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Space and Airborne Systems

Process Architecture and Criteria for Lessons Learned (LL)

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Raytheon Space and Airborne Systems

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Sound Familiar ?

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Users

- "It's a pain to weed through all the irrelevant lessons to get to the few 'jewels'. There should be an easier way to find the lessons that pertain to me."
- "Many of the lessons just seemed to repeat a company practice or instruction. Who thought this was a 'lesson learned'?"
- "It takes almost two weeks to review the lessons in the database. Who's got the time for that?"
- "We seem to learn some lessons over and over again."

Managers

- "Until we can adopt a culture that admits frankly to what really worked and didn't work, I find many of these tools to be suspect."
- "Despite the processes and procedures in place to capture and share lessons learned, I see no evidence that lessons are being applied toward future success."

Presentation Purpose

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- To study and examine a process architecture and criteria for lessons learned.

- As a strategy for implementation, we will
  - *Summarize a search for references of lessons learned within the CMMI model.*
  - *Establish criteria for a lessons learned process.*
  - *Examine a process architecture for lessons learned.*
  - *Discuss how to turn Lessons Learned into Lessons Applied*

Lessons Learned Systems Exist to Support Organizational Goals of
- *Promoting recurrence of successful outcomes*
- *Precluding the recurrence of unsuccessful outcomes*

Background

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- CMMI Model used for this presentation is CMMI-SE/SW/IPPD/SS, V1.1, Staged Representation, March 2002
- A search on “lessons learned” returned 25 references
- All references were cataloged and examined
- The following table summarizes these references

Background – LL References in the CMMI Model

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	Citation
1	Overview, GP 3.2, Collect Improvement Information
2	Overview, GP 3.2, Collect Improvement Information, Subpractice 3
3	Basic Process Management Process Areas (OPF Discussion)
4	Basic Process Management Process Areas (OPD Discussion)
5	PP [ML2], SP 2.3, Plan for Data Management
6	PMC [ML2], SP 2.3, Manage Corrective Action, Subpractice 3
7	PPQA [ML2], SP 1.1, Objectively Evaluate Processes, Subpractice 5
8	PPQA [ML2], SP 1.2, Objectively Evaluate Work Products and Services, Subpractice 8
9	OPF [ML3], Introductory Notes
10	OPF [ML3], SP 1.3, Identify the Organization's Process Improvements, Subpractice 1
11	OPF [ML3], SP 2.4, Incorporate Process-Related Experiences into the Org. Process Assets, Typ. Work Products 2
12	OPF [ML3], SP 2.4, Incorporate Process-Related Experiences into the Org. Process Assets, Subpractice 3
13	OPF [ML3], SP 2.4, Incorporate Process-Related Experiences into the Org. Process Assets, Subpractice 4
14	OPD [ML3], Introductory Notes
15	OPD [ML3], SP 1.3, Establish Tailoring Criteria and Guidelines
16	IPM for IPPD [ML3], Introductory Notes
17	IPM for IPPD [ML3], SP 1.4, Manage the Project Using the Integrate Plans, Subpractice 1
18	IPM for IPPD [ML3], SP 1.5, Contribute to the Organizational Process Assets, Typical Work Products 3
19	IPM for IPPD [ML3], SP 1.5, Contribute to the Organizational Process Assets, Subpractice 4
20	DAR [ML3], SP 1.3, Identify Alternative Solutions, Subpractice 1
21	OID [ML5], SP 1.3, Pilot Improvements, Typical Work Products 2
22	OID [ML5], SP 1.3, Pilot Improvements, Subpractice 6
23	OID [ML5], SP 2.2, Manage the Deployment, Subpractice 10
24	OID [ML5], GP 2.6, Manage Configurations
25	CAR [ML5], Introductory Notes

References appear in the Appendix but will not be reviewed here.

Background – Summary of LL References in the CMMI Model

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- Some requirements stated
  - *Process assets library (PAL)*
  - *What LL should be included for various process areas*
- No definition of a lesson learned
- No vision
- No criteria for a lessons learned process

Opportunity: Tailor These to Fit Your Organization

Establish LL Criteria: Define Terms

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- **A lesson learned is knowledge or understanding gained by experience.**
  - ***Negative experience***
  - ***Positive experience***

- **A lesson**
  - ***Must be significant***
  - ***Must be valid***
  - ***Must be applicable***
  - ***Could describe a problem or issue that the organization will investigate***

Establish LL Criteria: Define Terms - 2

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- **A lesson (continued)**
  - ***May contain or address pertinent info***
  - ***May provide information of interest***
  - ***May have a "sunset provision"***

A lesson is not simply restating or paraphrasing existing doctrine, policy, process, etc. This does not qualify as an appropriate and bona fide lessons learned.

Establish LL Criteria: Create A Strategic Plan

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- **Strategic Plan**
  - ***Define how your organization will collect, validate, store, distribute, and reuse knowledge to achieve organizational objectives***
  - ***Write a purpose statement***
    - **Example purpose: U.S. Navy Lessons Learned System**
  - ***Define the stakeholders in writing***
  - ***Define roles of all involved***

Establish LL Criteria: Build A Lessons Learned Process Architecture

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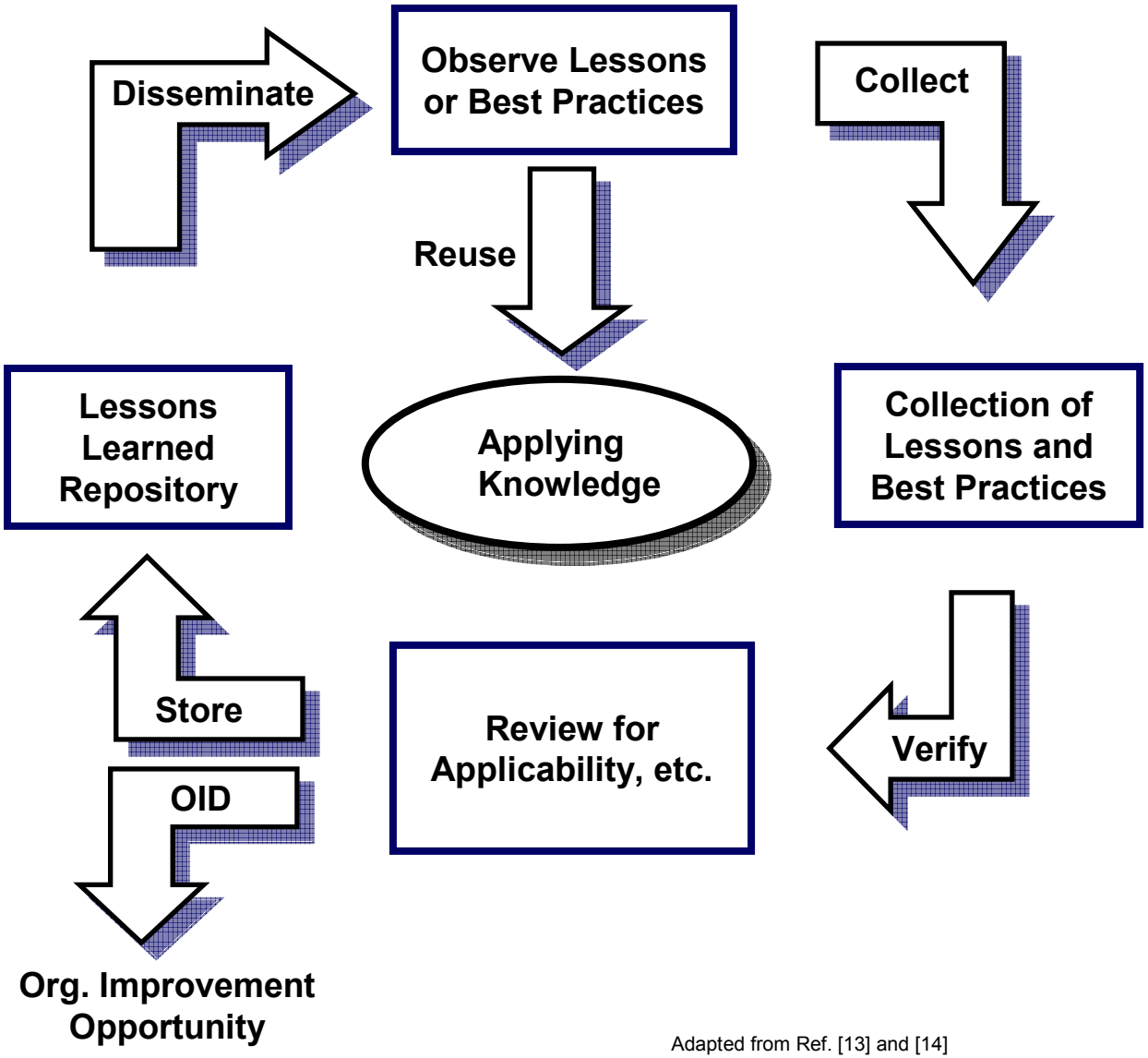

A Generic Process with 6 Elements:

- Collection
- Verification
- Storage
- Dissemination
- Reuse
- OID Identification

Adapted from Ref. [13] and [14]

Establish LL Criteria: Build A Lessons Learned Process Architecture

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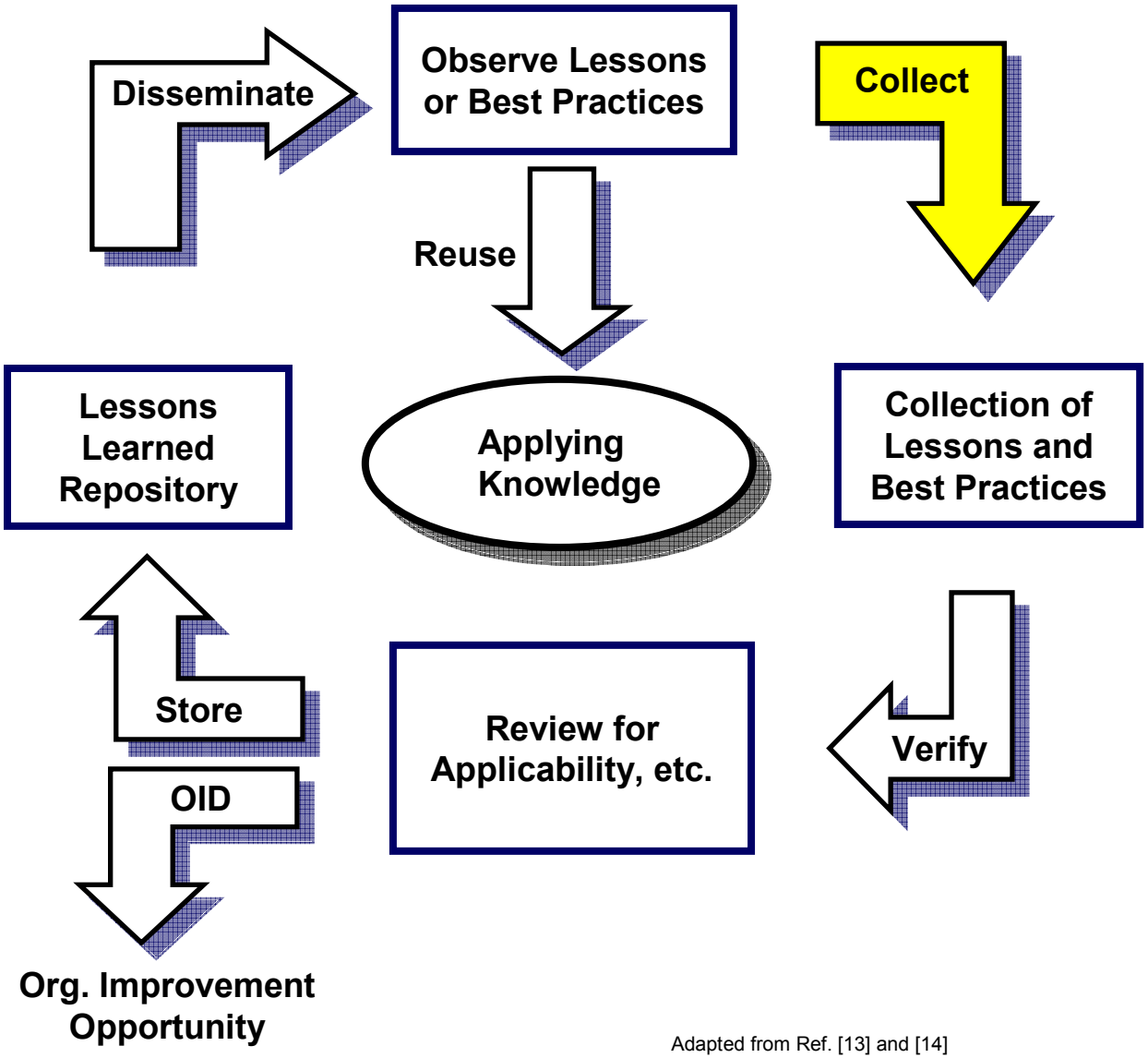

A Generic Process with 6 Elements:

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Adapted from Ref. [13] and [14]

Establish LL Criteria: Collection

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- Focuses on gathering lessons learned from many sources internal and external to the organization
- Collection types or sources
  - *Passive Collection*
  - *Reactive Collection*
  - *After Action Collection*
  - *Active Collection*
  - *Anonymous Contributions*

Focusing only on negative experiences reduces potential effectiveness and misses opportunities to improve all processes

Establish LL Criteria: Build A Lessons Learned Process Architecture

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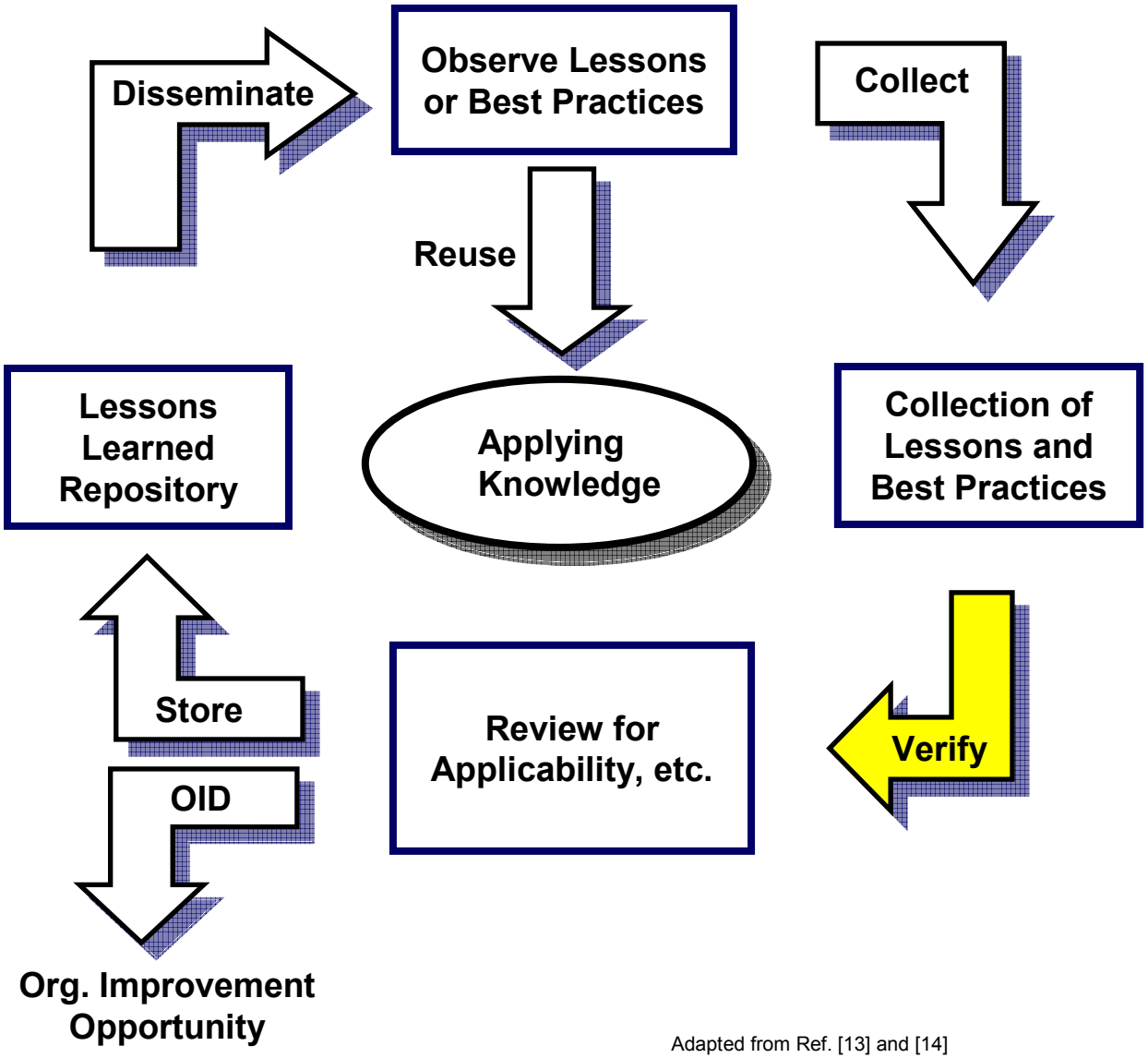

A Generic Process with 6 Elements:

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Adapted from Ref. [13] and [14]

Establish LL Criteria: Verification - 1

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- Focuses on validating lessons according to established standards
- Examples of verification standards
- How do these standards serve as guidelines?
  - *Adding to the collection*
  - *Removing from the collection*
  - *Priorities*
- Verification can also be used to
  - *Combine and/or adapt complementary or incomplete lessons*
  - *Identify systemic issues or improvement opportunities*

Verification allows your organization to tailor its lessons learned repository according to the standards it selects

Establish LL Criteria: Verification - 2

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- Usually performed by some kind of Gatekeeper
- Gatekeepers
  - *One or more domain or subject matter experts (SME) or researchers*
  - *Analyze lessons within a particular category*
  - *Typically look for lessons that meet or exceed a set of defined criteria*
  - *These people must be*
    - Respected within the organization
    - Provided the necessary resources (time, staff, etc.)

Gatekeepers help prevent lessons that state the obvious which discourages use of the LL collection by others

Establish LL Criteria: Verification - 3

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Some Criteria for Selecting / Adding a Lesson

- Relationship
- Relevancy
- Significance
- Authoritativeness
- Currency
- Research aids
- Systemic process issues
- Information – format, cost, restrictions
- Credibility or reputation of authors/publishers

Establish LL Criteria: Verification - 4

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Maintenance Issues

- **Obsolete lessons**
- **Gatekeepers periodically review**
- **Verification criteria for removing (weeding) lessons from the LL collection**
  - ***Value***
  - ***Accuracy***
  - ***Newness***
  - ***Demand***
  - ***User feedback***
  - ***Physical condition***
  - ***Multiple copies***

Establish LL Criteria: Build A Lessons Learned Process Architecture

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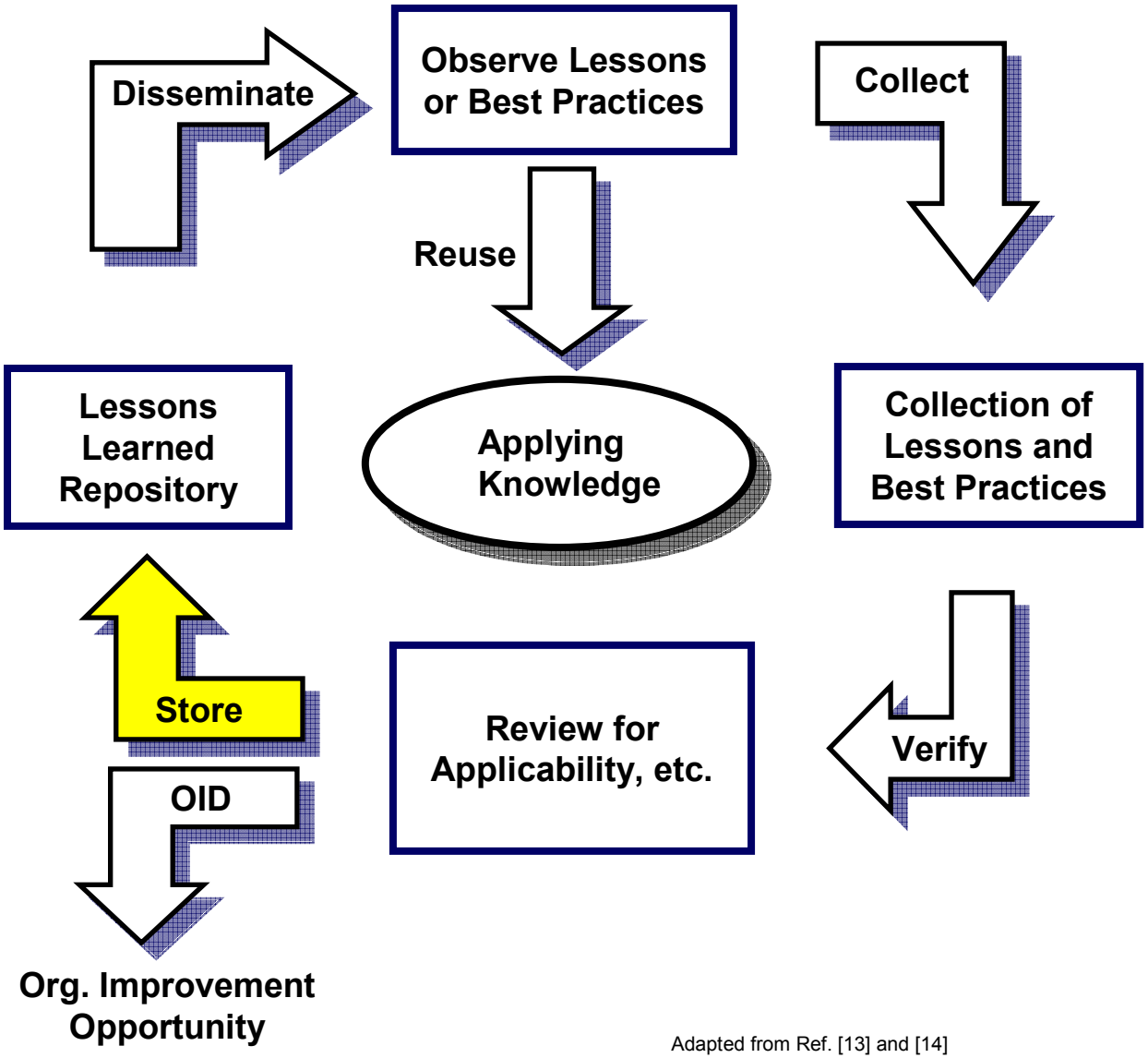

A Generic Process with 6 Elements:

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Adapted from Ref. [13] and [14]

Establish LL Criteria: Storage

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- Focuses on issues related to categorization, indexing, formatting, and structure
- Other storage issues
  - *Lesson representation*
  - *Task relevant representations*
  - *Submission templates*
  - *Online fields*
  - *Forwarding files or attachments*
  - *Separate project repositories*
  - *Repetitive errors*

Establish LL Criteria: Build A Lessons Learned Process Architecture

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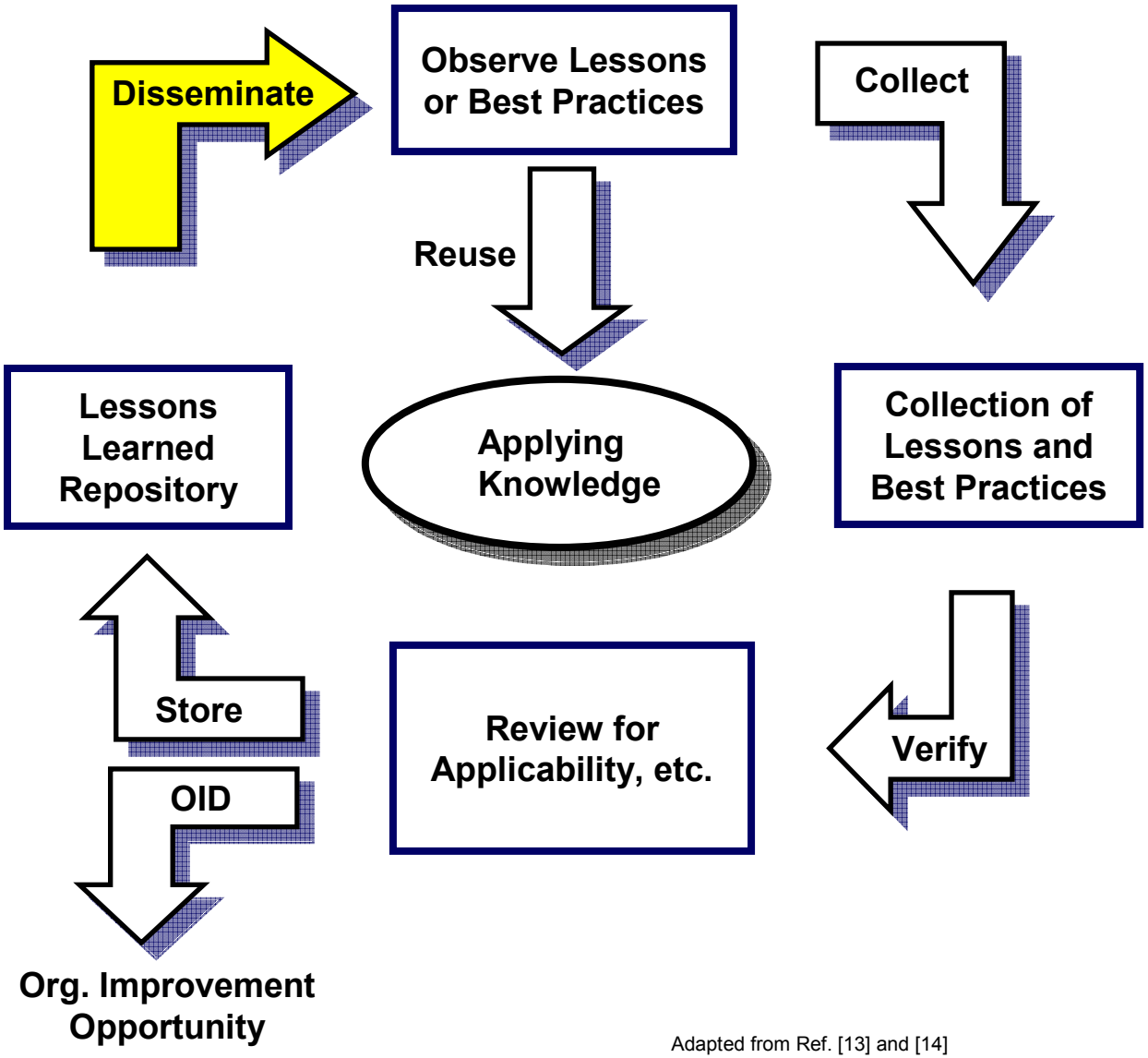

A Generic Process with 6 Elements:

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Adapted from Ref. [13] and [14]

Establish LL Criteria: Dissemination

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- Focuses on issues relating to the distribution of LL
- Some Issues
  - *Define and provide users a feedback cycle for a typical LL*
  - *User access*
  - *Search functions*
- Types of Dissemination: Passive and Active
- Passive Dissemination Definition
- Passive Dissemination Examples

Passive Dissemination: No User Action = No Dissemination

Establish LL Criteria: Dissemination - 2

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- Active Dissemination – Definition and examples
  - *Use Gatekeepers*
  - *"Push" lessons to potential users via list servers*
  - *Continuous lessons learning*
    - Training
    - Mentoring
    - Program reviews
    - After-action reviews
    - Project retrospectives
    - Periodic revisions to organizational policies and guidelines

Try to determine when a lesson's conditions are well matched by a decision context. Distribute these lessons to those individuals making decisions in the same or similar context.

Establish LL Criteria: Dissemination - 3

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- **Other Active Dissemination Examples**
  - ***Host a series of forums***
  - ***Capture and share the experiences of program managers, senior engineers, design architects, analysts, testers, finance managers, etc.***
    - **In writings**
    - **Verbally**

Establish LL Criteria: Build A Lessons Learned Process Architecture

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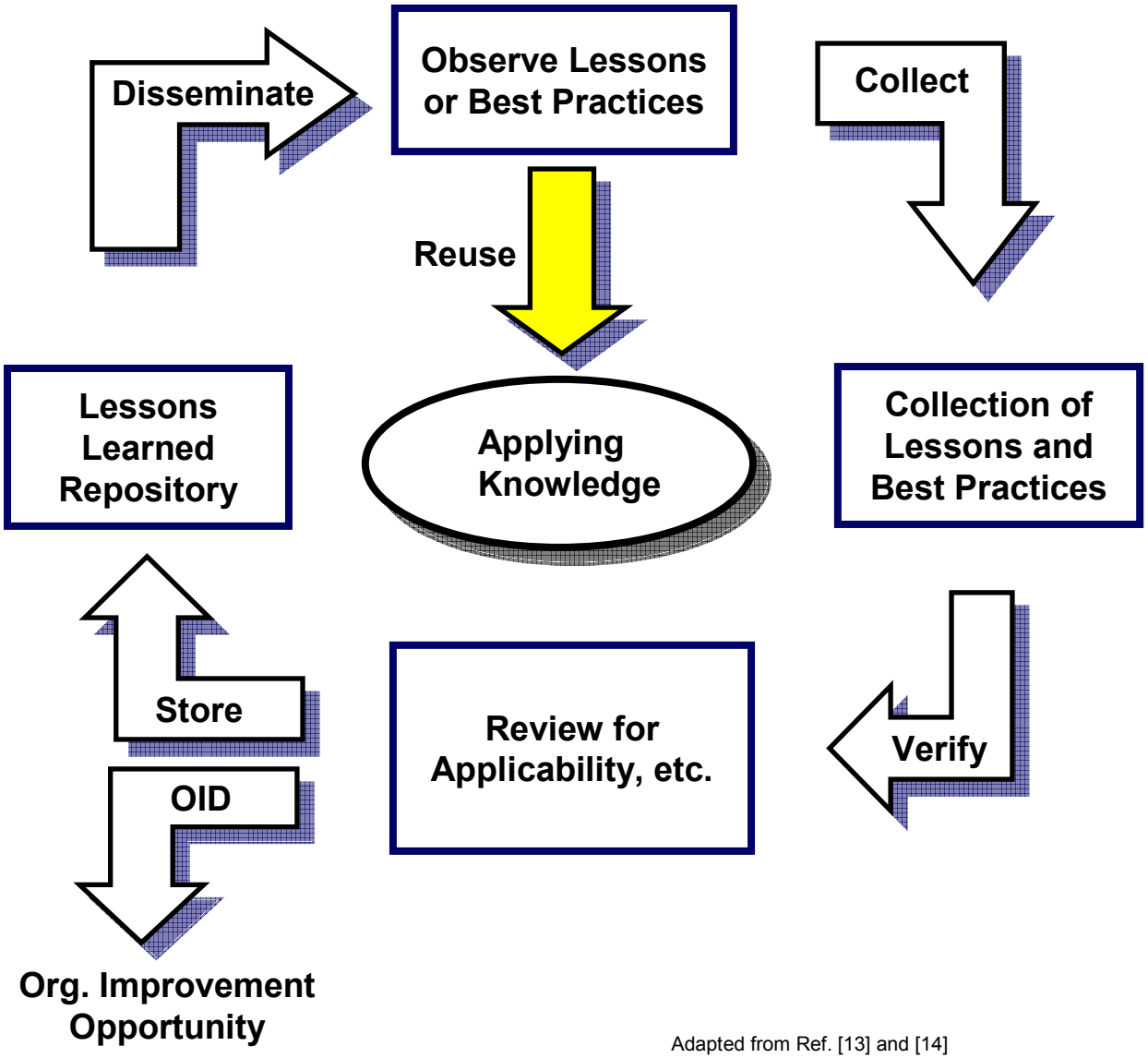

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Adapted from Ref. [13] and [14]

Establish LL Criteria: Reuse

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- Focuses on encouraging/promoting lessons to be used by someone other than the submitter
- Browser recommendation
  - *Definition and example*
- Learning recommendation
  - *Definition and example*
  - *Amazon.com features*
    - Customers can submit reviews of items (anonymously or not)*
    - Customers can read all reviews of an item*
    - Customers can rate the item (5 Star system)*
    - Customers can rate if the item was helpful to them
    - Customers can read all reviews of the same person ("favorite reviewer")

**** Raytheon SAS Feature***

Establish LL Criteria: Build A Lessons Learned Process Architecture

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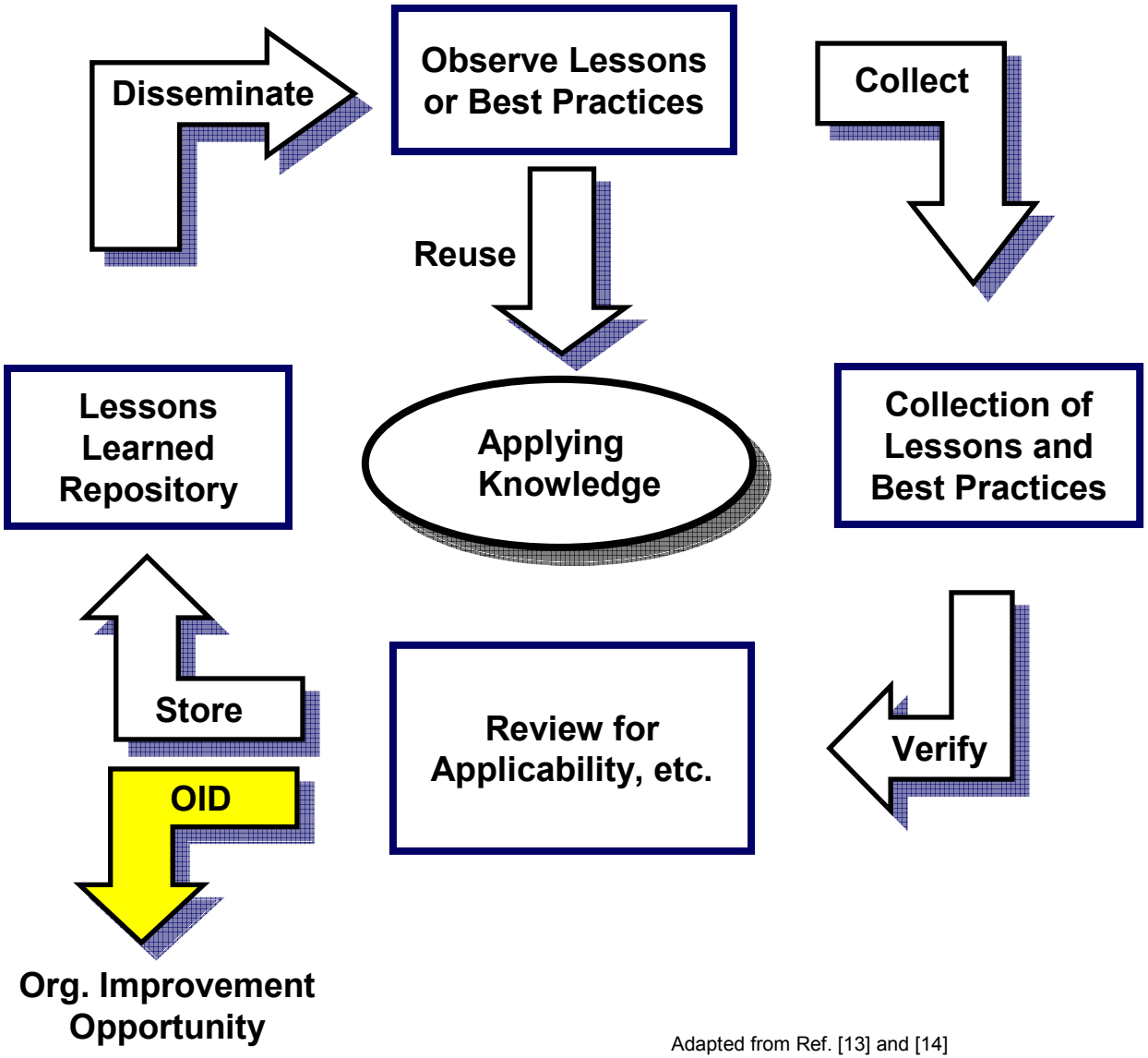

A Generic Process with 6 Elements:

- Collection
- Verification
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- OID Identification

Adapted from Ref. [13] and [14]

Establish LL Criteria: OID Identification

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- **Focuses on identifying incremental and innovative improvements that will measurably improve the**
  - ***Organization's processes***
  - ***Organization's technologies***

- **Analyze and evaluate**
  - ***The verified lessons***
  - ***The lessons learned process***

Provide periodic recommendations to the EPG (Enterprise / Engineering Process Group) of candidate improvements for selection and deployment

Establish LL Criteria: Target Performance Measurement

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- Turning Lessons Learned into Lessons Applied
- Use objective performance metrics
  - *Number of validated lessons*
    - Individual
    - Team
    - Program or project
    - Business unit
  - *Number of lessons applied*
    - Individual
    - Team
    - Program or project
    - Business unit

Raytheon SAS Lessons Learned Experience

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- Collecting Lessons Learned since the mid-1990s
- Multidisciplined approach
- SAS Programs submit applicable LL monthly
- LL collected, processed, and fed back to the programs
- Transitioning development phases

Summary

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- Lessons Learned are a principal component of an organizational culture committed to
  - *Knowledge management*
  - *Continuous improvement*
- Establishing and tailoring a Lessons Learned process will help you reach higher process Maturity Levels (CMMI, ISO, etc.)
  - *Collection, Verification, Storage, Dissemination, Reuse, OID Identification*
- Learn from successes as well as mistakes
- Lives may be saved by preventing recorded catastrophes from recurring!

Performance and Reuse Metrics are the Final Keys to Turn Lessons Learned into Lessons Applied

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Contact Information

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- **Questions ?**

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Appendix

Lessons Learned References in the CMMI

CMMI Background

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Summary of the Lessons Learned References in CMMI

- GP 3.2 Level 3+
- Basic Process Mgmt PAs
- PP Level 2
- PMC Level 2
- PPQA Level 2
- OPF Level 3
- OPD Level 3
- IPM Level 3
- DAR Level 3
- OID Level 5
- CAR Level 5

CMMI Lessons Learned Reference: GP 3.2

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- **Overview, GP 3.2, Collect Improvement Information**

  The purpose of this generic practice is to collect information and artifacts derived from planning and performing the process. This generic practice is performed so that the information and artifacts can be included in the organizational process assets and made available to those who are (or who will be) planning and performing the same or similar processes. The information and artifacts are stored in the organization's measurement repository and the organization's process asset library.

  Examples of relevant information include the effort expended for the various activities, defects injected or removed in a particular activity, and lessons learned.

  Sub 3: Document lessons learned from the process for inclusion in the organization's process asset library.

Requirements: Put lessons learned into the organization's PAL. Make them available to people planning/performing same/similar tasks.

CMMI LL Reference: Basic Process Management Process Areas

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- **OPF Discussion**

  ... the Organizational Process Focus process area helps the organization to plan and implement organizational process improvement based on an understanding of the current strengths and weaknesses of the organization's processes and process assets. Candidate improvements to the organization's processes are obtained through various means. These include process-improvement proposals, measurement of the processes, lessons learned in implementing the processes, and results of process appraisal and product evaluation activities.

- **OPD Discussion**

  The Organizational Process Definition process area establishes and maintains the organization's set of standard processes and other assets based on the process needs and objectives of the organization.

  ... Experiences and work products from performing these defined processes, including measurement data, process descriptions, process artifacts, and lessons learned, are incorporated as appropriate into the organization's set of standard processes and other assets.

CMMI Lessons Learned Reference: PP, Project Planning

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- **PP SP 2.3, Plan for Data Management**

  Data are the various forms of documentation required to support a program in all of its areas (e.g., administration, engineering, configuration management, financial, logistics, quality, safety, manufacturing, and procurement)...

  Data may be deliverable (e.g., items identified by a program's contract data requirements) or data may be nondeliverable (e.g., informal data, trade studies and analyses, internal meeting minutes, internal design review documentation, lessons learned, and action items)...

CMMI Lessons Learned Reference: PMC, Project Monitoring and Control

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- **PMC SP 2.3, Manage Corrective Action**

  Sub 3: Determine and document appropriate actions to correct deviations from planned results for corrective actions.

  Lessons learned as a result of taking corrective action can be inputs to planning and risk management processes.

CMMI Lessons Learned Reference: PPQA, Process and Product Quality Assurance

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- **PPQA SP 1.1, Objectively Evaluate Processes**

  Sub 5: Identify lessons learned that could improve processes for future products and services.

- **PPQA SP 1.2, Objectively Evaluate Work Products and Services**

  Sub 8: Identify lessons learned that could improve processes for future products and services.

CMMI Lessons Learned Reference: OPF, Organizational Process Focus

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- **OPF, Introductory Notes**

  Candidate improvements to the organizational process assets are obtained from various sources, including measurement of the processes, lessons learned in implementing the processes, results of process appraisals, results of product evaluation activities, results of benchmarking against other organizations' processes, and recommendations from other improvement initiatives in the organization.

- **OPF SP 1.3, Identify the Organization's Process Improvements**

  Sub 1: Determine candidate process improvements.

  - ***Review the lessons learned from tailoring the organization's set of standard processes***
  - ***Review the lessons learned from implementing the processes***

CMMI Lessons Learned Reference: OPF, Organizational Process Focus - 2

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- **OPF SP 2.4, Incorporate Process-Related Experiences into the Organizational Process Assets**

  TWP 2: Process lessons learned.

  Sub 3: Derive lessons learned from defining, piloting, implementing, and deploying the organizational process assets.

  Sub 4: Make lessons learned available to the people in the organization as appropriate.

  Actions may have to be taken to ensure that lessons learned are used appropriately.

  Examples of inappropriate use of lessons learned include the following:

  - ***Evaluating the performance of people***
  - ***Judging process performance or results***

  Examples of ways to prevent inappropriate use of lessons learned include the following:

  - ***Controlling access to the lessons learned***
  - ***Educating people about the appropriate use of lessons learned***

CMMI Lessons Learned Reference: OPD, Organizational Process Definition

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- **OPD, Introductory Notes**

  The organization's process asset library is a collection of items maintained by the organization for use by the people and projects of the organization. This collection of items includes descriptions of processes and process elements, descriptions of life-cycle models, process tailoring guidelines, process-related documentation, and data. The organization's process asset library supports organizational learning and process improvement by allowing the sharing of best practices and lessons learned across the organization.

- **OPD SP 1.3, Establish Tailoring Criteria and Guidelines**

  Flexibility in tailoring and defining processes is balanced with ensuring appropriate consistency in the processes across the organization...

  Consistency across the organization is needed so that organizational standards, objectives, and strategies are appropriately addressed, and process data and lessons learned can be shared.

CMMI Lessons Learned Reference: IPM (Integrated Proj. Management) for IPPD

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- **IPM for IPPD, Introductory Notes**

  Since the defined process for each project is tailored from the organization's set of standard processes, variability among projects is typically reduced and projects can more easily share process assets, data, and lessons learned

- **IPM SP 1.4, Manage the Project Using the Integrated Plans**

  Sub 1: Implement the project's defined process using the organization's process asset library

  - ***Using lessons learned from the organization's process asset library to manage the project***

- **IPM SP 1.5, Contribute to the Organizational Process Assets**

  TWP 3: Documentation (e.g., exemplary process descriptions, plans, training modules, checklists, and lessons learned).

  Sub 4: Document lessons learned from the project for inclusion in the organization's process asset library.

CMMI Lessons Learned Reference: DAR, Decision Analysis and Resolution

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- **DAR SP 1.3, Identify Alternative Solutions**

  Sub 1: Perform a literature search.

  A literature search can uncover what others have done both inside and outside the organization. It may provide a deeper understanding of the problem, alternatives to consider, barriers to implementation, existing trade studies, and lessons learned from similar decisions.

CMMI Lessons Learned Reference: OID, Organizational Innovation & Deployment

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- **OID SP 1.3, Pilot Improvements**

  TWP 2: Documented lessons learned from pilots.

  Sub 6: Review and document the results of pilots.

  Reviewing and documenting the results of pilots usually involves the following:

  - ***Identifying and documenting lessons learned and problems encountered during the pilot.***

- **OID SP 2.2, Manage the Deployment**

  Sub 10: Document and review the results of process- and technology-improvement deployment.

  Documenting and reviewing the results includes the following:

  - ***Identifying and documenting lessons learned.***

- **OID GP 2.6, Manage Configurations**

  Examples of work products placed under configuration management include the following:

  - ***Documented lessons learned from pilots***

CMMI Lessons Learned Reference: CAR, Causal Analysis and Resolution

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- **CAR, Introductory Notes**

  Since defects and problems may have been previously encountered on other projects or in earlier phases or tasks of the current project, causal analysis and resolution activities are a mechanism for communicating lessons learned among projects