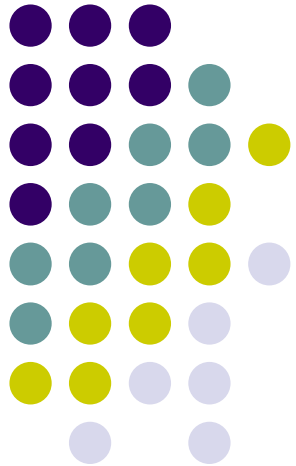
IS 2620

Supply Chain Security



Lecture 10
Oct 10, 2018

ICT Supply Chain

- Complex, Global, Distributed Interconnected Networks
  - Organizations, processes, products, services and infrastructure
  - Today's: Significant Complexity, Diversity and Scale
- System integrators
  - distinct role of assembling information systems, system components, and information services

Example:
Target breach – HVAC company

Global supply chain is the "the next playground for hackers,"
(International Maritime Bureau (IMB))

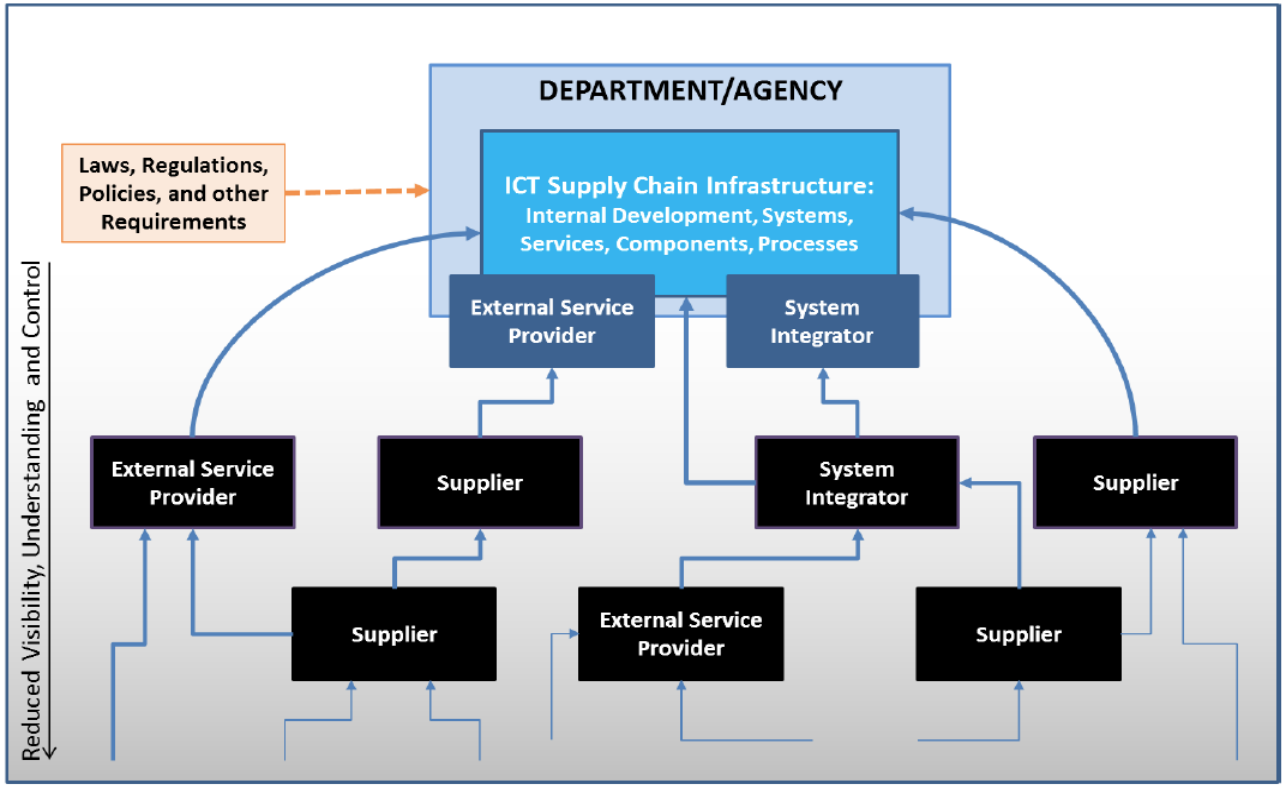
Gartner Says IT Supply Chain Integrity Will Be Identified as a Top Three Security-Related Concern by Global 2000 IT Leaders by 2017

NIST definition

The *ICT supply chain infrastructure* is the integrated set of components (hardware, software and processes) within the organizational boundary that composes the environment in which a system is developed or manufactured, tested, deployed, maintained, and retired/decommissioned.

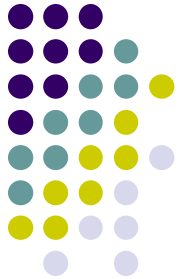
Elements provided by:
- Organization itself,
- System integrators,
- External service provider

Agreement documents



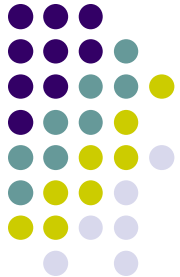
igure 1-2: Federal Agency Relationships with System Integrators, Suppliers, and External Service Providers with Respect to the Scope of NIST SP 800-161.

SC Environment



- System Integrators
  - organizations that provide customized services to an acquirer - custom development, test, and operations and maintenance; may include many suppliers
- Suppliers
  - organizations providing commercial off-the-shelf (COTS) to an acquirer
- External Providers of InfoSys Services
  - Outsourcing IT services –
  - Visibility and control of functionality and security controls are critical

Supply Chain



- The ICT supply chain infrastructure does not include:
  - The information system traversing the supply chain;
  - Any information system not used in the development, testing, maintenance, or retirement of information system components;
  - System integrator, supplier, and external service provider information systems that are outside of the organization's information system boundaries as defined by [NIST SP 800-37 Rev. 1];
  - System integrator, supplier, and external service provider people, processes, and technology that are not engaged in supporting the information *system development life cycle* (SDLC); and
  - The organization's people, processes, and technology not engaged in the SDLC for an information system.
    - For example, organization's shipping and receiving processes handling non-ICT are not included in the ICT supply chain infrastructure, such as food services or paper clips.

Supply Chain Risk

- ICT supply chain risks include
  - insertion of counterfeits, tampering, theft, and insertion of malicious software.
- Risks through exploits of vulnerabilities
  - Reduced functionality: poor or counterfeit components
  - Unwanted functionality: malware inserted, poor quality

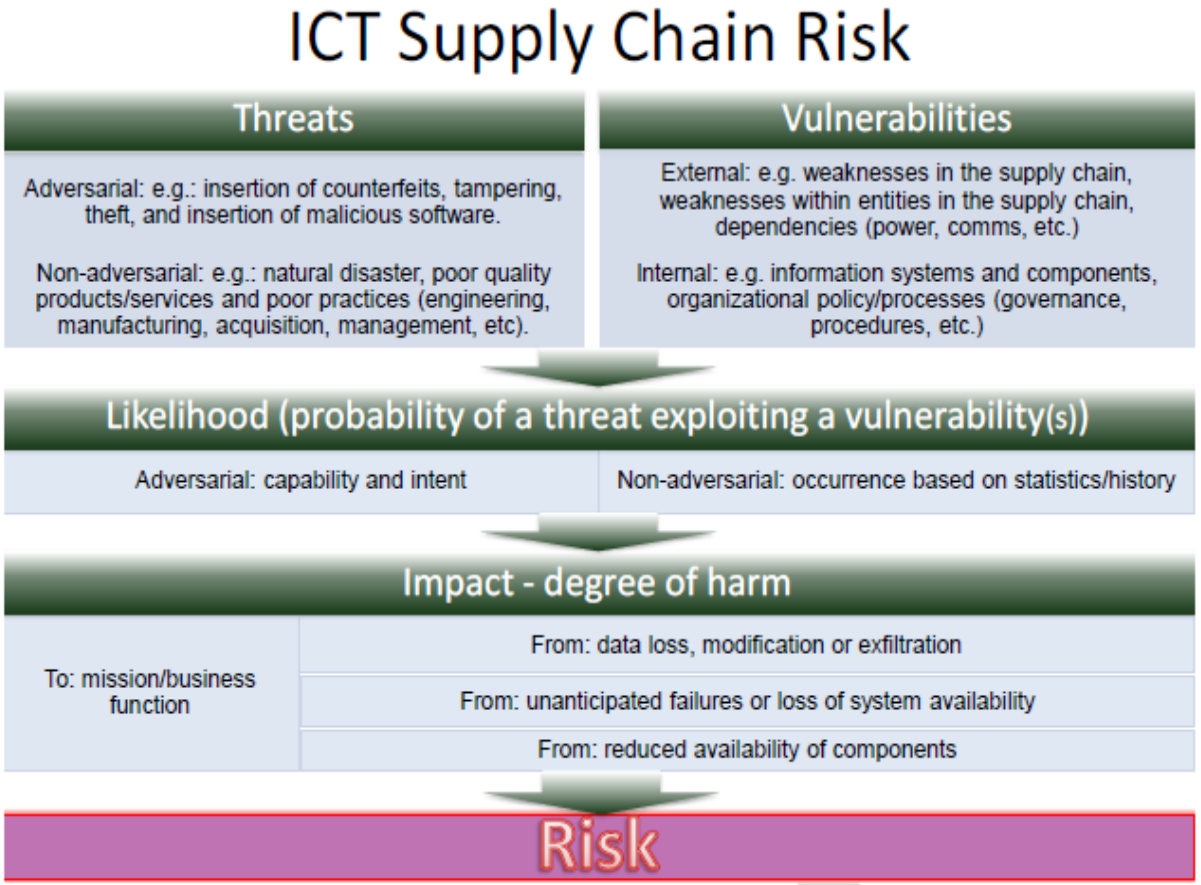
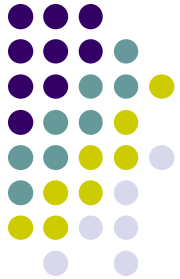


Figure 1-1. ICT Supply Chain Risk

SC and Globalization



- Adversary may include: Individuals, Orgs, Nation-states
  - Directly or indirectly affect management and operations of companies; E.g.,
    - foreign nation states may force (i) a manufacturer to hand over spec of sensitive US system (ii) insert malware
- Need to protect information that
  - describes the ICT supply chain (e.g., information about the paths of ICT products and services, both logical and physical),
  - traverses the ICT supply chain (e.g., intellectual property contained in ICT products and services), and
  - information about the parties participating in the ICT supply chain (anyone who touches an ICT product or service throughout its life cycle).

SC Visibility

WRT: how the technology that they acquire is developed, integrated, and deployed

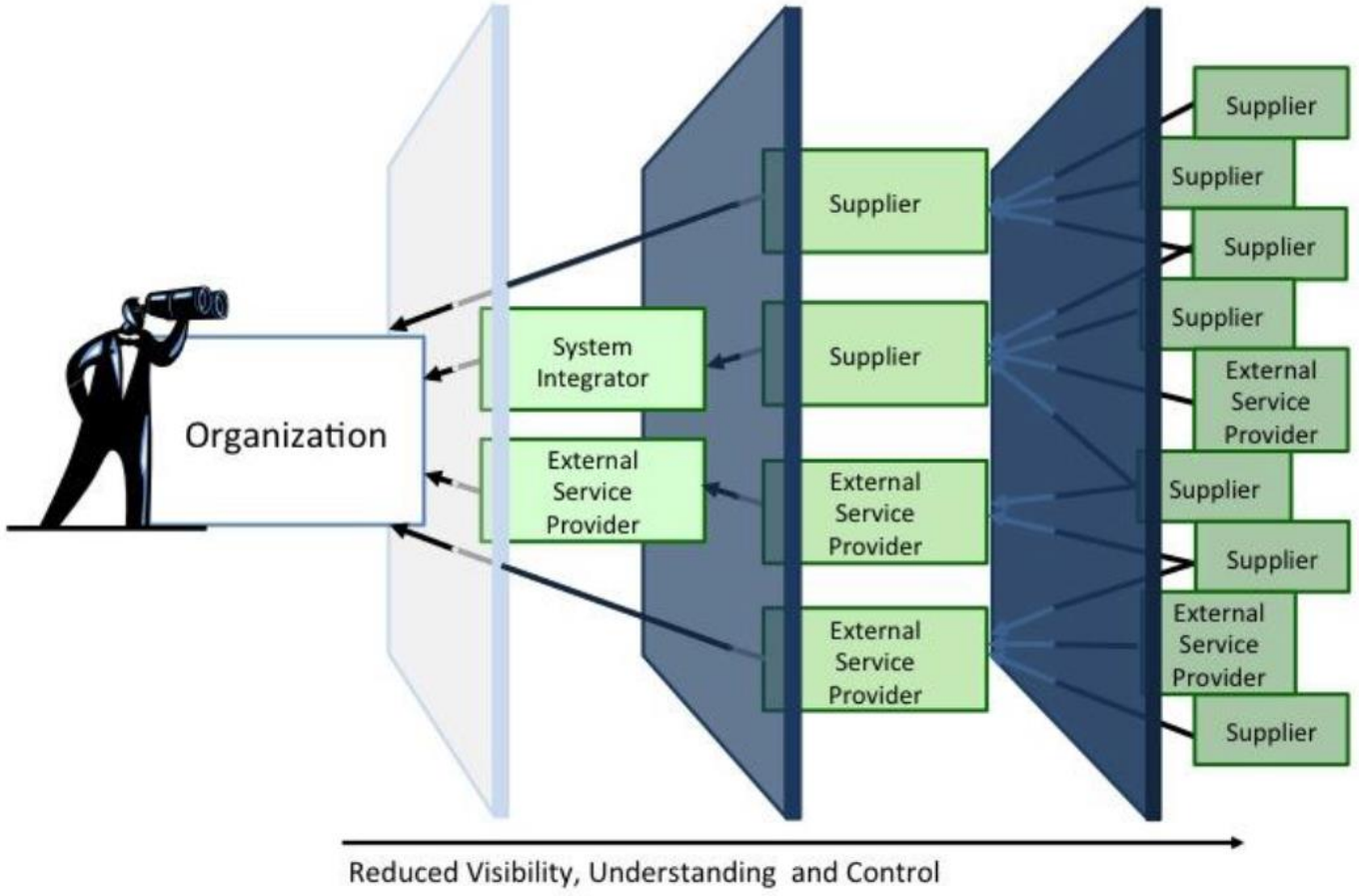
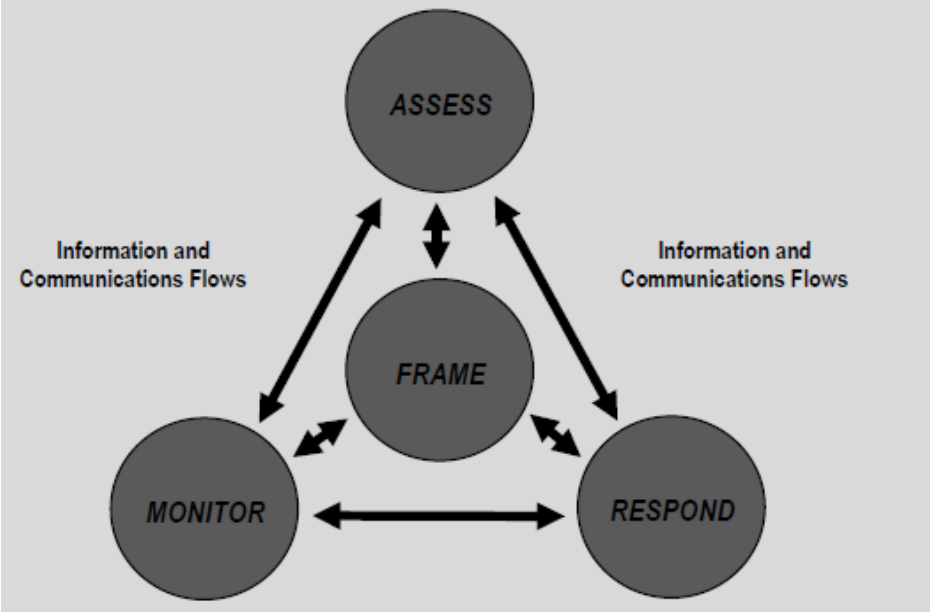


Figure 1-4: An Organization's Visibility, Understanding, and Control of its ICT Supply Chains

Integrate SC with RM

- *Frame risk* – establish the context for risk-based decisions and the current state of the system or ICT supply chain environment;
- *Assess risk* – review and interpret threat, vulnerability, and related information;
- ***Respond to risk once determined*** – select, tailor, and implement mitigation controls; and,
- ***Monitor risk*** on an ongoing basis, including changes to an information system or ICT supply chain environment,



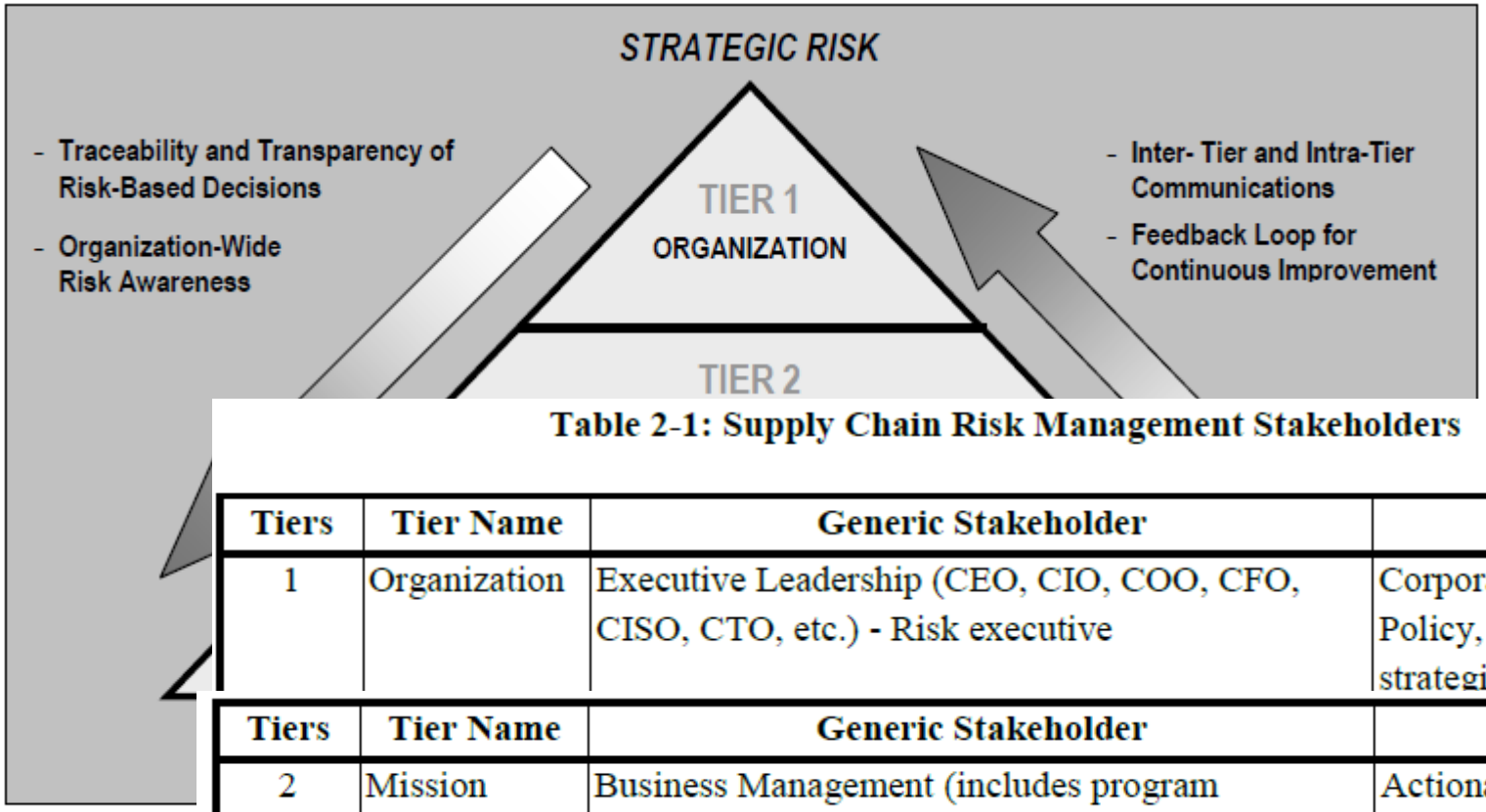


Table 2-1: Supply Chain Risk Management Stakeholders

Tiers	Tier Name	Generic Stakeholder	Activities
1	Organization	Executive Leadership (CEO, CIO, COO, CFO, CISO, CTO, etc.) - Risk executive	Corporate Strategy, Policy, goals and strategies
2	Mission	Business Management (includes program management (PM), research and development (R&D), Engineering [SDLC oversight], Acquisitions / Procurement, Cost Accounting, - "ility" management [reliability, safety, quality], etc.)	Actionable Policies and procedures, Guidance and constraints
3	Operation	Systems Management (architect, developers, QA/QC, test, contracting personnel (approving selection, payment and approach for obtaining, maintenance engineering, disposal personnel, etc.)	Policy implementation Requirements, constraints implementations

ICT SCRM Activities in Risk Management Process

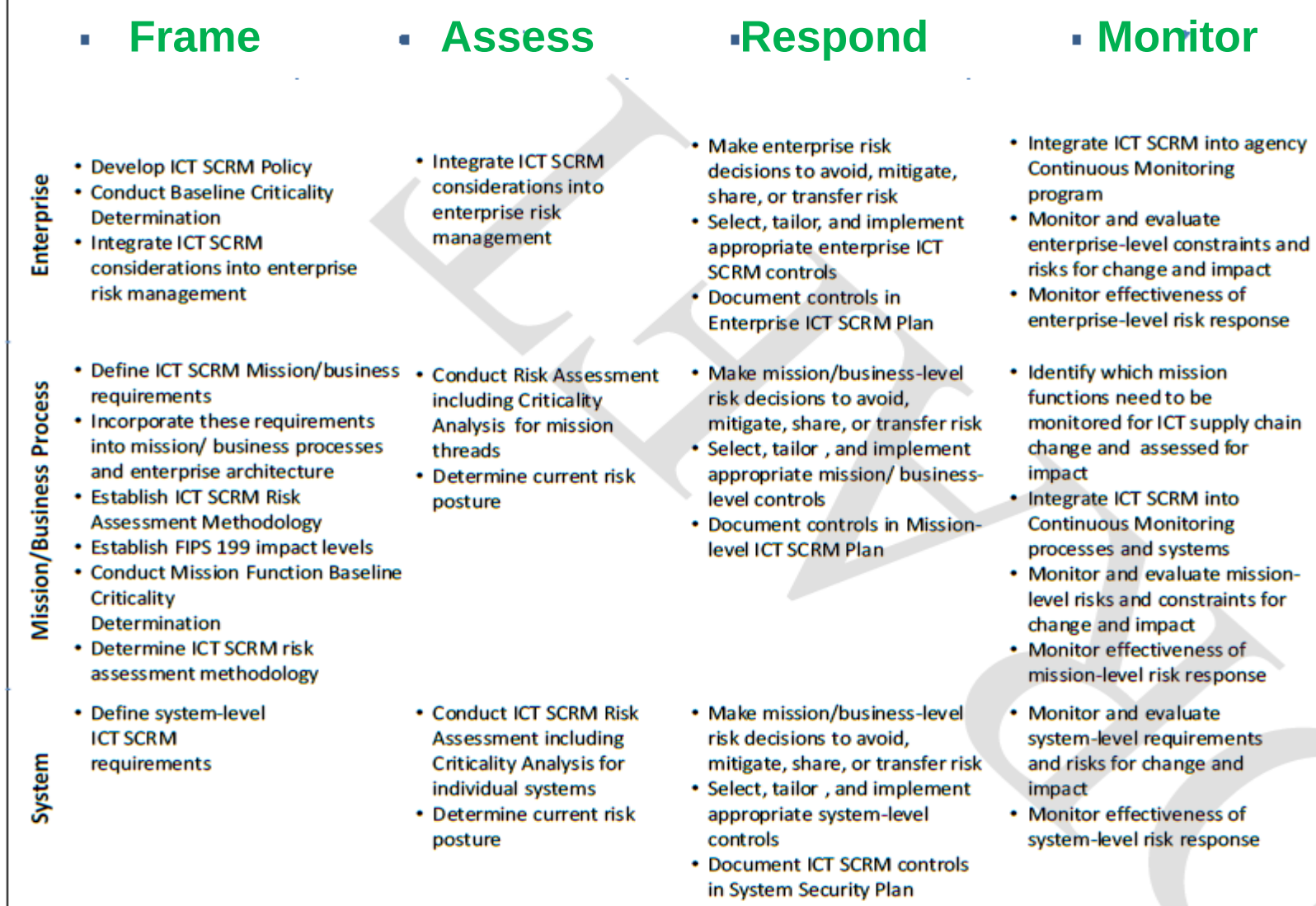


Figure 2-3. ICT SCRM Activities in Risk Management Process

SCRM Risk Assessment Process

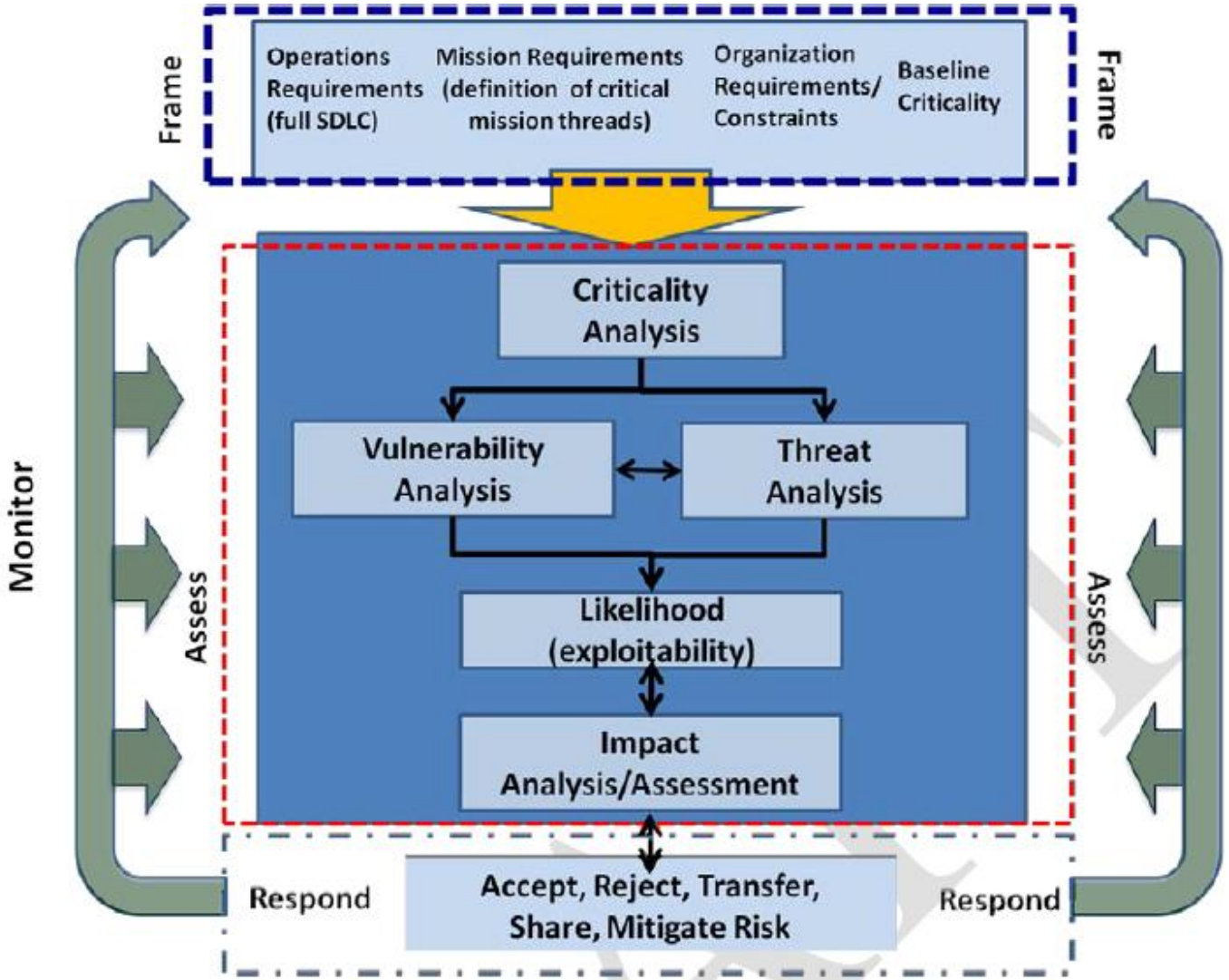


Figure 2-4. ICT SCRM Risk Assessment

Frame Step

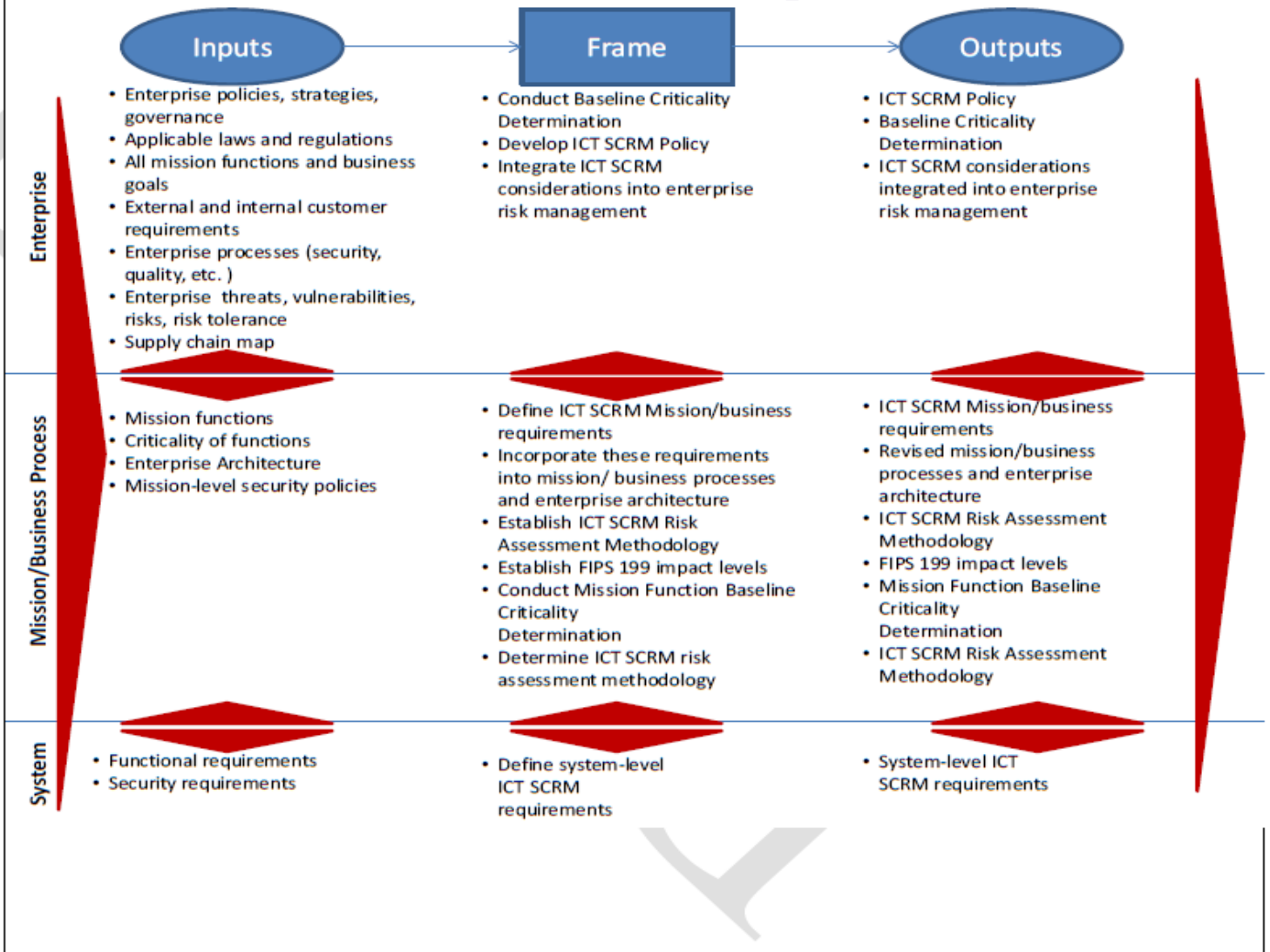


Figure 2-5. ICT SCRM in the Frame Step

Threat Agents

Threat Agent	Scenario	Examples
Counterfeiters	Counterfeits	Criminal groups seek to acquire and sell counterfeit ICT components for monetary gain. Specifically, organized crime groups seek disposed units, purchase overstock items, and acquire blueprints to obtain ICT components that they can sell through various gray market resellers to acquirers.[11]
Insiders	Intellectual property loss	Disgruntled insiders sell or transfer intellectual property to competitors or foreign intelligence agencies for a variety of reasons including monetary gain. Intellectual property includes software code, blueprints, or documentation.[12]
Foreign Intelligence Services	Malicious code insertion (see Appendix F Scenario 3)	Foreign intelligence services seek to penetrate ICT supply chain and implant unwanted functionality (by inserting new or modifying existing functionality) to be used when the system is operational to gather information or subvert system or mission operations.
Terrorists	Unauthorized access	Terrorists seek to penetrate ICT supply chain and may implant unwanted functionality (by inserting new or modifying existing functionality) or subvert system or mission operations.
Industrial Espionage	Industrial Espionage (see Appendix F Scenario 2)	Industrial spies seek to penetrate ICT supply chain to gather information or subvert system or mission operations.

Threat Considerations

Table 2-5. Supply Chain Threat Considerations

Tier	Threat Consideration	Methods
Tier 1	• Organization's business and mission • Strategic supplier relationships • Geographical considerations related to the extent of the organization's ICT supply chain	• Establish common starting points for identifying ICT supply chain threat. • Establish procedures for countering organization-wide threats such as natural disasters.
Tier 2	• Mission functions • Geographic locations • Types of suppliers (COTS, external service providers, or custom, etc.) • Technologies used enterprise-wide	• Identify additional sources of threat information specific to organizational mission functions. • Identify potential threat sources based on the locations and suppliers identified through examining the agency supply chain map.
		• Scope identified threat sources to the specific mission functions, using the supply chain maps. • Establish mission-specific preparatory procedures for countering threat adversaries/natural disasters.
Tier 3	• SDLC	• Consider the phase in the system development life cycle to determine the level of detail with which threats should be considered. • Identify and refine threat sources based on the potential for threat insertion within individual SDLC processes.

Vulnerabilities

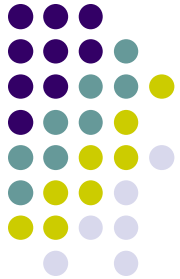
Table 2-6. Supply Chain Vulnerabilities Considerations

Tier	Vulnerability Consideration	Methods

Tier 1	• Organization's business and mission
	• Supplier relationships (e.g., system integrators, COTS, external services)
	• Geographical considerations related to the extent of the organization's ICT supply chain
	  • Enterprise / Security Architecture
	  • Criticality Baseline
		• Examine agency Supply Chain Maps and/or historical data to identify especially vulnerable locations or organizations.
		• Analyze agency mission for susceptibility to potential supply chain vulnerabilities.
		• Examine system integrator and supplier relationships for susceptibility to potential supply chain vulnerabilities.
		• Review enterprise architecture and criticality baseline to identify areas of weakness requiring more robust ICT supply chain considerations.

Tier 2	• Mission functions • Geographic locations • Types of suppliers (COTS, custom, etc.) • Technologies used	• Refine analysis from Tier 1 based on specific mission functions and applicable threat and supply chain information. • Consider using CVEs to characterize and categorize vulnerabilities. • Consider using scoring guidance to prioritize vulnerabilities for remediation.
Tier 3	• Individual technologies, solutions, and suppliers should be considered	• Use CVEs where available to characterize and categorize vulnerabilities • Identify weaknesses

Consequences of SC threats



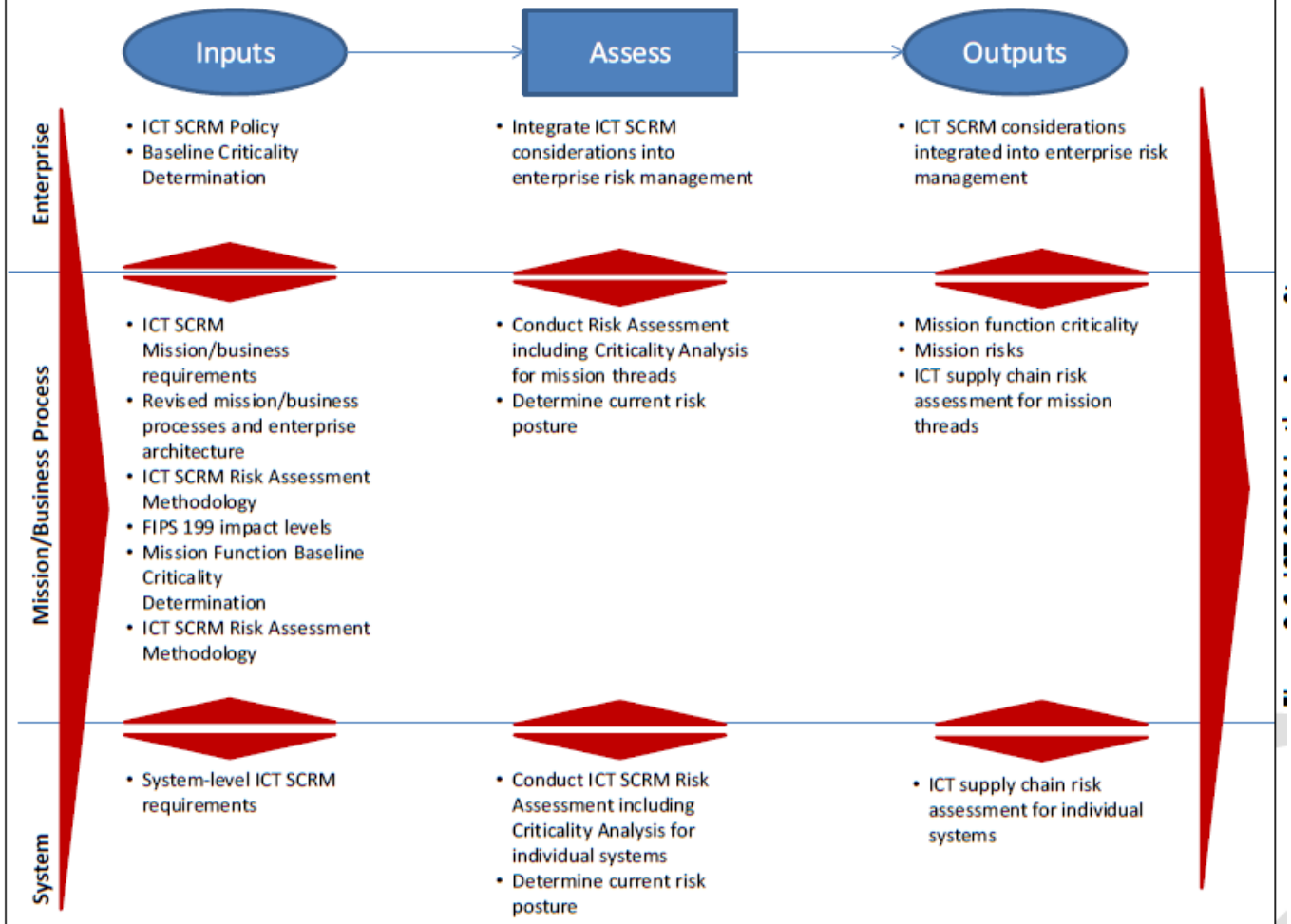
- Examples of SC Consequences and Impact:
  - An earthquake in Malaysia reduced the number of commodity DRAMs to 60% of the world's supply, creating a shortage for hardware maintenance and new design.
  - Accidental procurement of a counterfeit part resulted in premature component failure, therefore impacting organization's mission performance.

Integration with RM

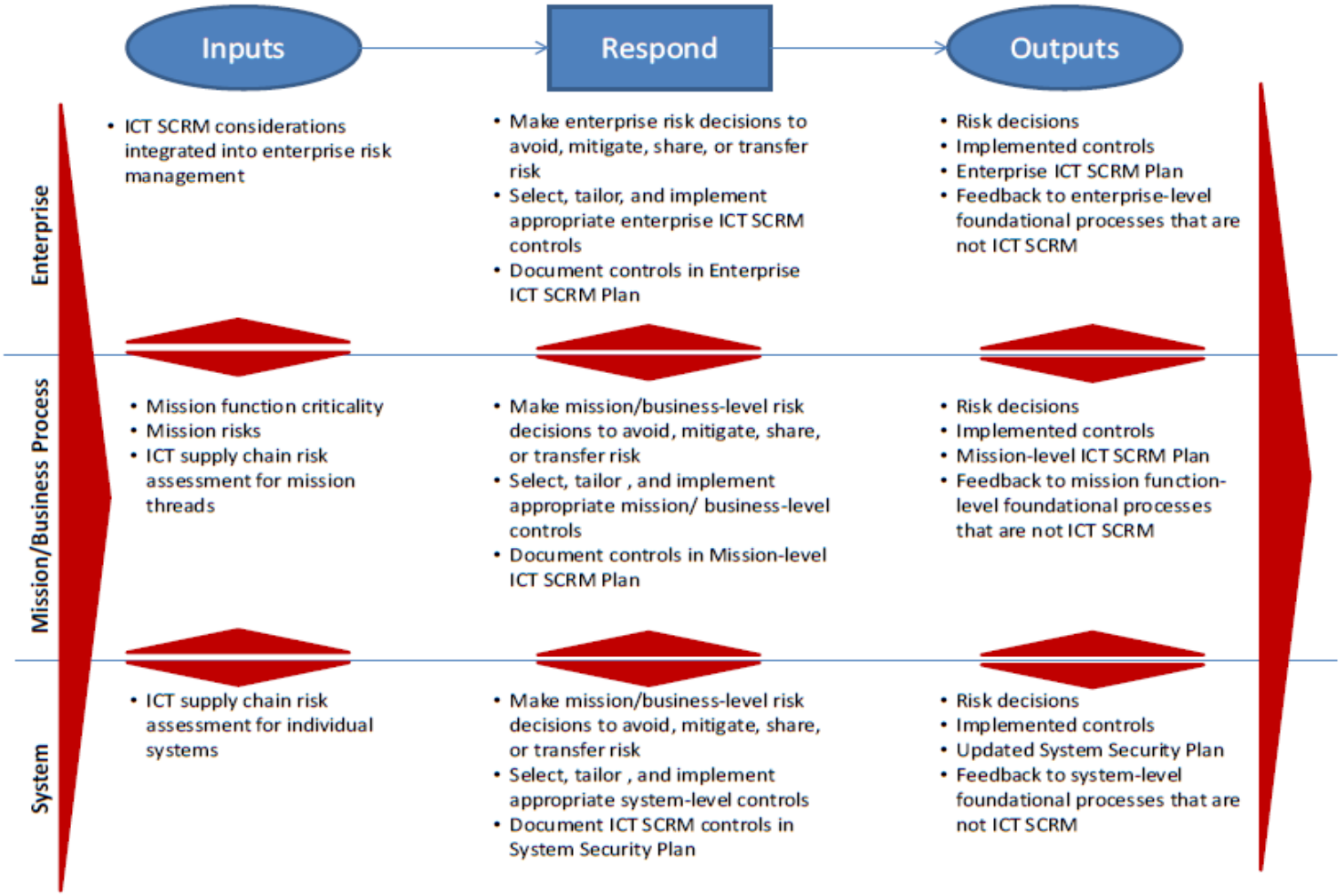
- Need to identify: Agency constraints and SC-specific constraints

Tier	Agency Constraint	ICT Supply Chain Constraint
Tier 1	• Enterprise policies, strategies, governance • Applicable laws and regulations • Mission functions • Enterprise processes (security, quality, etc.)	• Develop enterprise ICT SCRM policy based on the existing agency policies, strategies, and governance; applicable laws and regulations; mission functions; and enterprise processes.
Tier 2	• Mission functions • Criticality of functions • Enterprise Architecture • Mission-level security policies	• Define ICT SCRM Mission/business requirements. • Incorporate these requirements into mission/ business processes and enterprise architecture.
Tier 3	• Functional requirements • Security requirements	• Define system-level ICT SCRM requirements.

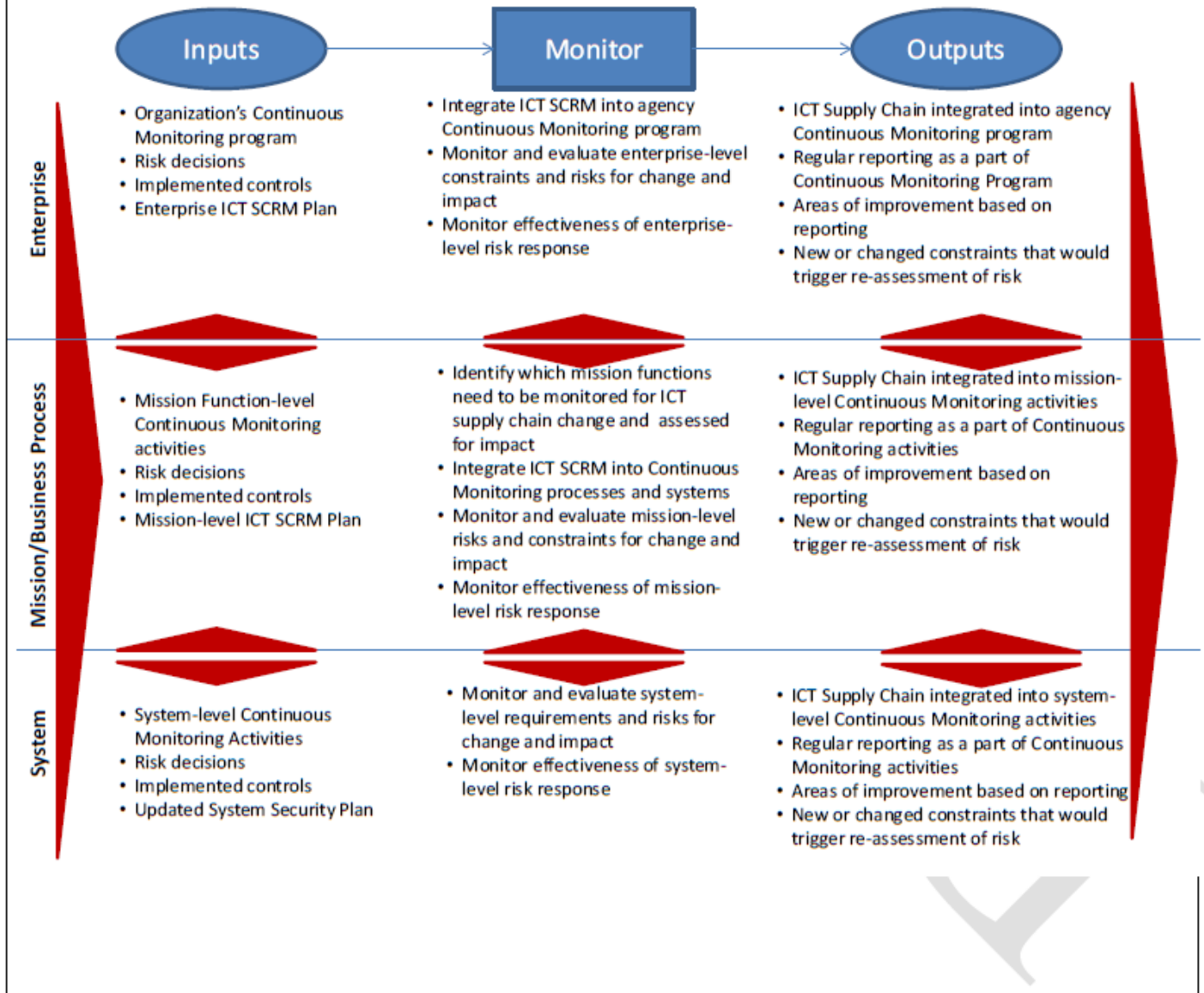
Assess Step


Inputs
Assess
Outputs
Enterprise
• ICT SCRM Policy
• Baseline Criticality Determination
• Integrate ICT SCRM considerations into enterprise risk management
• ICT SCRM considerations integrated into enterprise risk management
Mission/Business Process
• ICT SCRM Mission/business requirements
• Revised mission/business processes and enterprise architecture
• ICT SCRM Risk Assessment Methodology
• FIPS 199 impact levels
• Mission Function Baseline Criticality Determination
• ICT SCRM Risk Assessment Methodology
• Conduct Risk Assessment including Criticality Analysis for mission threads
• Determine current risk posture
• Mission function criticality
• Mission risks
• ICT supply chain risk assessment for mission threads
System
• System-level ICT SCRM requirements
• Conduct ICT SCRM Risk Assessment including Criticality Analysis for individual systems
• Determine current risk posture
• ICT supply chain risk assessment for individual systems

Respond Step



Monitor Step



Summary

- Supply Chain Risk Management is critical to ensuring the overall system security
- Proper integration of SCRM within the organizational RM is important
- Three tiers of organizational risk management need to be adopted for SCRM