An Integrative Method for Appraising Modular Open System Maturity

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Agenda

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Part II	**The Open System Maturity Model**
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Why Modular Open systems?

- Shift in customer taste/expectation
- Evolving needs/requirements
- Rapidly changing technologies
- Growing need for situational awareness
- Rising significance of Real-Time information
- Aging legacy of stove-pipe systems
- System development cost escalation trends
- Rising support and maintenance costs
- Increased complexity (e.g., Increasing Operator Workload / Information Overload)
- Reducing decision time line and response time
- Emerging standards

MOSA Vision

Affordable, Producible, Sustainable, Interoperable, Reconfigurable, and Growing System Capability based on Modular Architecture and Open Standards for Appropriate

Key Interfaces

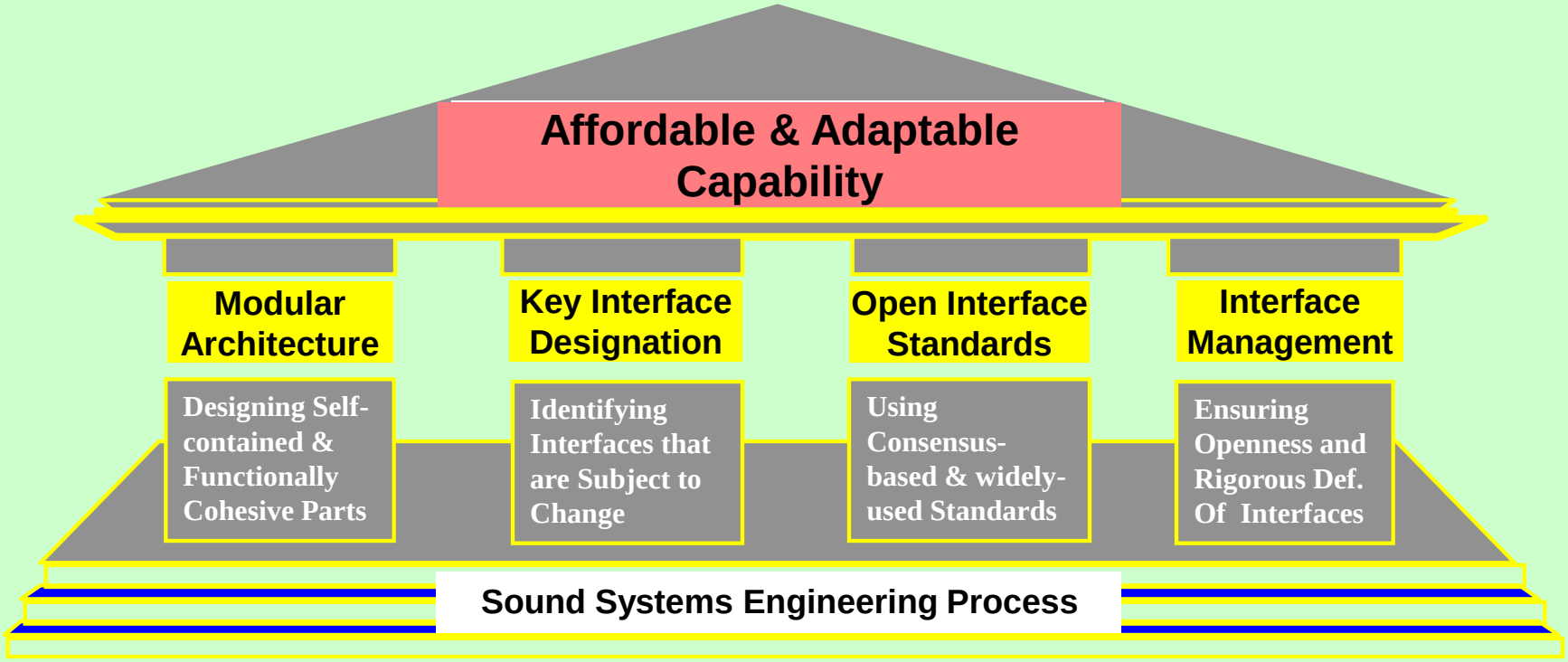
What is an Open System?

- **Open System**: A system that uses modular architecture and implements open standards for appropriate key interfaces.
- **Open Standard**: A widely implemented standard, the use of which is non-proprietary.
- Interface Standard: A standard that specifies the physical and logical characteristics of an interface.
- **Key Interface**: The interface of a module that is characterized by the need to be interoperable, easily changed, replaced or isolated because of complexity, obsolescence, or cost.

WHAT IS MODULAR OPEN SYSTEM APPROACH (MOSA)?

- An integrated business and technical strategy that employs a modular design and, where appropriate, defines key interfaces using widely supported, consensus-based standards that are published and maintained by a recognized industry standards organization.
- Encompasses practices that are basic to implementing
  - Effective MOSA process
  - Advanced open system practices

FUNDAMENTAL MOSA PRINCIPLES (BUILDING BLOCKS)



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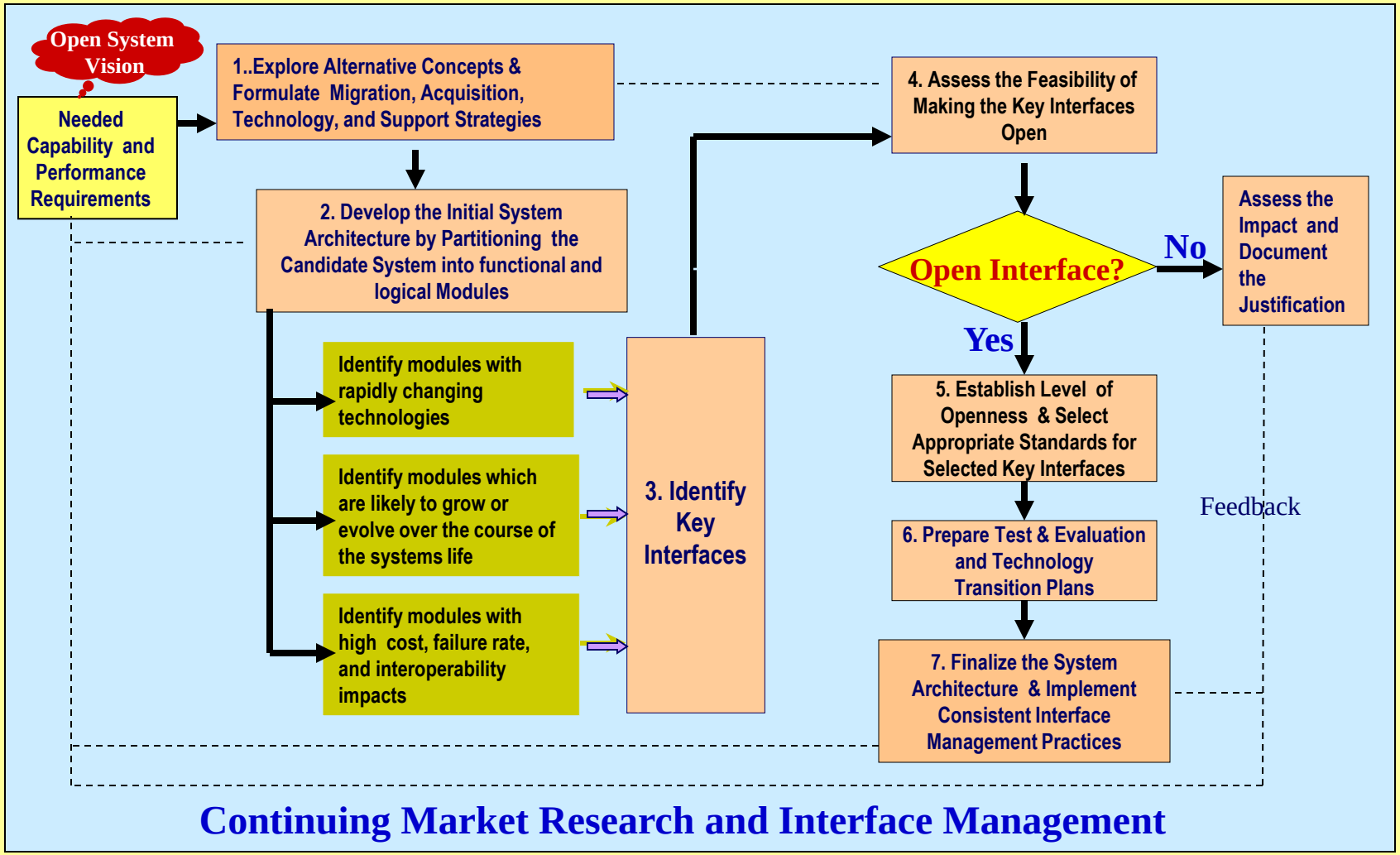
MOSA Process

- A set of business and engineering activities, methods, practices, and transformations that organizations use to develop and maintain affordable, producible, interoperable, reconfigurable, and adaptable systems and associated products (e.g., design documents, architectures, test cases, user manuals, interface management plans, etc.).
- A Means of predicting the likely outcomes to be expected from the next system or product development project the organization undertakes
- A common process that applies to the development of an adaptable product or service in the engineering development domain

The MOSA Process



Suitable Environment & Sound Systems Engineering Process

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Modular Open System Maturity

- Measures an organization's overall open system maturity and the extent to which a specific MOSA process is explicitly defined, managed, measured, controlled, and effective.

- As an organization gains in modular open system maturity, it institutionalizes its MOSA Process within its knowledge and corporate infrastructure and culture to ensure its endurance and effectiveness.

The MOSA CMM Purpose

The integration of Modular Open System practices within the CMMI Framework. The effort is aimed at enabling organizations to:

- Understand process areas and specific practices required for launching open system improvement processes
- Identify process areas that contribute to each step of organizational Modular Open System Process maturity
- Provide valuable information to technical staff and process improvement groups to:
  - Identify strengths and weaknesses of system integrators, contractors and suppliers
  - Determine the risks of selecting among different contractors for awarding business and to monitor performance
  - Provide a set of specific evaluation criteria against which the contractors proposals will be evaluated

MOSA Performance

- The actual results achieved by an organization That follows a Modular Open System Approach Process.
- Examples of Expected performance:
  - More effective change management
  - Ease of technology insertion
  - Growing capability
  - Improved interoperability
  - Less integration risks
  - Lower cycle time
  - Vendor independence
  - Reduced total ownership costs

Bottom Line:
Greater chance to more effectively adapt an organization and its constituent systems to changes in the internal and external environment.

MOSA Maturity Model

- A Staged Representation Model that identifies the practices that are basic to implementing effective MOSA process and advanced open system practices.
- Assigns to those practices associated maturity levels ranging from negligible to mature and well-managed organization-wide application of open systems.
- Identifies the path through the various practices for achieving higher levels of modular open system maturity and improvement of organizational capability and adaptability.

Modular Open System Capability

- The range of expected results that will most likely be achieved by following a MOSA Process.
- Measures an organization's MOSA Process improvement achievement.
- The MOSA Capability Maturity Model delineates the characteristics of a mature, capable MOSA Process.

Major Characteristics of Mature Modular Open System Capability

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Examples of Capabilities/Requirements Necessitating MOSA Implementation

- Dominant performance that requires access to the latest technologies
- Need for continuing integration and reconfiguration capability
- Unstable longer-term requirements that are addressed as evolving increments
- When technologies/engineering for full capability still need to be developed and a spiral development strategy is pursued
- When products or spare parts are competitively produced and the organization must maintain continuing access to multiple sources of supply
- Desire to mitigate the intensity and magnitude of risks associated with proprietary standards and sole source of support throughout a system life cycle
- Need for design flexibility, modularity, and interface control
- System of systems interoperability requirements that unequivocally call for compliance with specific open standards, protocols, or standardized data formats
- When the system has to have connectivity with other systems to properly function
- Need for commonality of hardware, software, and support systems

Modular Open System Maturity Levels

- Level 5: Complete (Total Organization) Openness
- Level 4: Extensive (System of Systems) Openness
- Level 3: Reasonable (Individual System) Openness
- Level 2: Limited (Subsystem) Openness
- Level 1: Negligible Openness

OS Maturity Level 5: Complete (Total Organization) Openness

Examples of Expected Results:

- Organization has institutionalized the Modular Open System Process within its overall organization structure and culture
- Modular Open System Process is managed as a regular business activity
- The organization is pursuing a disciplined, standardized and creative Modular Open System Process
- Continuous improvement of the organizational processes including Modular Open System Process
- Negligible difference is observed between targeted and actual open system benefits
- Pursuit of a pro-active management philosophy in system development and sustainment, in establishing measures, and in monitoring the progress on implementing a standardized modular open system process
- Well-defined roles and responsibilities for adopting and influencing open standards across the organization.
- Lessons learned on modular open system application are disseminated widely and effectively
- Organization-wide openness provides capability to:
  - Continuously and affordably modernize systems, and processes
  - Connect systems and organizational stakeholders, and create commonality across platforms and systems
  - Enable affordable, long-lasting, and adaptable systems and products
  - Reconfigure systems and applications as needs and technology changes
  - Effective and continuing knowledge sharing

Characterized by openness of all the appropriate key interfaces within all the systems in the organization

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OS Maturity Level 4: Extensive (System of Systems) Openness

Examples of Expected Results:

- A majority of key interfaces within selected system and system of systems (collaborating systems) are defined by open standards
- Emphasis is placed on reuse and commonality of products across domains
- Use of open standards in family of systems is being consciously assessed
- Metrics for measuring the openness of systems and processes have been established and being used
- An interface management plan has been established
- Organization is capable to predict total cost of ownership, development cycle time, and system capabilities at different blocks of improvement within reasonable margin of error.
- Most of the benefits of open systems are being realized
- An organization-wide repository of open system lessons learned exists
- Selection of interface standards based on well-defined criteria and priorities
- Quantitative open system objectives and indicators have been established
- MOSA Process has been integrated with all the other appropriate organizational processes

Characterized by openness of appropriate key interfaces within and among selected systems

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OS Maturity Level 3: Reasonable (Individual Systems) Openness

Examples of Expected Results:

- Key interfaces within certain systems have been defined and feasibility of using open standards for such interfaces is assessed
- A well-defined MOSA Process based on sound system engineering processes, and common and organization-wide understanding of the activities, roles, and responsibilities has been established
- MOSA Process has been integrated with the overall acquisition and system engineering processes
- A roadmap for MOSA implementation has been prepared
- Within established systems/platforms, cost, schedule, and functionality are under control, and progress is successfully being tracked
- The criteria for selecting interface standards have been established
- Limited measures for tracking the progress on MOSA implementation are established
- An organization-wide open system training program has been established to ensure adequate open system knowledge and skills
- Verification and validation testing mechanisms have been developed

Characterized by openness of appropriate key interfaces within selected systems

OS Maturity Level 2: Limited (Subsystem) Openness

Examples of Expected Results:

- An open system czar has been appointed and his/her areas of responsibility have been assigned
- A basic Modular Open System Process management discipline has been established on an ad-hoc basis
- The process for implementing open systems in selected subsystems is being monitored and controlled
- A plan to assess the feasibility of the open system strategy has been prepared
- Open system policies and procedures for their implementation have been established
- Limited open system training is provided
- A majority of obstacles toward open system implementation have been identified and removed
- Stakeholders responsible for implementation or being impacted by open systems are identified
- Some resources for open system implementation have been allocated
- Suppliers are encouraged to use open interfaces for certain components
- Some of the barriers toward open system implementation are identified and removed.
- Earlier successes in open system implementation are repeated as limited lessons are gathered, analyzed, and documented

Characterized by openness of appropriate key interfaces within limited subsystems

OS Maturity Level 1: Negligible Openness

Examples of Expected Results:

- The organization has identified the benefits of open systems and has adopted open standards for a few key interfaces within one or more components comprising a subsystem (e.g., use of open interface standard for a display processor)
- Open system application at this level is characterized by:
  - No Modular Open System Process management discipline
  - Scattered open interfaces due to individual system engineer's preference
  - Firefighting (e.g., reacting to immediate interoperability or integration problems)
  - excessive risk taking
  - Lack of short and long-term open system strategies and plans (reactionary management philosophy)
  - Orientation towards proprietary products, interface, and systems
  - Absence of organization-wide policies for open system implementation
  - Over the budget and schedule products and systems.

Characterized by openness of a few components within a subsystem

Proposed MOSA CMM Appraisal Method

The proposed method is based on 3 simple steps:

1. Reviewing the tangible output of the MOSA process (e.g., tangible MOSA benefits, hardware and software interface descriptions, type of standards used, conformance management activities, etc.)

2. Conducting structured interviews and gathering detailed relevant objective evidences from a total of 116 questions that provide ability to "tailor" the parameters of the appraisal to the needs of the organization

3. Using the gathered evidence as the basis for appraising the maturity of MOSA Process implementation in the sponsor organization

The Appraisal Instrument

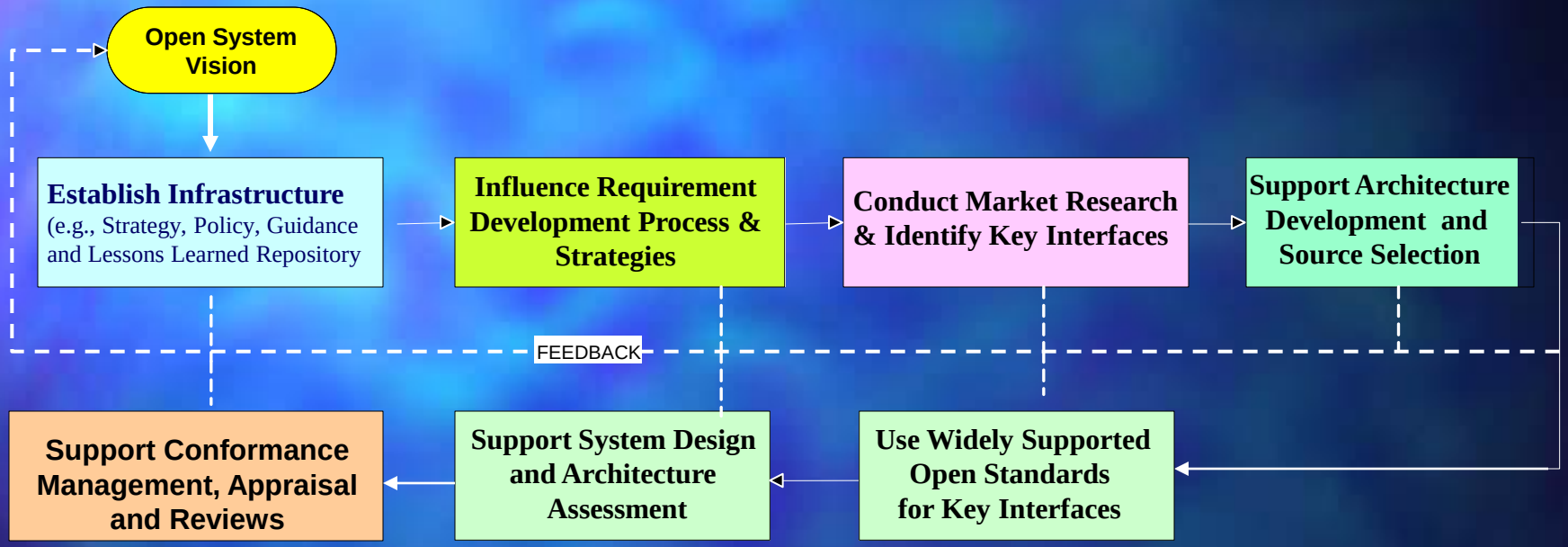
Contains a total of 125 structured questions with the following MOSA Maturity level breakdown:

- Maturity Level 5 – 17 questions
- Maturity Level 4 – 50 questions
- Maturity Level 3 – 38 questions
- Maturity Level 2 – 20 questions

Appraisal Areas Covered by the Questionnaire

- Capability Development
- Acquisition Strategy
- Contracting
- Design Process
- Resources
- Risk Mitigation
- Tools
- Test and Evaluation

Core Tasks For Implementing MOSA Process



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Appraisal Rating

Based on the mean response to the specific maturity level questions, the appraisal team may assign the following MOSA process implementation rating:

- 5 - Fully implemented
- 4 - Largely implemented
- 3 - Moderately implemented
- 2 - Partially implemented
- 1 - Not implemented

MOSA CMM Appraisal Method
Areas of Application

Assess MOSA Process improvement of

- **Programs**
  - **New**
  - **Legacy**
- **Suppliers**
- **Organizations of all sizes involved in engineering and development of :**
  - **Defense and other IT Intensive Systems comprising of mechanical, electrical, electronic, hydraulic, power, sensor, and other components**
  - **Tools and test facilities**

Proposed MOSA CMM Appraisal Method Advantages

1. **Simplicity** – The appraisal process only uses 3 steps and a number of interviews
2. **Flexibility** – The questions that can be tailored provide to the needs of the organization
3. **Quickness** – the process appraisal could be implemented in less than 3 weeks
4. **Standard Guidance** – The appraisal uses well accepted definitions
5. **Cost effective** – The main focus of the appraisal is on using the MOSA Process as a means toward fulfillment of benefits
6. **Ease of implementation -** the method could be easily deployed with a minimum of required consultants and outside vendor support.
7. **Understandable** – The method avoids heavy jargon and use of acronyms The terminology used is grounded in common business vernacular.

Appraisal Guidelines

- Ensure the involvement of the sponsor organization and other stakeholders throughout the appraisal process
- Ensure that the appraisal team has proper skills
- Tailor the proposed appraisal method to specific needs and the level of MOSA understanding
- Immediately address the high risk areas and accentuate the positives found
- Do not make the appraisal or MOSA Process improvement an end into itself - Translate the appraisal findings to specific business gains
- Record the traceability between the data collected during the appraisal and the findings and/or ratings
- Findings should specify the appraisal constraints, and serve as a basis for organizational and MOSA process improvements
- Ensure the confidentially of the information
- Ensure open communication
- Do not forget to document throughout the appraisal process
- Be objective