficient manner.

Amplifying the issue is a retiring workforce that exceeds the pool of incoming qualified replacements. For example, in 2008 just one of AIA's 280 plus member companies expects to hire 50,000 engineers over the next five years and the engineering school pipeline is expected to graduate only 44,000 per year for all of America's high tech industries. This means that approximately 25% of the graduating qualified engineers per year are needed and could be absorbed by just one company. There are many other industries and organizations that pull from the same pool of graduates.

Efforts are underway to increase the number pre-collegiate students interested in Science, Technology, Engineering and Mathematics (STEM). This scenario addresses the deficit of retirement to influx of new qualified workers. Therefore, the tacit knowledge that was captured needs to be available to a workforce expected to replace an even greater number of retirees.

6.1.3 Scenario Initiation – Who or What Starts It?

An employee who is a Subject Matter Expert becomes eligible for retirement. The organization recognizes the need to capture the knowledge which that employee possesses.

6.1.4 Sequence of Events within activity – "Swim Lanes"

- The HR system provides report to employee's manager that the employee will soon be eligible for retirement.
- Employee and manager determine that employee's critical knowledge needs to be captured. Together they develop an Employee Knowledge Capture Plan (EKCP) to ensure that the knowledge is in re-usable electronic form.
- Manager determines that it is cost effective to capture the employee's tacit knowledge electronically.
- The following is an example of one portion of the plan.
    - Manager asks employee to develop series of presentations training material (with speaker notes) and arranges for lunch-and-learn training sessions.
    - Employee develops training material and adds applicable metadata to the presentation files to enhance discoverability within the EKM system.
    - The EKM system extracts the additional metadata from the presentations.
    - Employee conducts lunch-and-learn training sessions to facilitate tacit knowledge transfer to other employees.
    - Lunch-and-learn sessions are video recorded.

- Video material has additional EKM metadata added to enhance discoverability.

- In general, all electronic information stored in the EKM has the necessary metadata added to enhance discoverability within the EKM system.

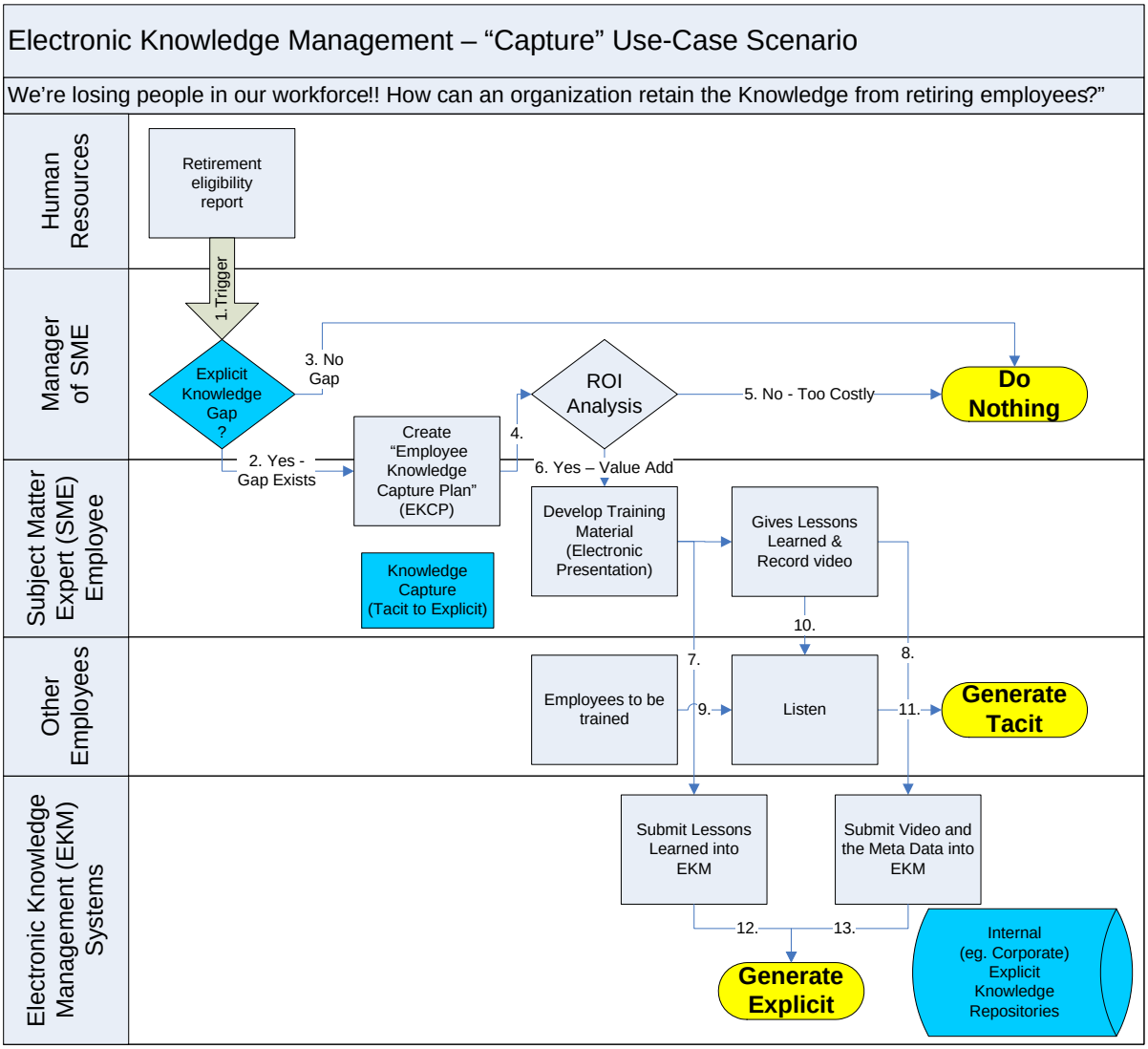


Figure 5 "Capture" Use-Case Scenario

6.1.5 Actors – Roles of Participants

- Manager of SME Employee
- Human Resources (HR)
- SME Employee – who will soon be eligible to retire
- Other Employees – those receiving training
- EKM Systems

6.1.6 Controls – External Influences / Constraints

- Information security policies
- Business culture of sharing vs. protecting information
- Costs associated with labor and EKM system
- Employee availability and willingness to participate
- Incomplete ability to accurately capture some forms of knowledge

6.1.7 Internal Decision Points

- Does an explicit knowledge gap exist?
  - Yes – make knowledge capture decision
  - Decide on knowledge capture methods (EKCP)
    - Make cost effectiveness decision (ROI)
    - Decide on knowledge capture timing

6.1.8 Information Flows

1. Trigger - Retirement eligibility report identifies employee and potential effective date
2. Gap exists, description of the knowledge gap
3. No Gap, do nothing
4. Plan detail for cost, schedule, resources (employee, trainees), methods.
5. Not cost effective, do nothing
6. Budget, schedule and tasking to develop training material
7. Training material
8. Video recording of training
9. List of employees that need training
10. Live training
11. Tacit knowledge
12. Explicit content - Training material
13. Explicit content - Video recording of training

6.1.9 Scenario Results – Range Of Possible Outcomes And Output

6.1.9.1 Do Nothing

- Knowledge Lost
- Cost to Regain
- Risk to Organization

6.1.9.2 Do Something

6.1.9.2.1 Use Tacit Knowledge Transfer

- Knowledge is captured
- Such capture is temporary and may need to be repeated
- Some knowledge degradation is to be expected
- Quantifiable costs

- Better and more informed decisions become possible by the mentee (one who is mentored)

6.1.9.2.2 Use Explicit Electronic Knowledge Capture

- Knowledge is permanently captured
- Costs to capture and maintain are considerable and not easily quantified
- More easily shared
- Better and more informed decisions become possible by all within the organization

6.1.10 Exception Handling

- Not applicable to this scenario

6.1.11 Performance Requirements/Service Level Agreements

- Not applicable to this scenario

6.2 "Use" Use-Case Scenario - Title: "Discovering Field Failure Trends"

6.2.1 Description

This scenario provides a specific example of the generic "Use" Use-Case and illustrates a situation where a product failure in the field results in the need to gather relevant structured and unstructured knowledge previously captured, and to analyze the results to determine failure trends of the system.

6.2.2 Justification

The purpose of this scenario is to describe the process for using EKM to improve reliability and availability of systems by early identification of failure trends. An analysis is performed of electronic information and data that can be used to determine trends of system or component failures and lead to reliability and performance improvements.

An example of this need is illustrated in the Program Key Performance Parameters and requirements typically specified by the OSD. There is also an internal need for the support of Performance-Based Logistics (PBL) in contracts to strive for cost reductions and reliability and performance improvements.

6.2.3 Scenario initiation – who or what starts it?

Additional information required to make a decision to improve system reliability and availability. In response to the OSD Memo there is a need to analyze, document and report KPPs and Knowledge, Skill, Ability (KSA) related to reliability and availability for a deployed operational system.

6.2.4 Sequence of events within activity – "swim lanes"

- The Office of the Secretary of Defense OSD issues Memo policy regarding Key Performance Parameters (KPP) metrics affecting Defense Program contracts to Program Management Offices.
- The Program Management Offices:
  - Interpret the KPP Memo
  - Define the KPP data requirements
  - Ensure the availability of the data from applicable parties
  - Task the Responsible Engineering Authority (REA) to report on fielded subsystem's KPPs that were designed by the REA
  - For this scenario, the REA determined that there is Knowledge Gap.
- The REA queries the Explicit Knowledge/Information/Data (Internal/External) repositories to determine missing data and who the responsible parties are for capturing that data.
- REA submits a Tacit Knowledge Query to the Subject Matter Experts (SME) within the Contractor Quality Data Steward Organization.
- SME(s) queries the Explicit Knowledge/Information/Data (Internal/External) repositories to determine missing data and who the responsible party (or parties) is for capturing that data.
- Have the applicable party (or parties) capture the missing data within the applicable registry or repository:
  - Contractor Registry of system performance
  - Customer Registry of system performance
  - Repositories of Engineering and Material data

6.2.5 Actors – Roles of Participants

- Program Management Offices
- Responsible Engineering Authority (REA)
- Contractor Quality Data Steward for KPP
- Customer Quality Data Steward
- Contractor Registry of System Performance Data (Internal)
- Customer Registry of System Performance Data (External)
- Repositories of Engineering and Material data
- Knowledge Repositories of Alumni Knowledge

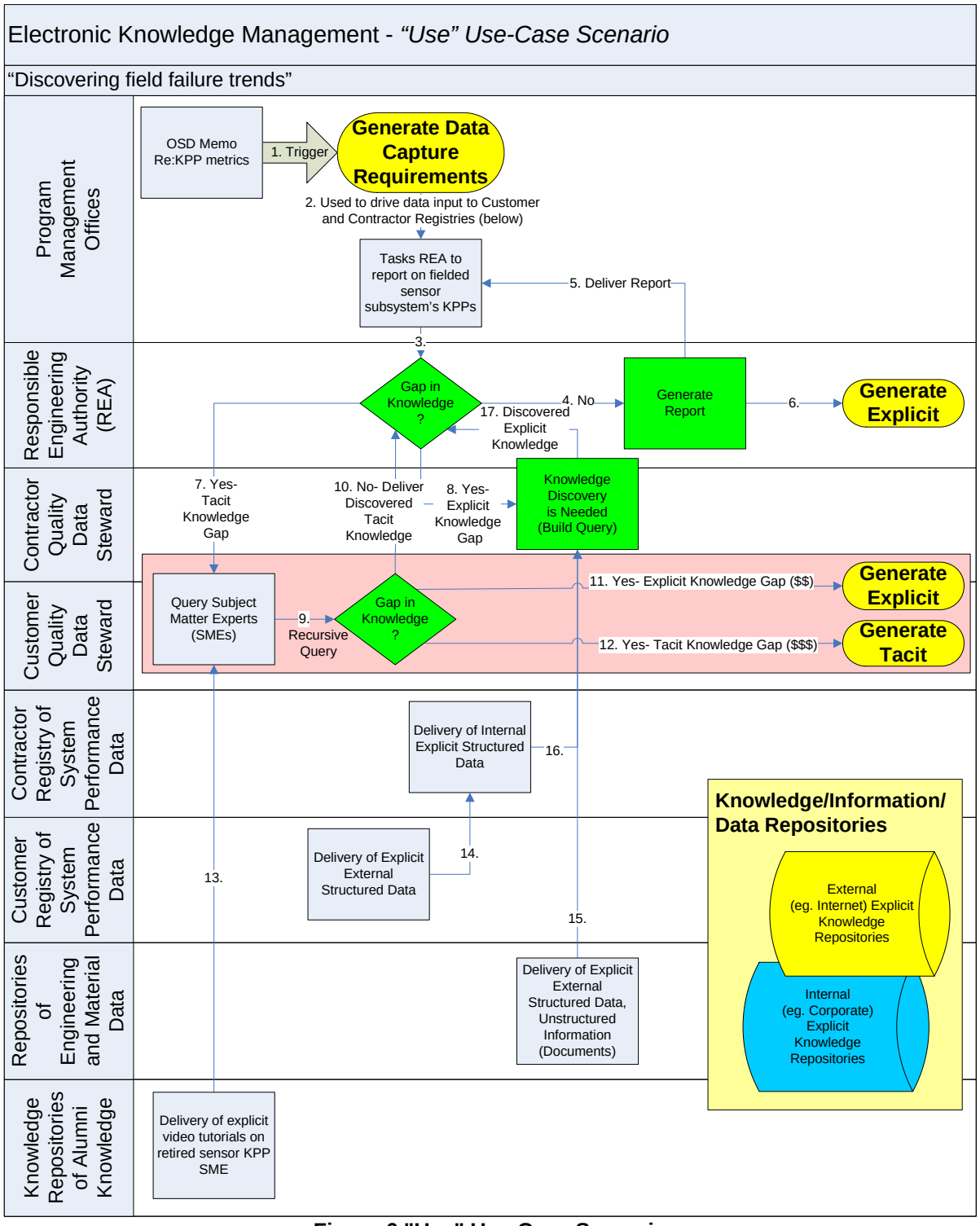


Figure 6 "Use" Use-Case Scenario

6.2.6 Controls – External Influences/Constraints

- Information security policies
  - Accessibility and availability to Data in Customer/Supplier system
- Business culture?
  - Customer/Supplier willingness to participate
- Contract
- Costs associated with Life-cycle support and EKM system
- Accuracy of data capture by the customer
- Reference Use-Case Scenario 4 “Preserving Knowledge / eDiscovery Process”
- Currency, accuracy, completeness and ability to understand the data captured
- Incomplete ability to accurately capture some forms of data

6.2.7 Internal Decision Points

- Describe individual arrows (information) and the EKM system
- Tacit Knowledge Gap
- Knowledge Discovery Needed
- Explicit Knowledge Gap
- Sufficient Knowledge to Act

6.2.8 Information Flows

1. Trigger - OSD Memo that requires KPP metrics
2. KPP metric data capture requirements
3. Definition of the task to generate KPP analysis report
4. No gap in REA knowledge for report generation
5. Report delivery
6. Explicit report
7. Yes – Tacit knowledge gap. Definition of task for SME to deliver needed tacit information
8. Yes – Explicit knowledge gap. Definition of task for SME to deliver needed explicit information
9. Information regarding SME’s tacit information gap
10. No tacit knowledge gap. Deliver needed information
11. Yes – explicit knowledge gap. Information needed to generate more knowledge
12. Yes – tacit knowledge gap. Information needed to generate more knowledge
13. Explicit knowledge from query
14. Explicit knowledge from query
15. Explicit knowledge from query
16. Explicit knowledge from query
17. Needed explicit knowledge discovered for report

6.2.9 Scenario Results – Range Of Possible Outcomes And Output

- Report on KPP metric analysis
- Possible new tacit or explicit knowledge
- Possible new data capture requirements

6.2.10 Exception Handling

- Not applicable to this example scenario

6.2.11 Performance Requirements/Service Level Agreements

- Not applicable to this scenario

6.3 "Manage" Use-Case Scenario - Title: "Managing Electronic Knowledge"

6.3.1 Description

This "Manage" Use-Case Scenario illustrates the processes and components necessary for managing the accuracy, currency, and relevance of electronic knowledge and ensuring its long-term archival and retention. Company records management policies and procedures are an integral part of this scenario.

6.3.2 Justification

In order to maintain over time the accuracy and relevance of electronic knowledge, it is important to adopt best practices for the preservation, governance, and destruction of information that is in electronic form.

Ensuring accuracy and relevance will serve to improve the efficiency of knowledge discovery. The effective implementation of preservation and destruction policies will serve to control storage requirements for EKM.

Preservation will need to include consideration of any changes to information systems and the ability to recover data generated by systems that may no longer be available. The AIA/ASD **LOng Term Archival & Retrieval (LOTAR)** is one project that is addressing this challenge for engineering information.

6.3.3 Scenario initiation – who or what starts it?

Managing electronic knowledge is an ongoing activity, but certain aspects of it are triggered by:

- A discovered flaw or issue with electronic knowledge
- A scheduled periodic reviews for accuracy and relevance
- An unscheduled event, such as an eDiscovery requirement

In the context of this scenario, a flaw was discovered in the accuracy of the captured system failure data. The failure was due to a faulty sensor on the system causing key performance parameters to be out of tolerance.

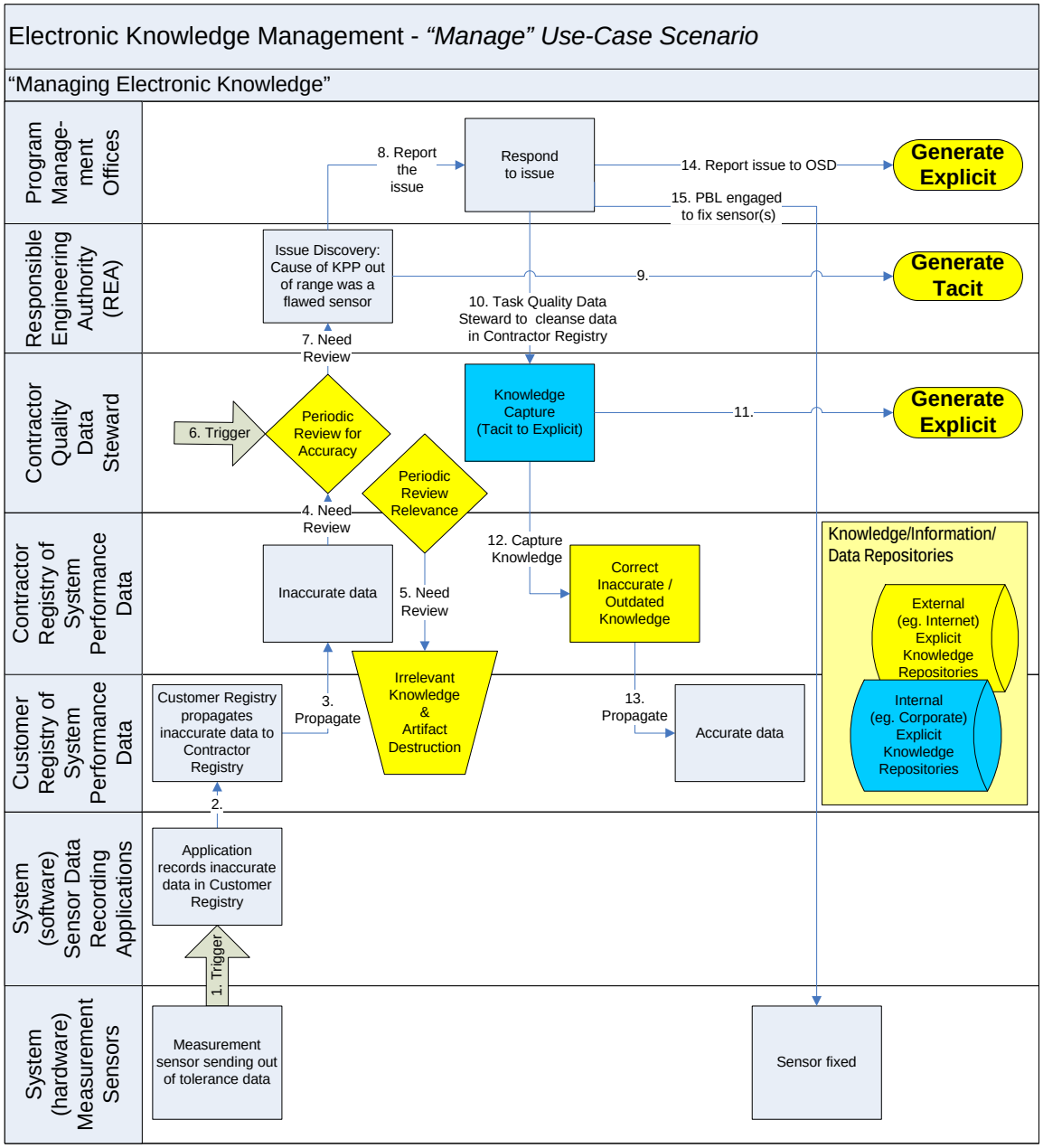


Figure 7 "Manage" Use-Case Scenario

6.3.4 Sequence of events within activity – "swim lanes"

- The System (hardware) Measurement Sensor is out of tolerance resulting in inaccurate data recorded in the Customer Registry of system performance data.
- Inaccurate data was passed from the Customer Registry to the Contractor Registry.

- During analysis of the data, the Responsible Engineering Authority (REA) discovered the issue and determines that the cause was a flawed sensor.
- The REA reports the issue to the Program Management Office.
- The Program Management Office takes the appropriate actions, some of which include informing the customer that the sensor must be replaced and inform the Data Quality Steward that inaccurate data needs to be cleansed.
- The Data Quality Steward coordinates with the Customer and Contractor(s) to ensure that all repositories are cleansed.

6.3.5 Actors – Roles of Participants

- Program Management Offices
- Responsible Engineering Authority (REA)
- Contractor Quality Data Steward for KPP
- Contractor Registry of System Performance Data (Internal)
- Customer Registry of System Performance Data (External)
- System (software) Sensor Data Recording Application
- System (hardware) Measurement Sensors

6.3.6 Controls – External Influences / Constraints

- Governmental legal rulings and law
- Contractual obligations
- Company records management policies and procedures
- Security and information protection requirements
- Information technology capability, resources and costs
- Facilities storage capacities

6.3.7 Internal Decision Points

- Review for accuracy and relevance

6.3.8 Information Flows

1. Trigger – Bad data from sensor
2. Bad data propagated from recording system to customer registry
3. Bad data propagated from customer to contractor registry
4. Need to perform periodic review flag
5. Need to perform periodic review flag
6. Trigger – Perform review
7. Realization of bad data in registry
8. Realization of bad data in registry report
9. Realization of bad data in registry
10. Task detail for Data Quality Steward to cleanse bad data
11. Information needed to cleanse data
12. Information needed to cleanse data
13. Information needed to cleanse data
14. Report of issue to OSD

15. Task detail for fixing sensor sending bad data

6.3.9 Scenario Results – Range Of Possible Outcomes And Output

- Full compliance
- Associated risks for lack of full compliance

6.3.10 Exception Handling

- Not applicable to this example scenario

6.3.11 Performance Requirements / Service Level Agreements

- Not applicable to this scenario

6.4 "eDiscovery / Preserve" Use-Case Scenario - Title: "Preserving Knowledge / eDiscovery Process"

6.4.1 Description

This scenario provides a specific example of the generic "eDiscovery / Preserve" Use-Case and illustrates a situation where the discovery of an alleged counterfeit sensor results in the need to adjust the preservation controls associated with relevant electronic information, and the eDiscovery legal implications of such an event.

6.4.2 Justification

The purpose of this scenario is to describe the process for using EKM to respond properly to legal requirements regarding the preservation of electronic knowledge that is relevant to litigation. It is important to adopt best practices for the preservation, governance, and destruction of such data, in order to avoid unnecessary risks, legal costs and penalties.

6.4.3 Scenario Initiation – who or what starts it?

Managing electronic knowledge is an ongoing activity, but certain aspects of it are triggered by:

- A discovered flaw or issue with electronic knowledge
- A scheduled periodic reviews for accuracy and relevance
- An unscheduled event, such as an eDiscovery requirement

In the course of fixing it, the sensor was suspected of being counterfeit. The assumption was reported and appropriate action was taken to test and then remove the part. Legal review and action was required to evaluate the preservation process to incorporate possible new scenarios into rules that govern the preservation process.

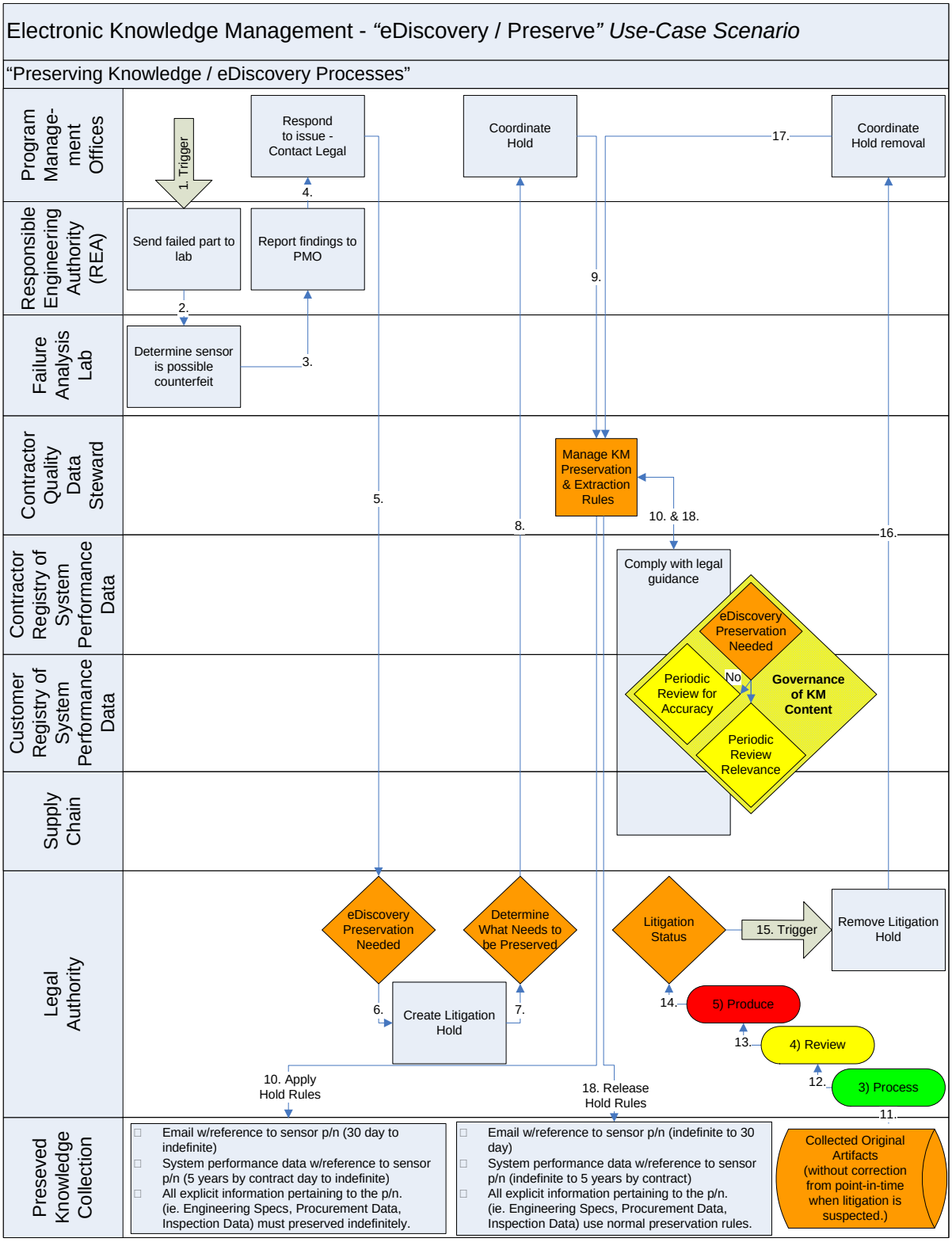


Figure 8 "eDiscovery / Preserve" Use-Case Scenario

6.4.4 Sequence of events within activity – "Responsibility Diagram"

- The REA decides that the (out-of-tolerance) System (Hardware) Measurement Sensor must be analyzed to establish true design.
- Lab analysis determines that the Measurement Sensor is potentially counterfeit. The Lab Failure Analyst reports the findings to the REA.
- The REA reports the findings to the Program Management Office.
- In response to these findings, the PMO requests legal advice.
- Legal advises the PMO to issue a litigation hold relating to the preservation of all explicit information pertaining to all items with the same part number. The scope of the legal hold might include the single part (serial number), part family with the same part number, or all parts produced by that manufacturer.
- The eDiscovery "Hint of Litigation" results in initiating action by the PMO against the supply chain.
- Once the impact of litigation proceeding has been determined, the litigation hold may be changed according to Legal.
- The Data Quality Steward(s) will adjust preservation rules as appropriate to accommodate Legal's ruling.
- The Program Management Office oversees all required actions to comply with a new / changed set of rules.
- The Data Quality Steward(s) coordinate with the Customer Registry, Contractor Registry and Supply Chain members to ensure that all are in compliance

6.4.5 Actors – Roles of Participants

- Program Management Offices
- Responsible Engineering Authority (REA)
- Failure Analysis Lab
- Data Quality Steward
- Contractor Registry of System Performance Data (Internal)
- Customer Registry of System Performance Data (External)
- Supply Chain
- Legal Authority
- Preserved Knowledge Collection

6.4.6 Controls – External Influences / Constraints

- Governmental legal rulings and law
- Contractual obligations
- Company records management policies and procedures
- Security and information protection requirements
- Information technology capability, resources and costs
- Facilities storage capacities

6.4.7 Internal Decision Points

- Determine if eDiscovery preservation is needed

- Determine what needs to be preserved
- Determine litigation status change

6.4.8 Information Flows

1. Trigger – Need to send sensor for failure analysis
2. Task detail to send sensor for failure analysis
3. Lab results of potential counterfeit part
4. Report of lab results of potential counterfeit part
5. Report of lab results of potential counterfeit part
6. Decision of the need to a litigation hold
7. Information related to the task of deciding what needs preservation
8. Information related to the need to create a litigation hold
9. Definition of the information needing to be held
10. Adjusting of preservation rules
11. Collected information for legal “Process”
12. Collected information for legal “Review”
13. Collected information for legal “Produce”
14. Collected artifacts delivered to court
15. Trigger - Court decision and litigation status change
16. Notification of need to remove litigation hold
17. Definition of the information needing to be released from hold
18. Adjusting of preservation rules

6.4.9 Scenario Results – Range Of Possible Outcomes And Output

- Full compliance
- Associated risks for lack of full compliance
- Court fines for spoliation

6.4.10 Exception Handling

- Not applicable to this example scenario.

6.4.11 Performance Requirements / Service Level Agreements

- Not applicable to this scenario

Appendix A – Delivering eBusiness Solutions

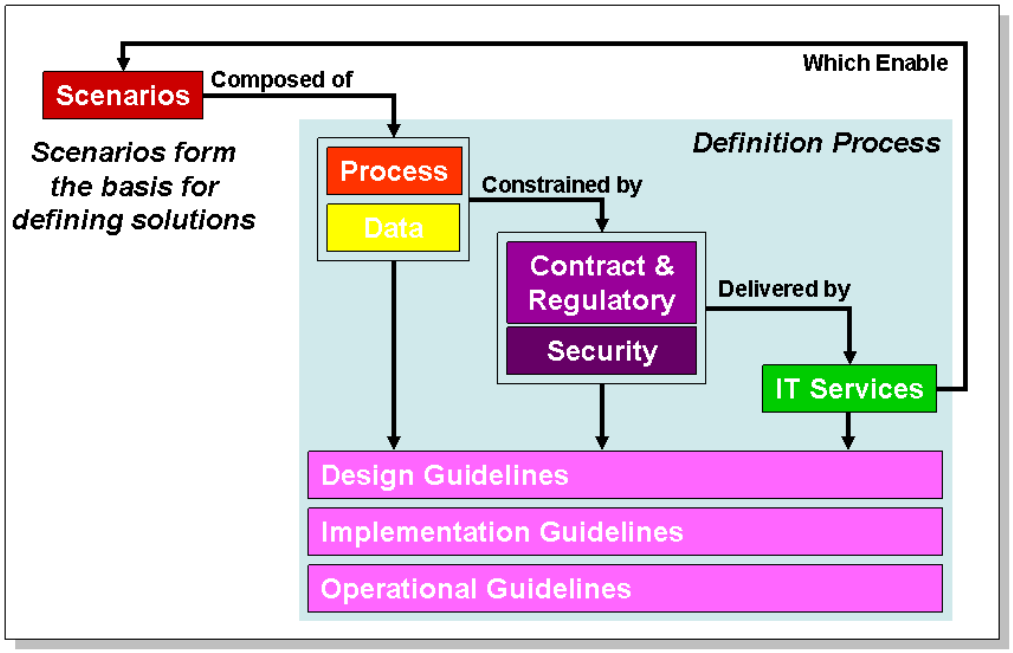
The basic process for delivering a business solution is based on the definition of a particular requirement for a business process or interaction, described in sufficient detail to allow agreement by subject matter experts on the validity of the scenario and the identification by the EEIC of the necessary eBusiness components required to meet the business need.

A scenario should contain the following information:

- Name - meaningful title
- Description of the problem/requirement, and the business justification for action
  Integrated process diagram – business user view containing:
  - Scenario initiation - what starts it?
  - Actors – roles of participants shown in "swim lanes"
  - Sequence of events within activity
  - Controls – external influences/constraints
  - Internal decision points
  - Information flows – using existing components if possible
    - Repositories
    - "Master data"
  - Scenario results – range of possible outcomes and output
  - Exception handling

The scenario defines the processes and information flows required, and existing scenario components may be reused in order to simplify the development of common solutions.

Delivering Business Solutions



Once the scenario definition has been agreed in business terms by the subject matter experts, the business solution can be developed by selecting candidate components from the AIA eBusiness framework to support the scenario, and any requirements for tailoring those requirements. Key steps in the process include:

- Review process flow diagrams against available standard process components
- Identify specific information transactions between actors – across "swim lanes"
- Identify available and required information components
- Identify fixed information sources accessible to multiple actors, such as reference data standards
- Identify communication mechanisms and performance requirements - select IT service components
- Identify security mechanism components required
- Identify commercial and regulatory components
- Identify missing components that need to be provided - may lead to framework extensions
- Tailor components as necessary
- Validate design against original scenario

Architectural guidance should provide any necessary design time guidelines on the specific information models, reference data and process definitions to be used, and on the development of a business case.

Implementation guidance should provide any necessary build time guidelines, such as the key characteristics of any implementation to ensure interoperability of solutions. Consideration should be given to the need for a reference implementation for testing and validation of software, and the provision of any examples.

Operational guidance should provide any necessary run time guidelines, such as working constraints.

Appendix B – Glossary of Terms

- **eDiscovery Definition:** eDiscovery refers to any process in which electronic data is sought, located, secured, and searched with the intent of using it as evidence in a civil or criminal legal case.
- **Explicit Knowledge Definition:** Explicit knowledge is knowledge that has been or can be articulated, codified, and stored where it is available to others.
- **Explicit Knowledge Gap Definition**: An explicit knowledge gap exists when a person or organization is unable to discover information or knowledge needed to accomplish a task.
- **Knowledge Capture Definition**: Knowledge capture is the process of converting tacit knowledge to explicit knowledge.
- **Knowledge / Information / Data Repository Definition**: A knowledge / information / data repository is the component of an enterprise's knowledge management system where knowledge is developed, stored, organized, processed, and available for search and retrieval.
- **Metadata Definition**: Information covering who, what, when, why, where, and how associated with a unit of information or data.
- Master Data Management
- Metadata Management
- **Pull Method Definition**: The pull method requires the person seeking knowledge to initiate the effort to discover the applicable data or information from the Knowledge/Information/Data Repositories.
- **Push Method Definition**: The push method is initiated by a third party (someone other than the person seeking knowledge) resulting in the unsolicited receipt of the information.
- **Spoliation of Evidence Definition:** The intentional or negligent withholding, hiding, alteration or destruction of evidence relevant to a legal proceeding.
- **Structured Data Definition**: Data that resides in predefined fields within a record or file (typically stored within a database).
- **Tacit Knowledge Definition**: Tacit knowledge is the knowledge that is in people's heads based on their life experiences.
- **Unstructured Data Definition**: Information stored as text or rich media objects.

Appendix C – Acronym List

- Aerospace and Defense (A&D)
- Electronic Content Management (ECM)
- Electronic Document Management (EDM)
- Employee Knowledge Capture Plan (EKCP)
- Electronic Knowledge Management (EKM)
- Electronically Stored Information (ESI)
- Key Process Parameters (KPP)
- Knowledge, Skill, Ability (KSA)
- LOng Term Archival & Retrieval (LOTAR)
- Large System Integrators (LSI)
- Original Equipment Manufacturers (OEM)
- Performance-Based Logistics (PBL)
- Responsible Engineering Authority (REA)
- Really Simple Syndication (RSS)
- Software as a Service (SaaS)
- Small to Medium Enterprise (SME)
- Subject Matter Experts (SMEs)
- Service Oriented Architecture (SOA)