

# Open Innovation and Technology Maturity Analysis

**U.S. Department of Defense (DoD)  
R&D and Technology Management**

TMC 2007  
Sept 11-13, 2007

Presented by:  
Has Patel  
Infologic, Inc.  
[has.patel@infologic.com](mailto:has.patel@infologic.com)  
(888) 325 0500 Ext. 100



**INFOLOGIC**  
*The logical approach to harness innovation*

INFOLOGIC, INC.  
1048 Irvine Avenue #624  
Newport Beach, CA 92660  
[www.infologic.com](http://www.infologic.com)

# Report Documentation Page

Form Approved  
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>SEP 2007</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2007 to 00-00-2007</b>	
4. TITLE AND SUBTITLE <b>Open Innovation and Technology Maturity Analysis</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Infologic, Inc.,1048 Irvine Avenue #624,Newport Beach,CA,92660</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM002182. Presented at the AFRL Technology Maturity Conference held in Virginia Beach, VA on 11-13 September 2007.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>48</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# Agenda

## ART to SCIENCE ?

**I. Innovation Management:** Innovation Agenda for Public and Private Organizations: Concerns, Needs and Strategies, Why Innovation Management Art?, Need to convert to Science. Define an Innovation Management Model.

**II. Innovation Management: DoD R&D and Technology Management Process**

Develop a framework which incorporates DoD Acquisition Management framework (e.g: TRLs), DoD Business Transformation strategies (e.g: Evolutionary Acquisition), GAO Recommendations (e.g: Knowledge-based Acquisition), DoD Community concerns & suggestions (e.g: Multi-Dimension Maturity Analysis, System of Systems integration), and Industry best practices (e.g: the Gate Process, CMMI, Technology Hype Cycle and Adoption Cycle.

**III. Knowledge-Based Gate Process:** An Art to Science process which may be employed by DoD R&D organizations and Program Managers to manage technologies through their life cycle. Introduce an Innovation Management methodology: TechIP ( Technology Insertion Plan )

**IV. Execution:** Strategies to implement the Framework and Process.

# Strategic Issues: Innovation Agenda

## Challenges

### ■ Innovation Agenda?

- Developing breakthrough products, revamping processes, and introducing improved or new business models.
- Emerging Technology Insertion & Integration.
- Open Innovation (export and import Intellectual Property (IP) and technologies).

### ■ Why Innovation Agenda?

- Private Organizations: Challenges of a flattened, competitive and information rich global economies (New consumers, shifting demographics, Global R&D and Technology villages and External & Global Intellectual Property (IP) sources).
- Public Organizations (DoD): Meeting the Security challenges of the 21<sup>st</sup> Century (Imperatives – Strategic, Technology, Threat and Risk Mitigation)

### ■ What Are we doing to meet these challenges?

# Strategic Issues: Meeting the Challenges

## Innovation Management Needs Recognized

■ **Private Organizations:** Recent Gartner Group, Deloitte and IBM studies have said Innovation is the “top of the mind” for corporate and public CEOs. Recent IBM study, titled: “Expanding the Innovation Horizon” concluded that:

- Business Model Innovation Matters: Business process innovation
- External Collaboration is Indispensable: Collaboration beyond the walls
- Innovation requires Orchestration from the top: Strategic commitments, teams, rewards and technology/process integration

■ **Public Organizations (DoD):** DoD Force Transformation:

- Support the Joint Warfighting Capability of the DoD
- Enable Rapid Access to Information for Strategic Decisions
- Reduce the Cost of Defense Business Operations
- Improve Financial Stewardship to the American People

# Strategic Issues: Innovation Management is Art

## Call to Action: An Innovation Management model which incorporates rigor, metrics and discipline



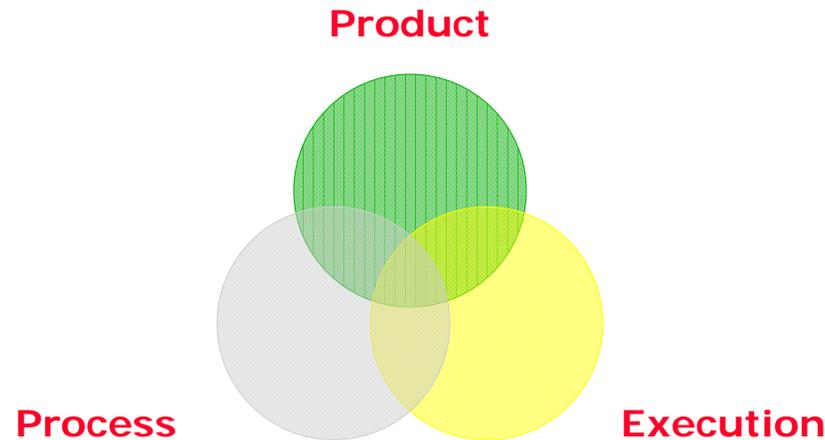
- Innovation should be held as same measurement rigor as other core functions.
- Innovation Opportunity Is About How the Process is Managed – Not Just Ideas and Creativity
- Improving Innovation is not Beyond Leaders' Control – It must be measured and controlled
- Key Innovation Mistakes: Not Emphasizing Speed, and Not Managing with Discipline and Aggressiveness



- Defense Transformation: Clear Leadership, Accountability, and Management Tools Are Needed to Enhance DOD's Efforts to Transform Military Capabilities [GAO-05-70](#)
- Best Practices: Stronger Practices Needed to Improve DOD Technology Transition Processes [GAO-06-883](#)

# Innovation Management Model

**Innovation = f (Product, Process, Execution)**



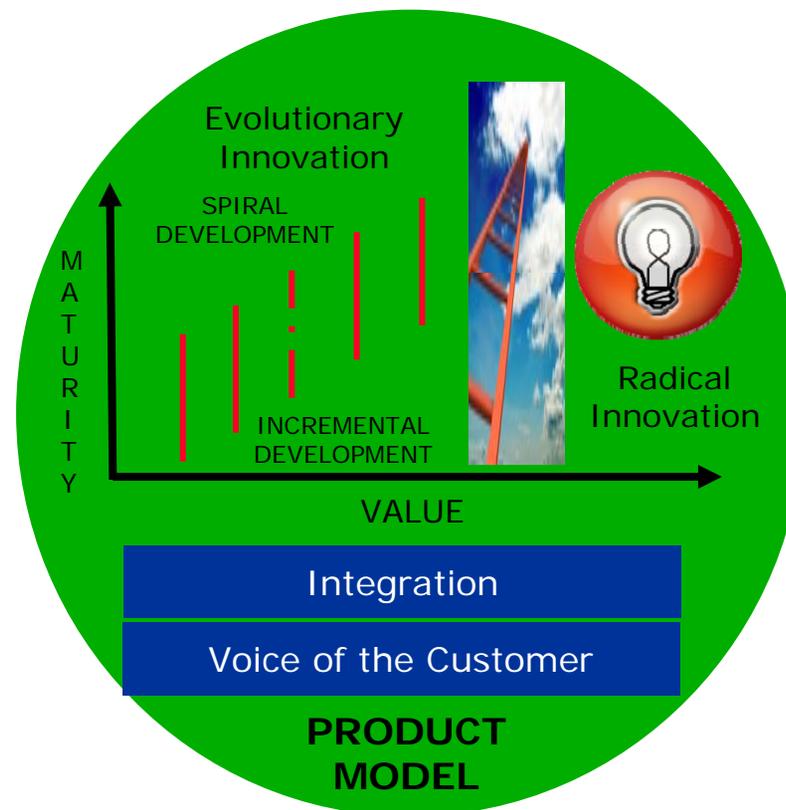
- **Product:** Technology-heavy (e.g: Airplane, iPod) OR Service-heavy (e.g: Starbucks System, eBay)
- **Process:** Any critical business process to ensure the success of product (e.g: iTunes for iPod, Marketing and Supply Chain Management)
- **Execution:** Management strategies to ensure that Innovation works! (WILL to ACT !!)

To measure the success of Innovation in an organization, maturity analyses should be conducted for all THREE components:

**Product, Process and Execution**

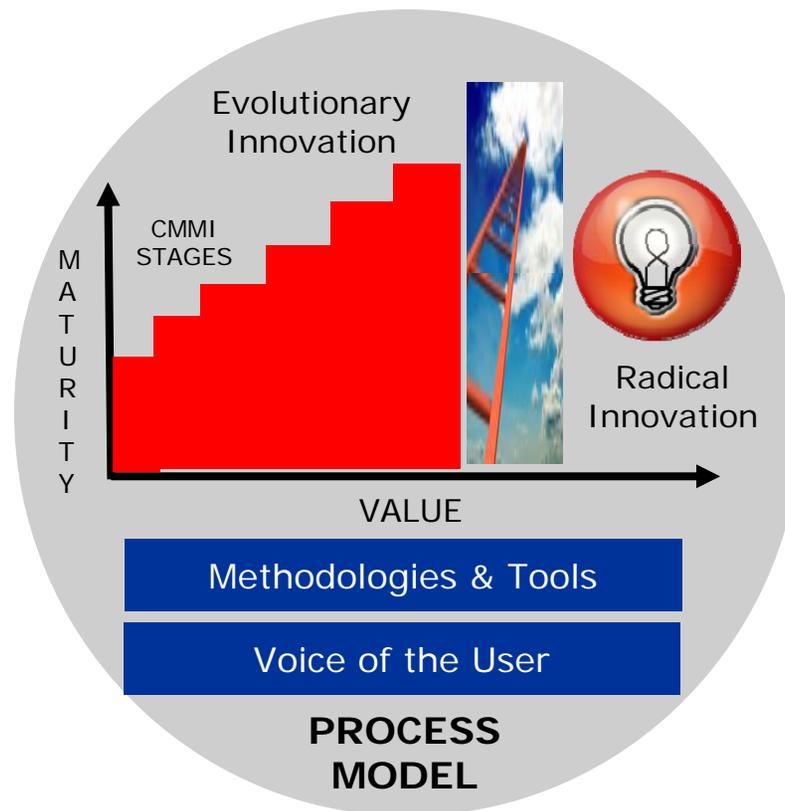
# Model: Product Maturity

## Spiral Development, Multi-Dimension Maturity Analysis, Integration and Voice of the Customer



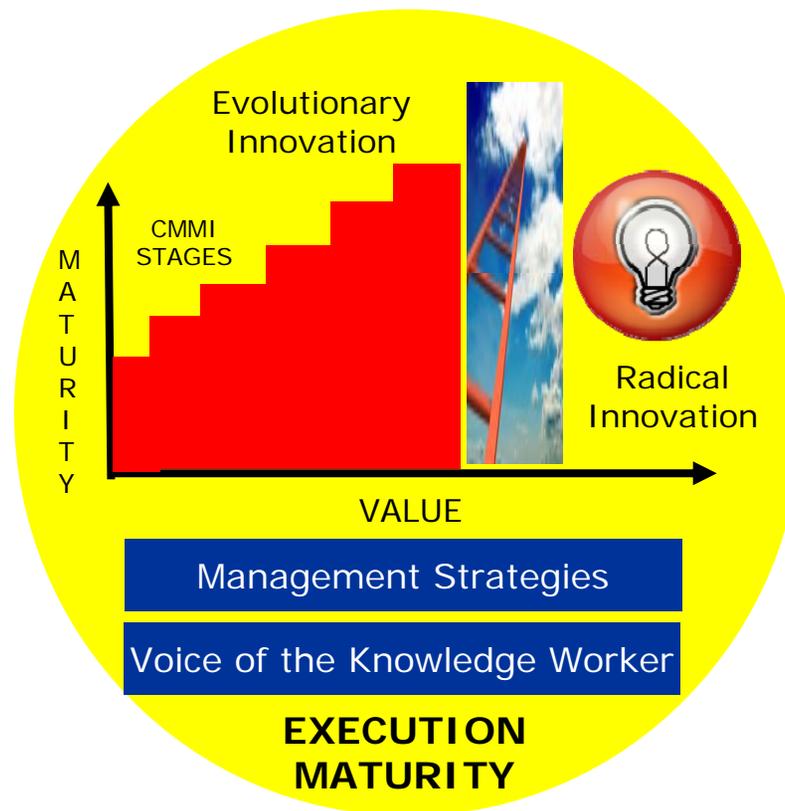
# Model: Process Maturity

**Model based on CMMI , Methodologies & Tools,  
and Voice of the User**



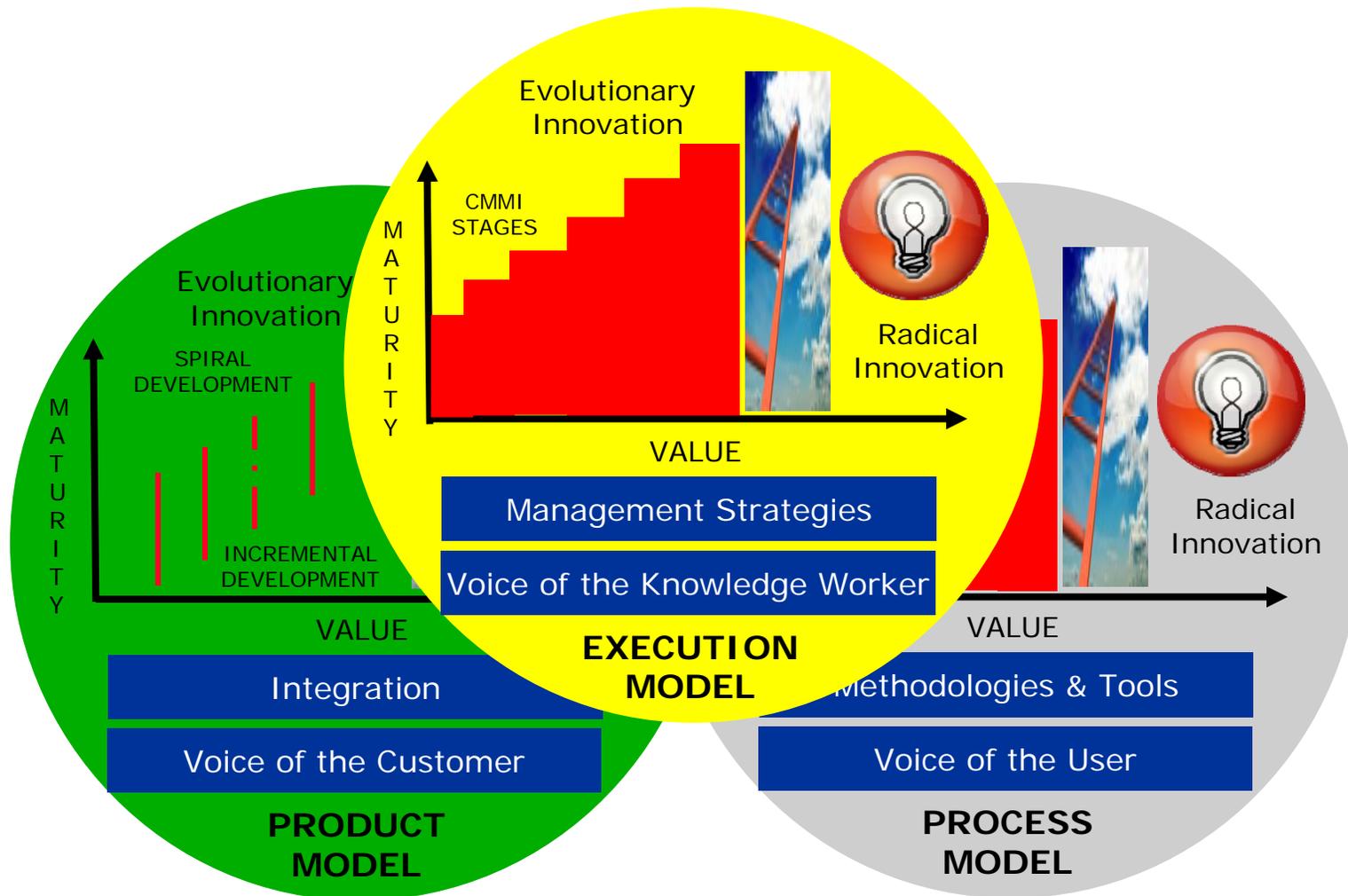
# Model: Execution Maturity

Model based on CMMI, Management Strategies, and Voice of the Knowledge Worker



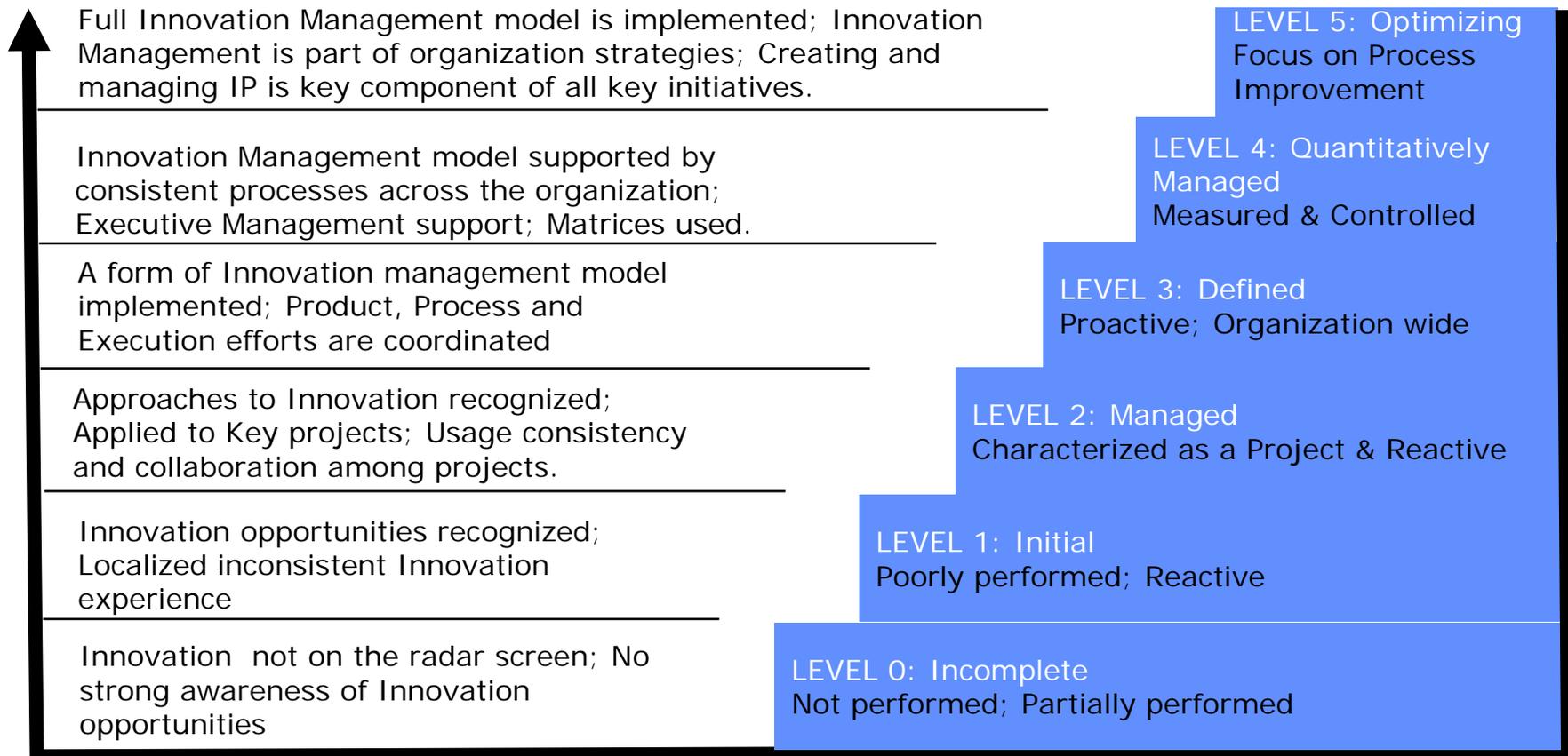
# Innovation Management Model: Components

**Innovation Maturity = f (Product, Process, Execution)**



# Innovation Management Model: Maturity

**Innovation Management is a Process and should be matured using the CMMI methodology**



# Innovation Model: Implementation

## An Innovation Model can be applied to varied functions of an Organization

### ■ Private Organizations

- Organization wide Innovation maturity – measure and control the whole organization's current level of maturity in adopting Innovation
- Product specific – measure and control Innovation in a given product (e.g: Idea to market for a given widget.)
- Process specific - measure and control Innovation in a given Process (e.g: Human Resource Management)

### ■ Public Organizations (DoD)

- Program Specific – measure the maturity of technologies and processes for a given Program through its life cycle (e.g: FCS)
- Sector Specific – measure the Innovation maturity of an organization (e.g: R&D and Technology Management)
- Initiative specific – measure the Innovation maturity for an Initiative (e.g: eGov)

# Agenda (Recap)

## ART to SCIENCE : A Framework

**I. Innovation Management:** Innovation Agenda for Public and Private Organizations: Concerns, Needs and Strategies, Why Innovation Management Art?, Need to convert to Science. Define an Innovation Management Model.

**II. Innovation Management: DoD R&D and Technology Management Process**

Develop a framework which incorporates DoD Acquisition Management framework (e.g: TRLs), Force Transformation strategies (e.g: Evolutionary Acquisition), GAO Recommendations (e.g: Knowledge-based Acquisition), DoD Community concerns & suggestions (e.g: Multi-Dimension Maturity Analysis), and Industry best practices (e.g: the Gate Process, CMMI, Technology Hype Cycle and Adoption Cycle).

**III. Knowledge-Based Gate Process:** An Art to Science process which may be employed by DoD R&D organizations and Program Managers to manage technologies through their life cycle. Introduce an Innovation Management methodology: TechIP ( Technology Insertion Plan )

**IV. Execution:** Strategies to implement the Framework and Process.

# Innovation Management Process Pitfalls: DoD R&D and Technology Management

## Need Process Re-engineering

### ■ Generic

- Lack of Common technology maturation and risk control matrices (a la financial ratios)
- Gap between R&D Portfolios and Program technology needs
- Use of ad-hoc software tools which do not address the product or technology life cycle
- Lack industry “best practices”- The Gate Process, Technology Hype & Adoption Cycles
- Undefined relationship management (between R&D and Program Management)

### ■ R&D Organizations

- Do not address technology transfer, insertion and INTEGRATION requirements
- “too much reliance” on technologists who are “sold” on their work; creating “Hype”
- Manages internally developed R&D projects
- A number of research efforts are undirected, unfocused and unproductive.

### ■ Program Management Offices

- TRLs conducted “too late/too few”; S&T Community “Hype” and PM’s “under pressure”
- Does not provide links to related methodologies, such as Spiral Development (SD).
- Addresses only “hard” technologies (hardware, software, etc.), and not “soft” technologies (algorithms, formulas, models, methodologies, work flow, etc.)

# Innovation Management Environmental Issues: DoD R&D and Technology Management

## Environmental Issues should be part of Innovation Management Process Development efforts

### ■ DoD Acquisition Management

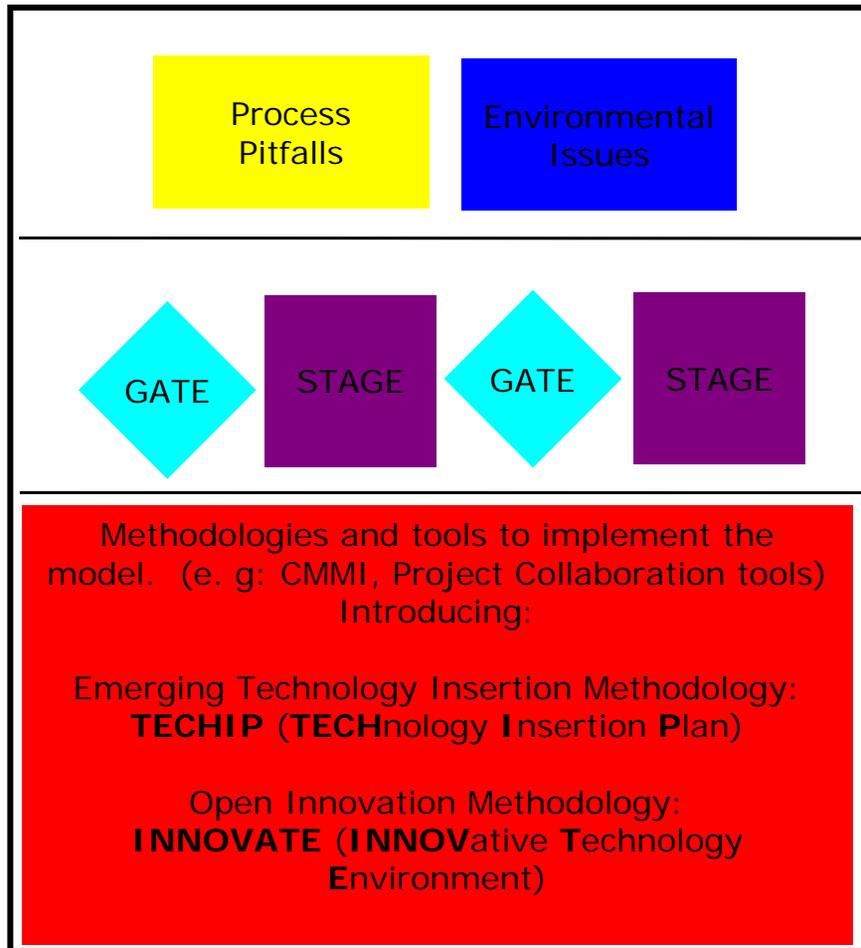
- DoDi/FAR 5000.5 - TRLs are single dimension & partially conducted
- Defense Transformation – Business transformation; Cost reduction; Evolutionary Development
- GAO Recommendations – Knowledge-based technology management
- DoD Community suggestions – Multi-level maturity; System-of-Systems (SoS) maturity

### ■ Industry Best Practices

- CMMI – widely adopted by Government and Industry
- Gate Process – Over 75% major U.S. product developers use some kind of Gate Process
- Hype Cycle – Gartner developed; large private organizations use for technology planning
- Adoption cycle – Technology based organizations use to position their products

# A Proposed Solution: A Gate Process which Addresses Pitfalls & Issues

## An Innovation Management Business Model



■ **BUSINESS MODEL:** A R&D and Technology Management Gate process which addresses .....

- **Process Pitfalls:**  
Generic;  
R&D Organizations;  
Program Management Offices.
- **Environmental Issues:**  
DoD Acquisition Management;  
Industry Best Practices.

■ **AGENDA:**

- Secure Sponsorship & develop plan
- Start with existing practices
- Migrate to a business model
- Communicate & Coordinate
- Track Progress

# Agenda - Recap

## ART to SCIENCE : A Methodology

**I. Innovation Management:** Innovation Agenda for Public and Private Organizations: Concerns, Needs and Strategies, Why Innovation Management Art?, Need to convert to Science. Define an Innovation Management Model.

**II. Innovation Management: DoD R&D and Technology Management Process**

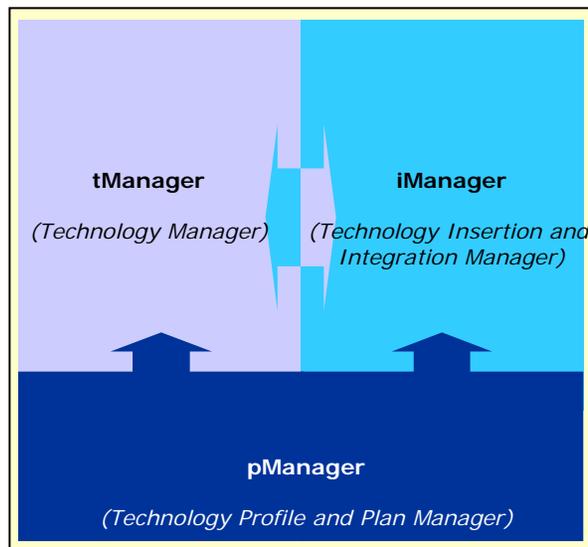
Develop a framework which incorporates DoD Acquisition Management framework (e.g: TRLs), Force Transformation strategies (e.g: Evolutionary Acquisition), GAO Recommendations (e.g: Knowledge-based Acquisition), DoD Community concerns & suggestions (e.g: Multi-Dimension Maturity Analysis), and Industry best practices (e.g: the Gate Process, CMMI, Technology Hype Cycle and Adoption Cycle).

**III. Knowledge-Based Gate Process:** An Art to Science process which may be employed by DoD R&D organizations and Program Managers to manage technologies through their life cycle. Introduce an Innovation Management methodology: TechIP ( Technology Insertion Plan)

**IV. Execution:** Strategies to implement the Framework and Process.

# TechIP Methodology: Introduction

**TechIP Methodology consists of two models, tManager & iManager, and associated tools, called pManager**



## ■ What is TechIP?

A knowledge-based Gate process and associated tools that can be used to identify critical research and technology elements, perform multi-dimension maturity analysis, risk assessment, technology insertion and integration activities for the full life cycle of a product.

## ■ Stages/Gates:

Consists of nine innovation gates and stages, named **iGate (Innovation Gate)** & **iStage (Innovation Stage)**

## ■ Components:

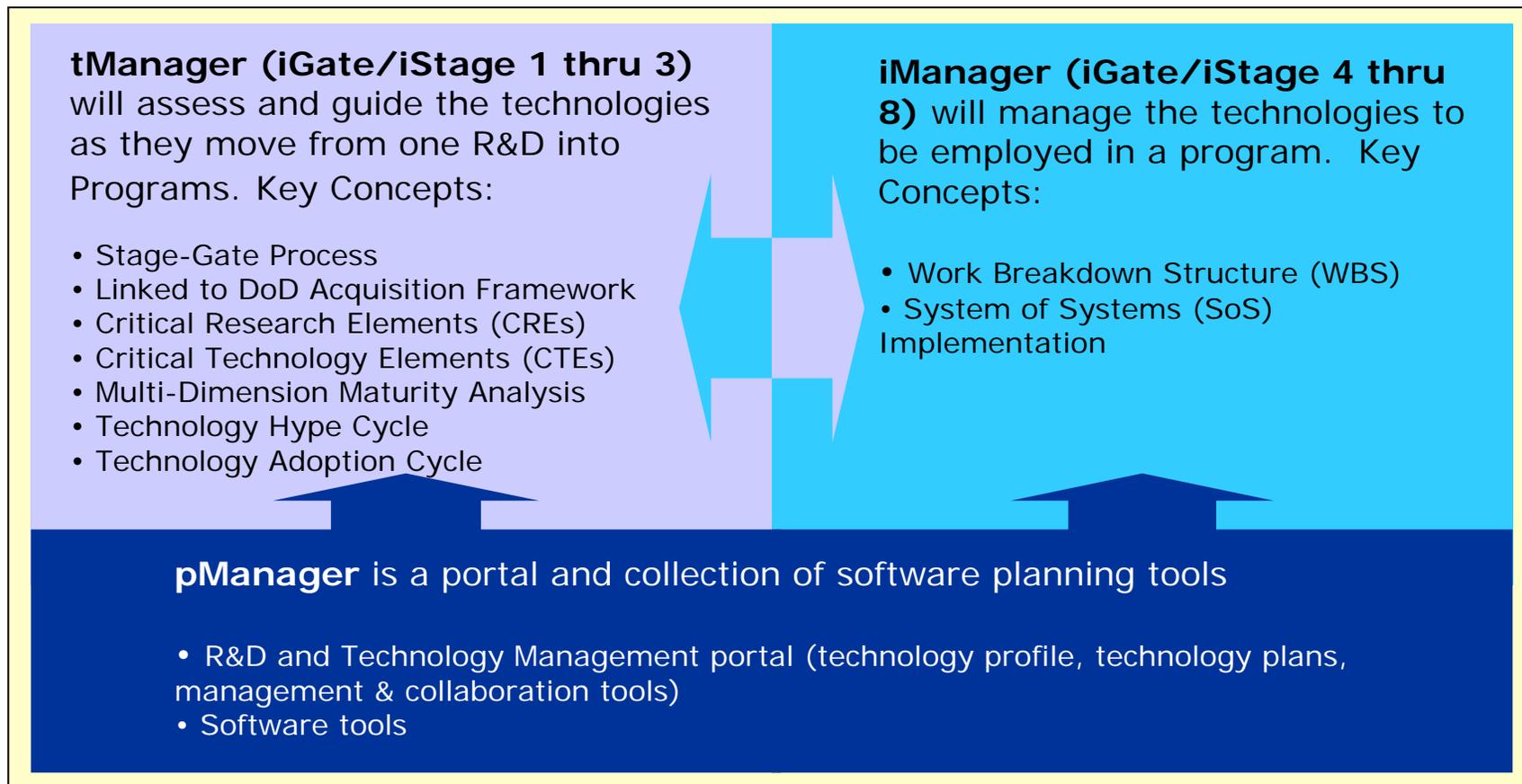
**tManager (Technology Manager)**

**iManager (Insertion and Integration Manager)**

**pManager (Profile and Plan Manager)**

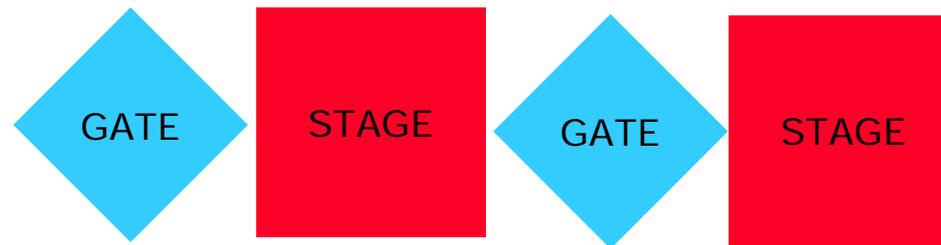
# TechIP Methodology: Components

**TechIP methodology provides a framework for the management of technology through its lifecycle.**



# TechIP : Stage Gate Process

The Gate process is a road map for moving a product from one STAGE to the next, using a GATE as a decision point.



## BENEFITS:

Product/Service portfolio align with organization objectives  
Portfolio has high value and balanced projects  
Projects stay within budget & done on time  
Spending reflects strategy

## STAGES:

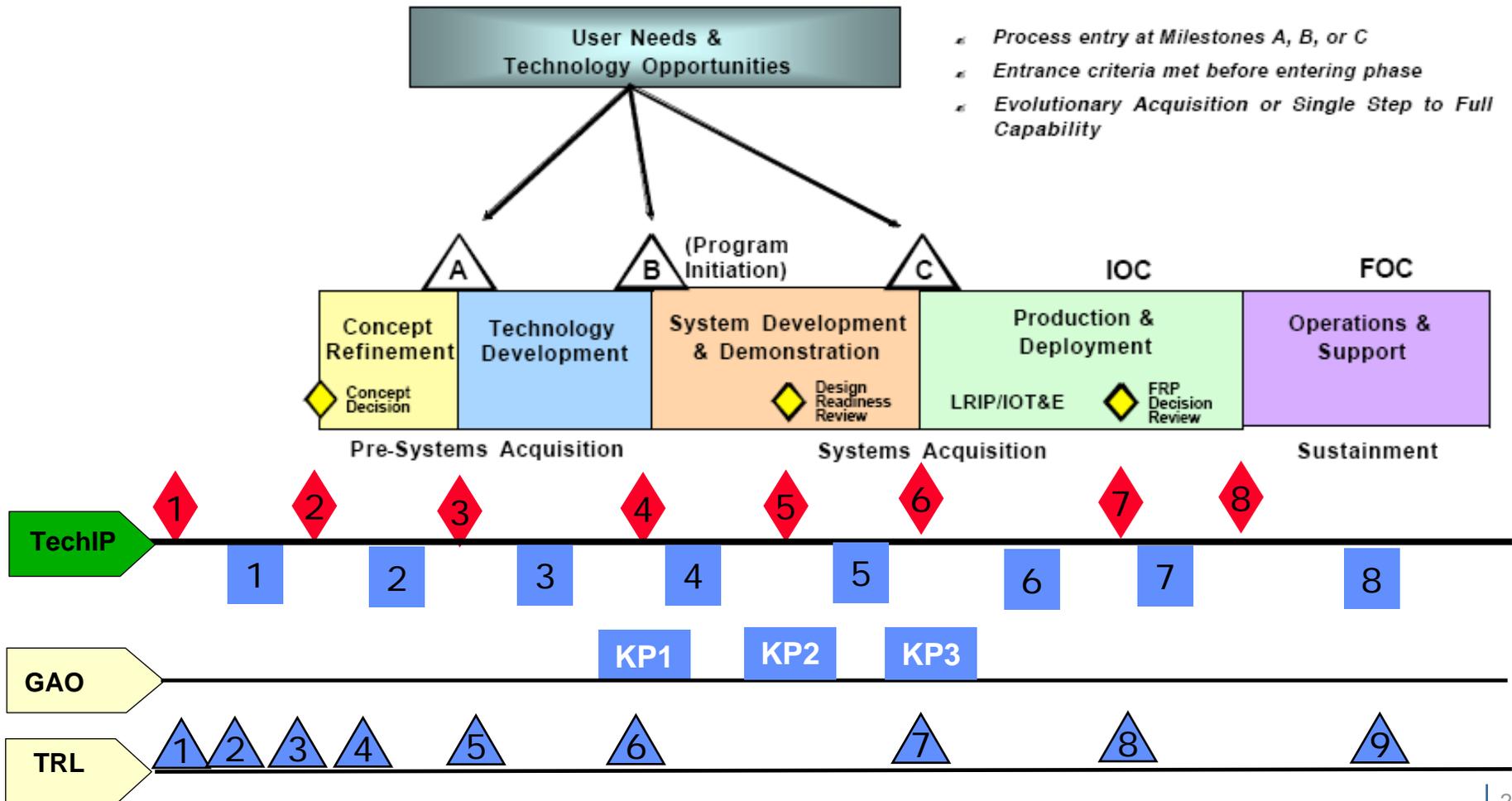
- Stages are where action occurs
- The team players undertake key tasks to gather information needed to advance the project to next point
- Stages are cross functional
- Each stage costs more than preceding stage - risk decreases and investments are allowed to mount

## GATES:

- Quality control check point
- Go/Kill and Prioritization decision points
- Path forward for the next STAGE and resource commitments are decided
- Common Formats:  
Deliverables, Criteria and Output

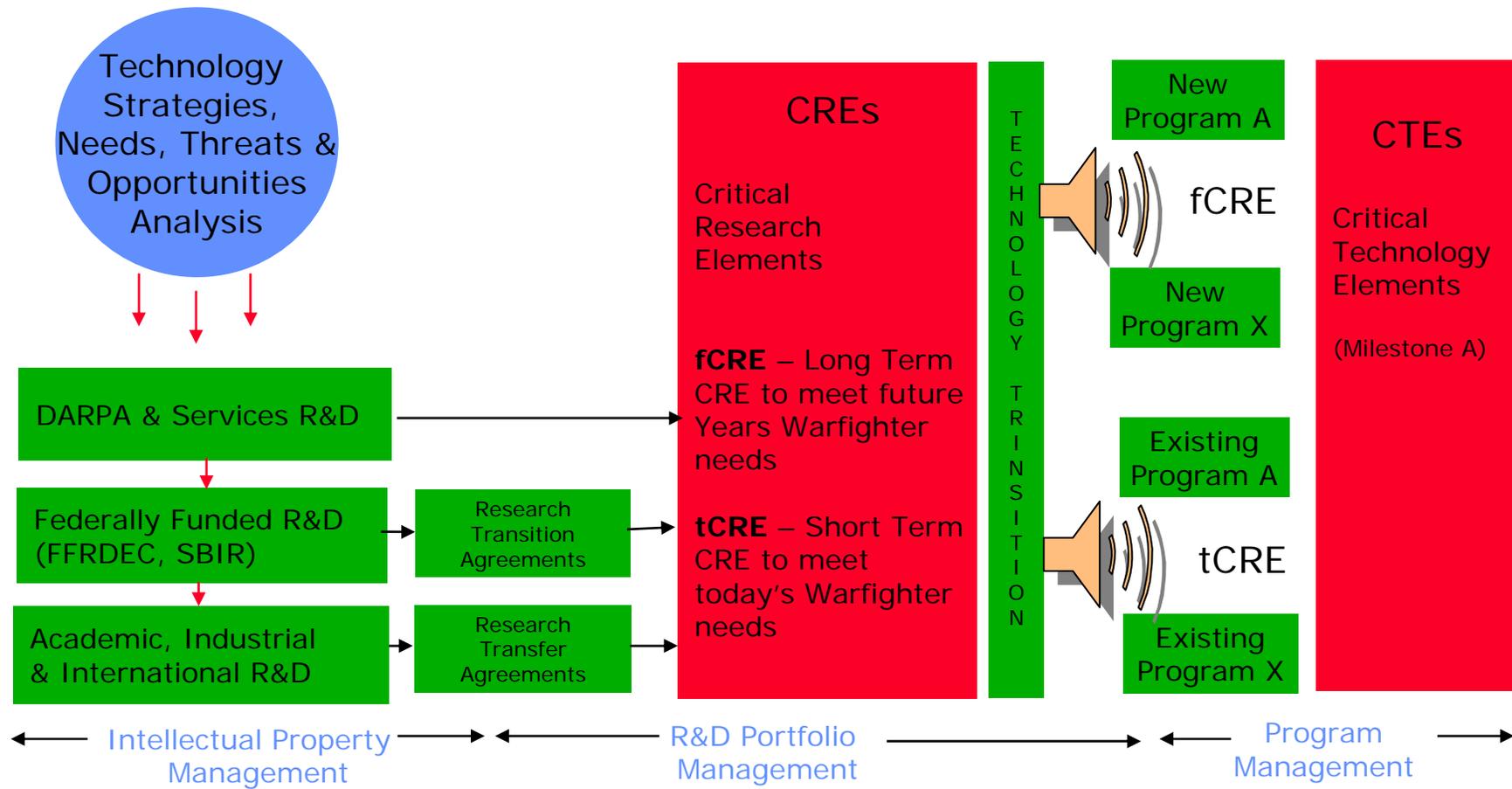
# TechIP & DoD Acquisition Framework

## TechIP steps aligned to the DoD Framework



# TechIP: Critical Research Elements

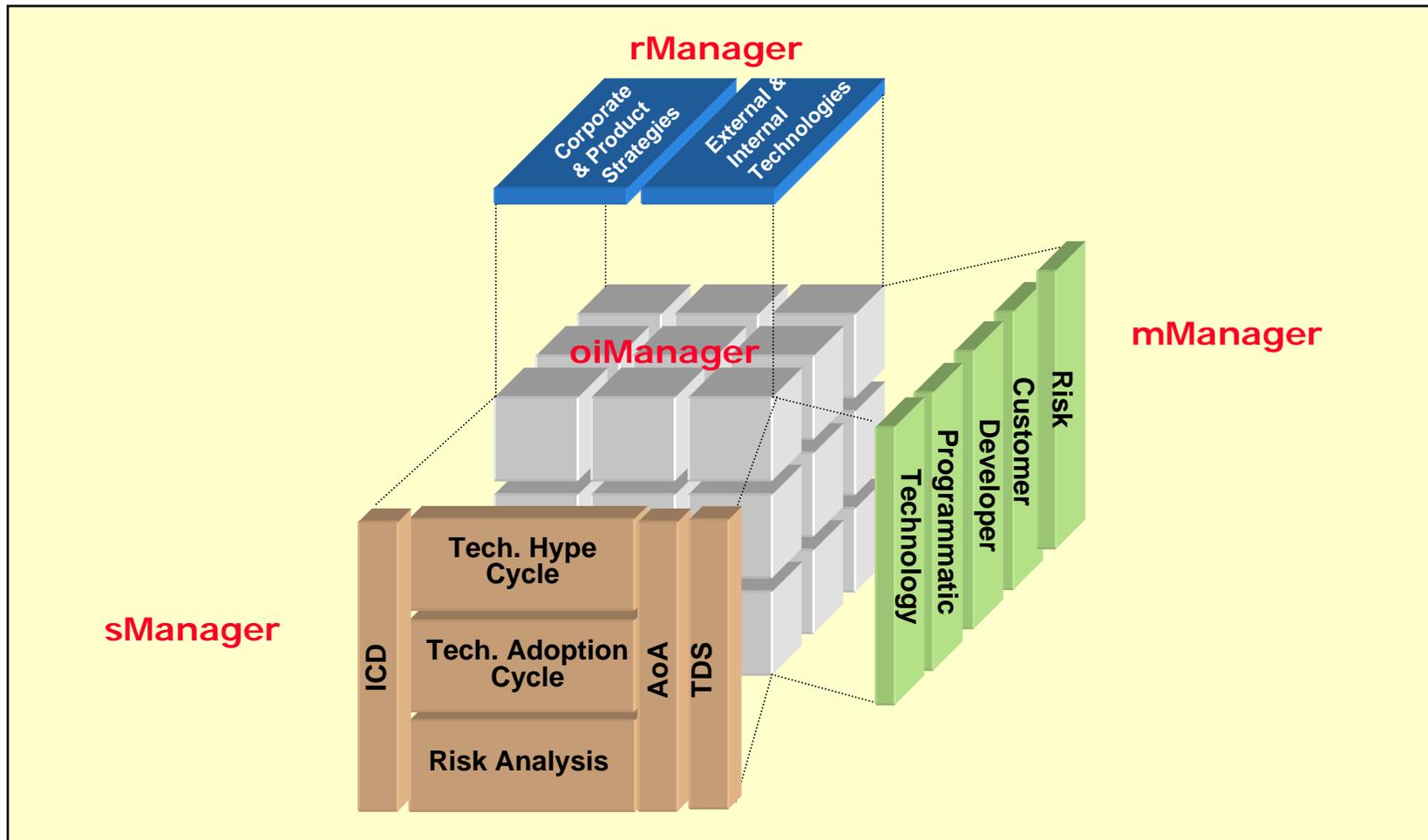
## TechIP links IP, R&D Portfolio and Program Management



Multi-Dimension Technology Maturity Analysis (InnovaTE Methodology)

# TechIP: Multi-Dimension Maturity Analysis - InnovaTE (Innovative Technology Environment)

The methodology comprises of reviewing user needs and technology opportunities (**rManager**), selecting Critical Technology Elements (**sManager**), conducting maturity analysis (**mManager**), and managing the Open Innovation process (**oiManager**)



## Multi-Dimension Maturity Analysis

### ■ Original Concept

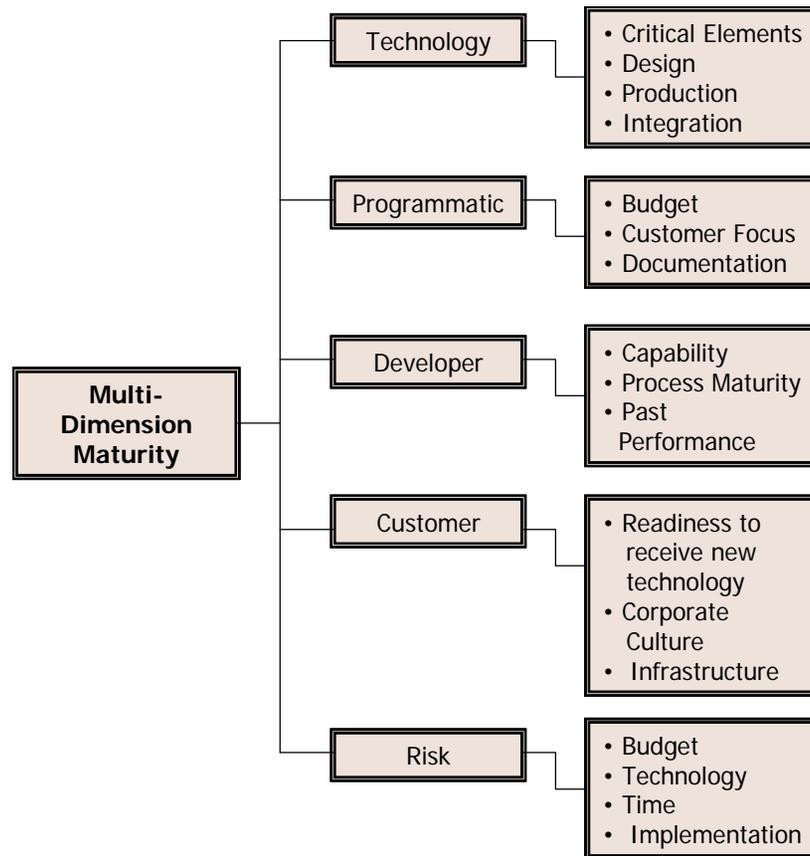
Presented and discussed during the inaugural DoD/NASA wide Technology Maturity Conference, 2006.

### ■ Functions

The purpose of mManager is to perform a systematic, matrix-based, multi-dimensional maturity analysis of the selected CTEs, called SRL (System Readiness Levels).

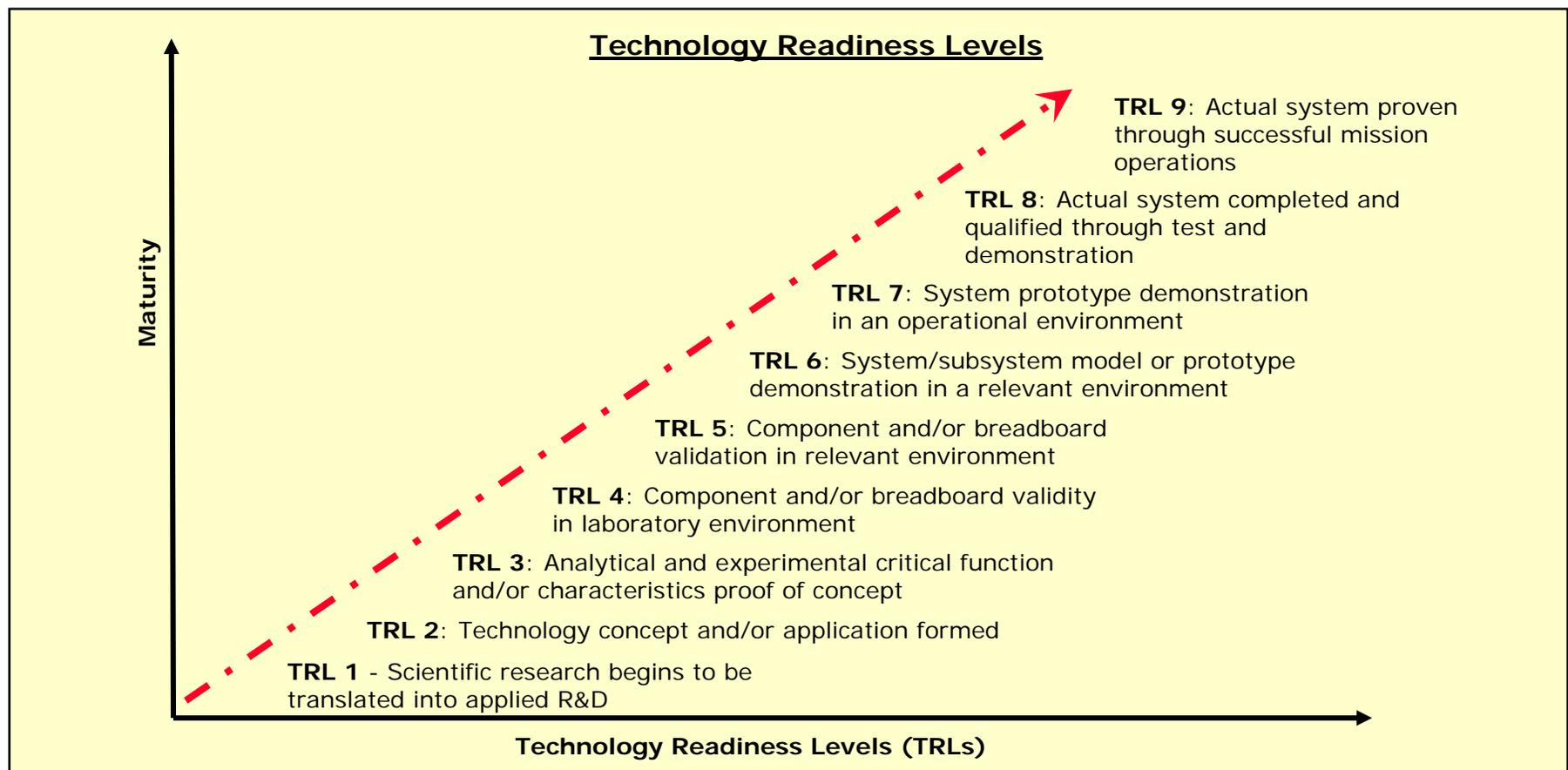
### ■ Result

A multi-dimension matrix, called SRL which is applicable to a Program/Product



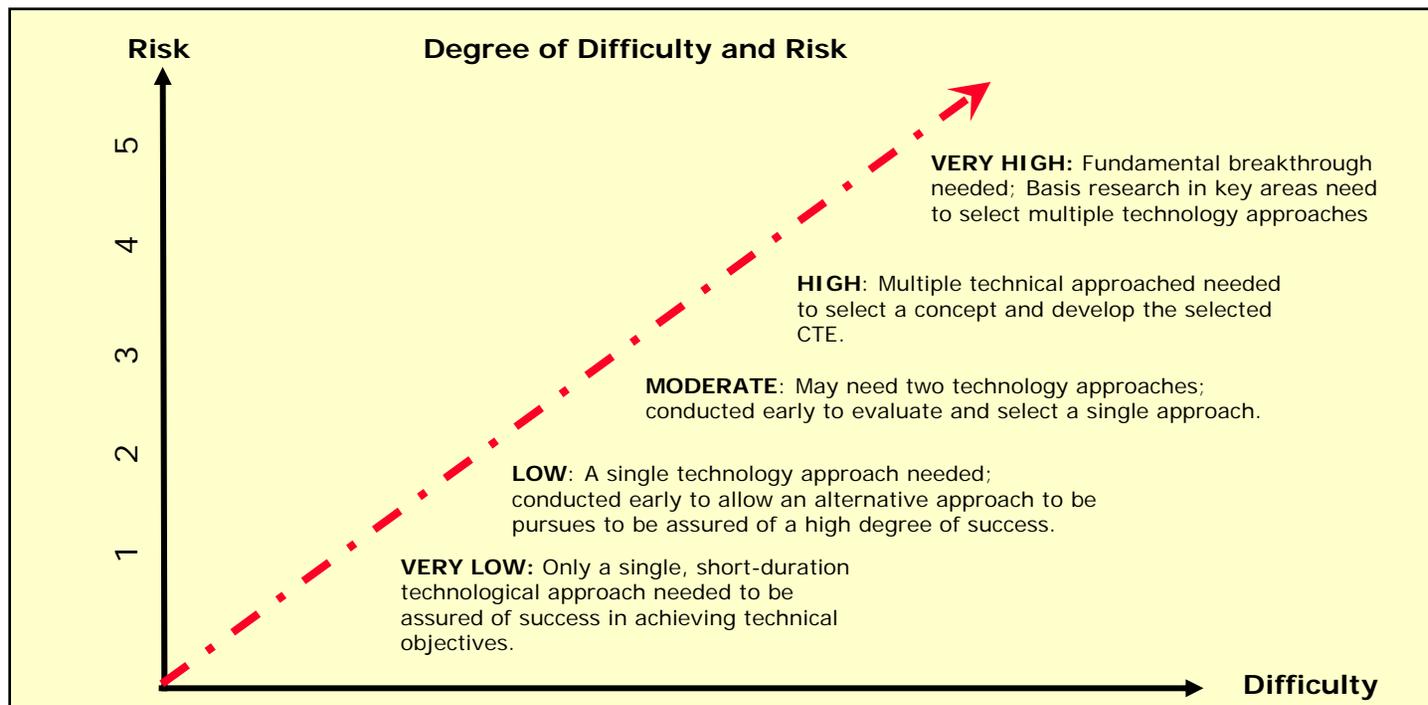
# TechIP: Technology Readiness Levels (TRLs)

NASA developed matrix to classify technology maturity, which is widely accepted by the Department of Defense (DoD)



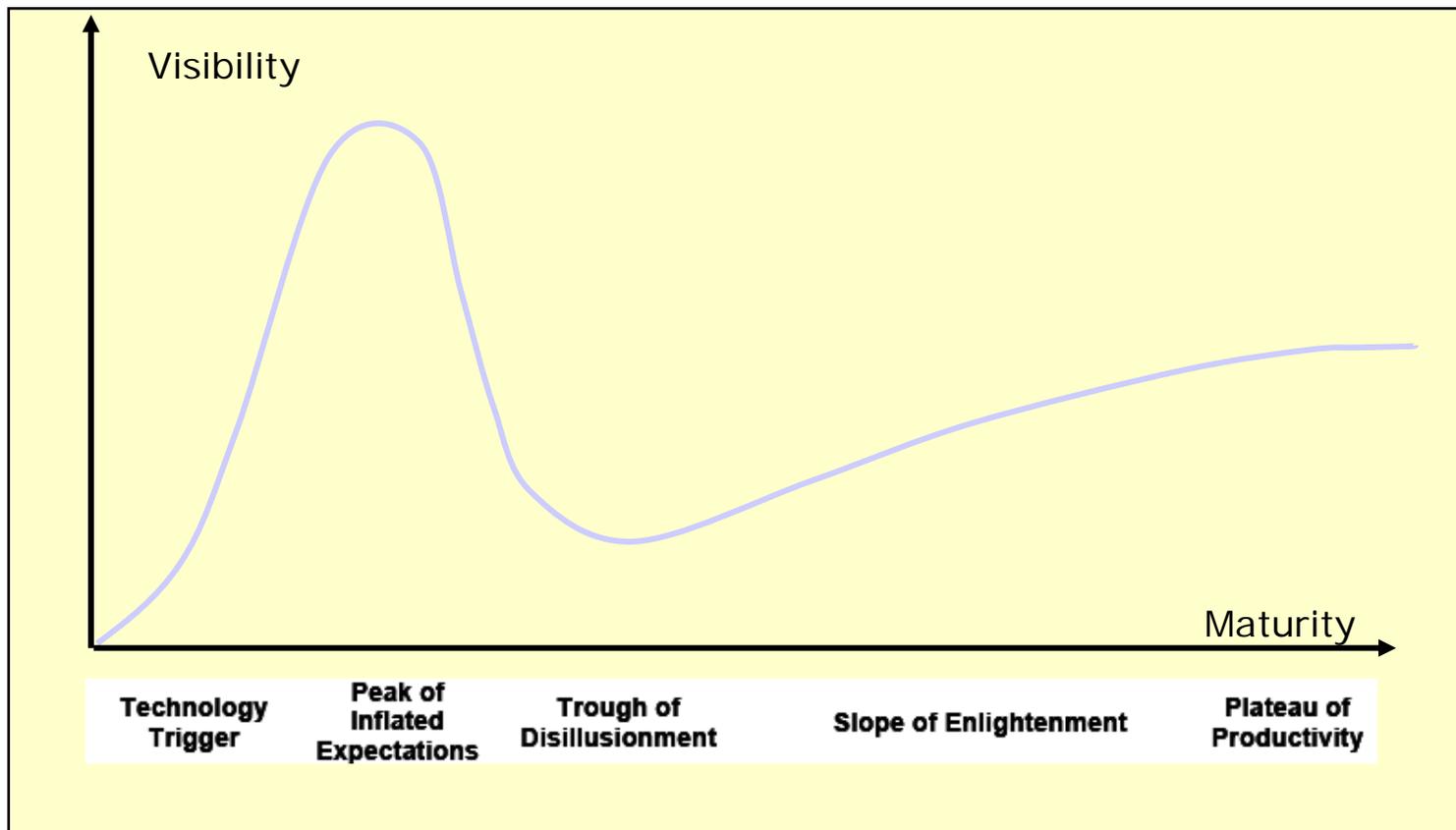
# TechIP: Risk Analysis

Risk Analysis can be used to group IP & R&D Portfolio



# Tech: Hype Cycle

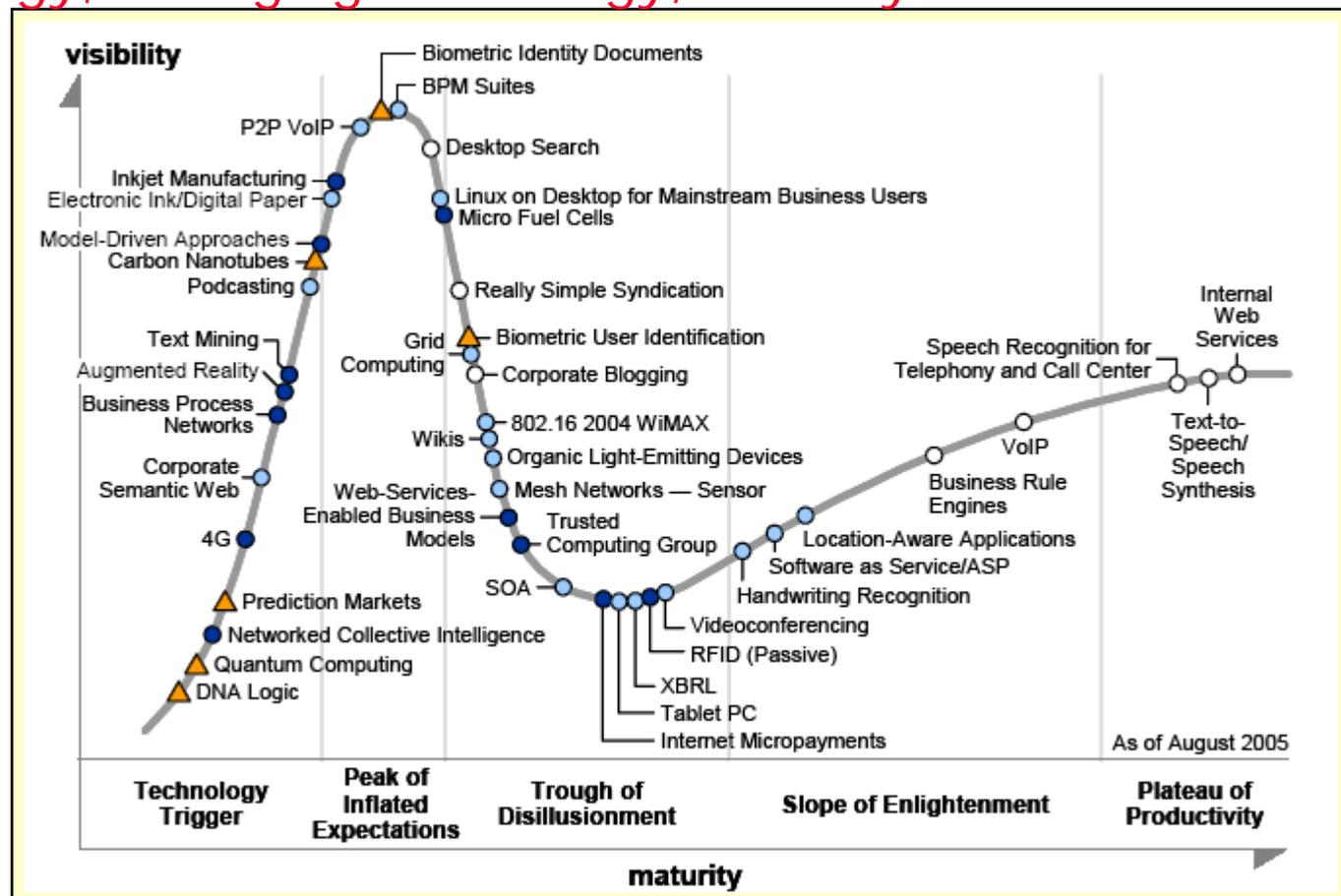
**A Hype Cycle provides a snapshot of technologies, identifying which technologies are hyped, suffering disillusionment, and stable enough to study deployment**



Source: Gartner, Hype Cycle for Emerging Technologies 2005

# Hype Cycle: Gartner's Emerging Technology Elements

Hype Cycles are developed for different domains (e.g: government technology, emerging technology, security assurance technology)



Source: Gartner, Hype Cycle for Emerging Technologies 2005

# Hype Cycle: How to Use

## Early Identification of Emerging Technology: Cuts through hypes and buzzwords

### ■ Develop:

- Generic hype cycles for Internal, External (corporate, Government and Academic) Technology Elements Hype Cycle
- Program specific Technology Elements Hype Cycle

### ■ Analyze:

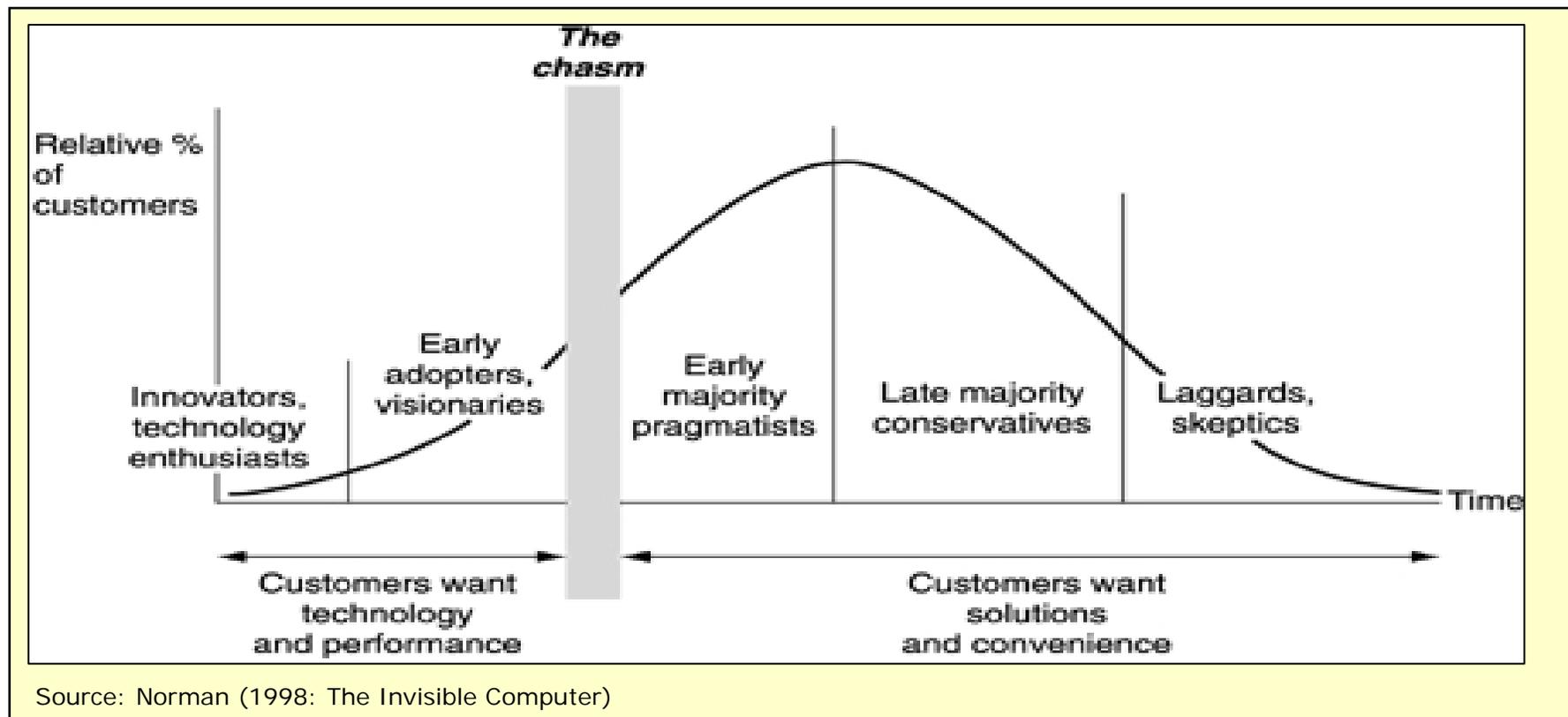
- What are the core technologies? What innovative technologies are available? What are the migration (existing to proposed technology) strategies?
- Develop “Gap Analysis” to understand future technology needs and competitive position.
- Develop technology road map

### ■ Select:

- Use the analysis as an input to IP/R&D/Program Management

# TechIP: Technology Adoption Life Cycle

**Technology developers should be viewed as R&D customers, and End users should be viewed as Technology developers customers**



# Adoption Cycle: How to Use

## Why good technology fail; inferior technology succeed

### ■ Develop:

- Link Technology Maturity to different User types.
  - Early stages – Technology dominates
  - Later stages – Usability, convenience and value
- Role of Technology developers in selecting technologies from R&D
- Role of end users in influencing product development

### ■ Analyze:

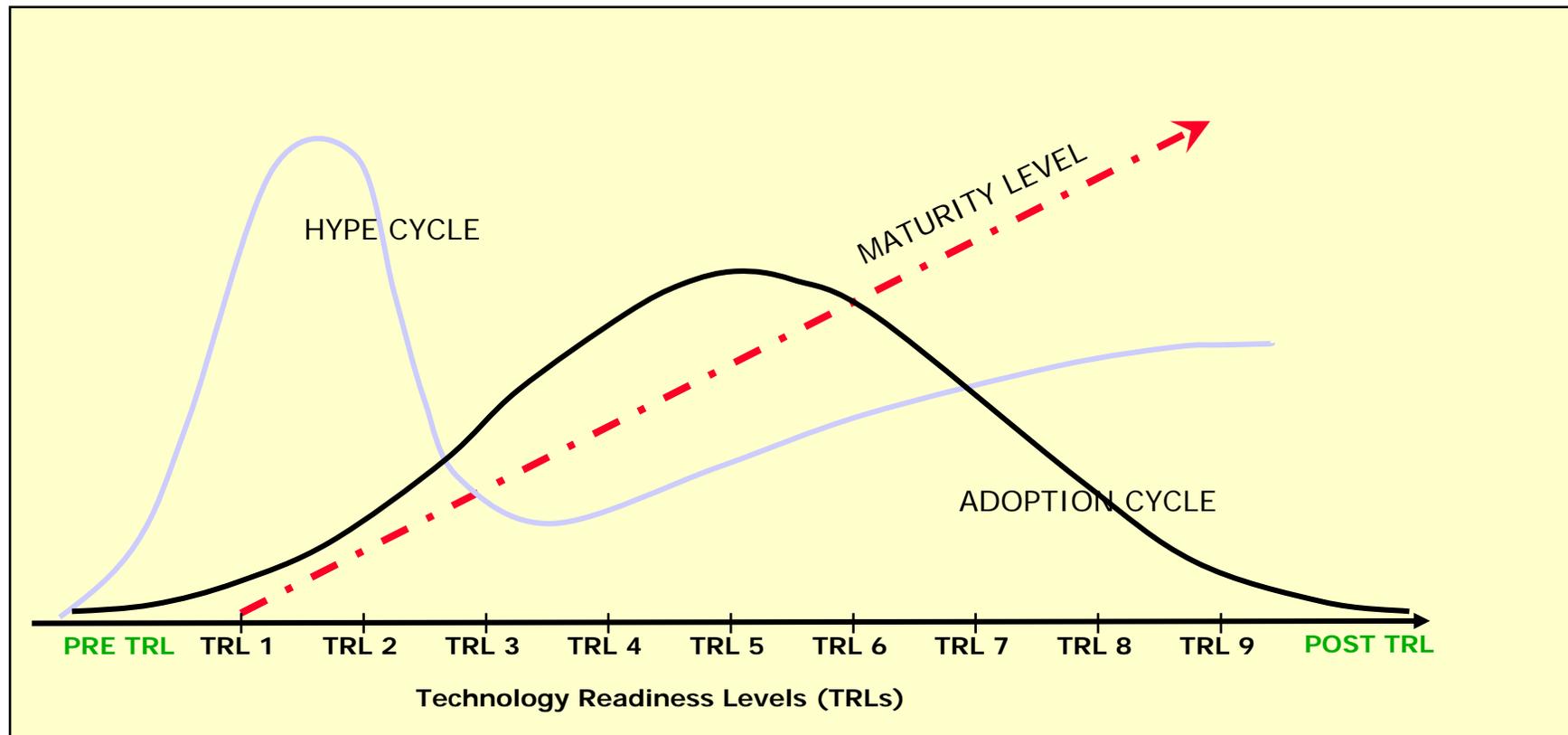
- Understand Different User Needs and Position Technology selection and budget to meet their requirements and perceptions.
- Difficulties in adopting disruptive technology
- Link demonstrations and implementations to appropriate User types.
- Innovation in Processes to support selected Technology

### ■ Select:

- Use the analysis as an input to IP/R&D/Program Management

# TechIP: Analysis of Alternatives

Maturity Levels should be linked to related technology evaluation cycles



# tManager: How to Use

**Technology management should include “best practices”**

## ■ **Develop:**

- Pre-TRL activities
- Post-TRL activities

## ■ **Analyze:**

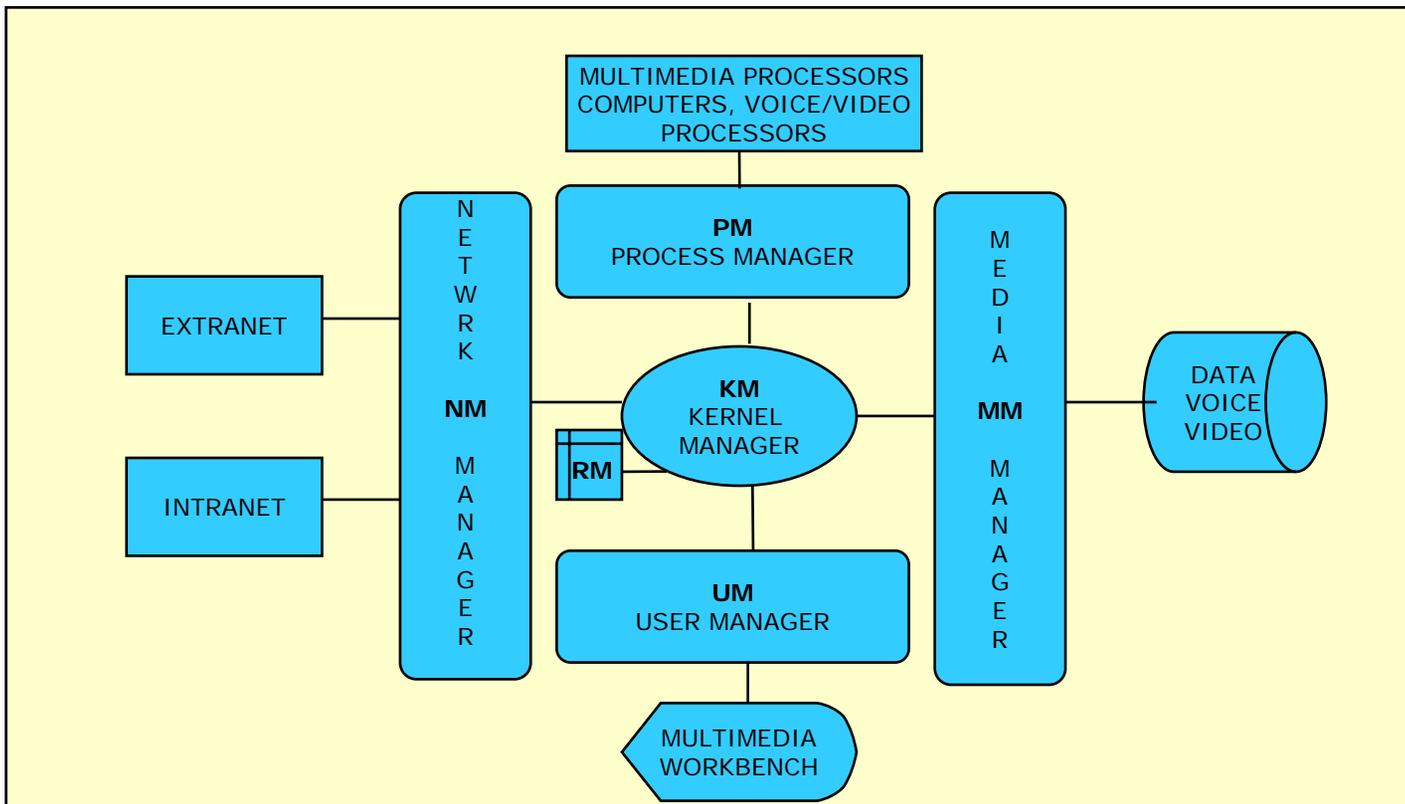
- Technology Cycle results
- Project team incentives (and associated performance requirements) to maintain and implement “Live TDS” through complete product life cycle

## ■ **Select:**

- Incorporate in to TDS

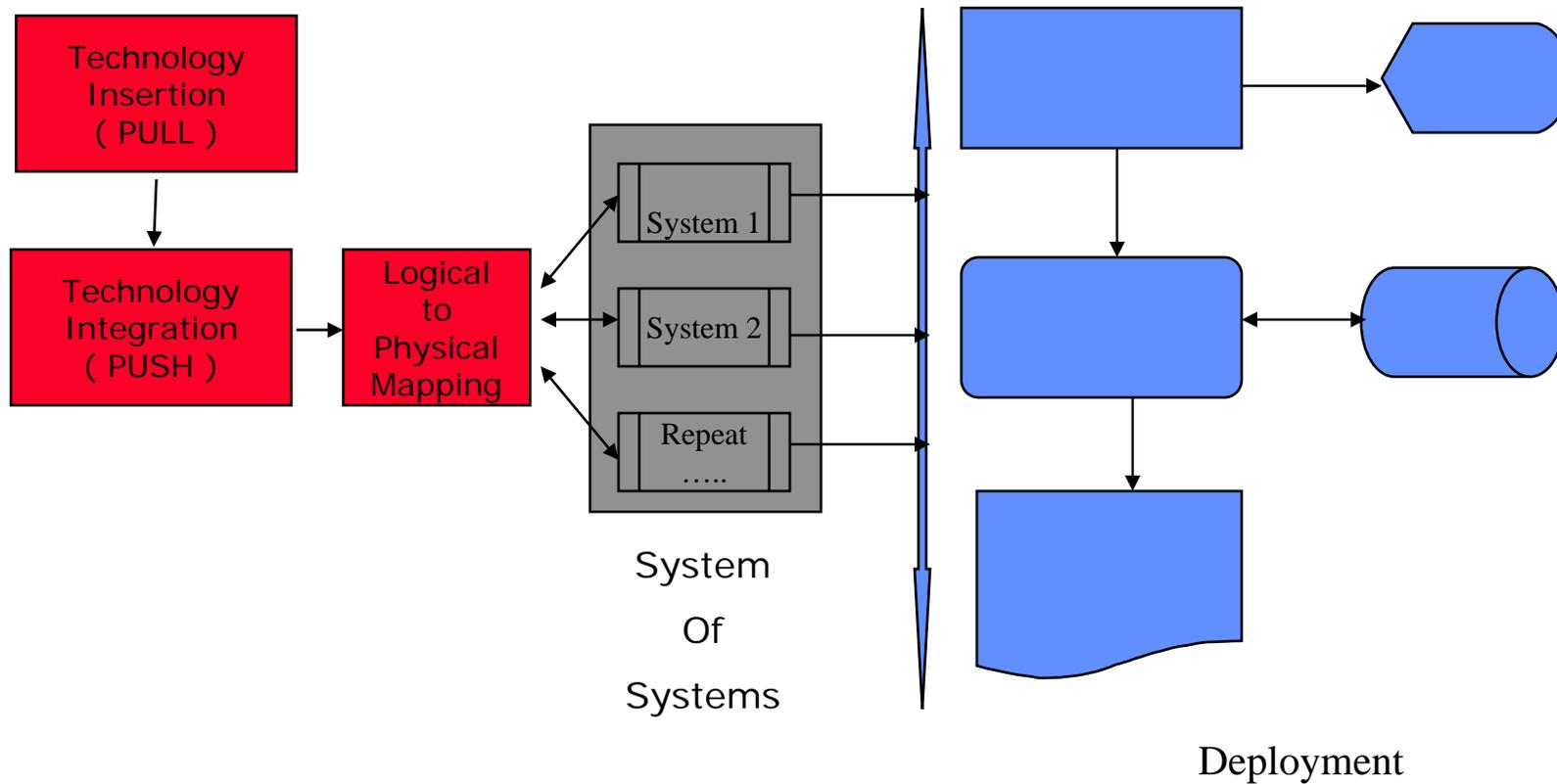
# TechIP: Work Breakdown Structure

Generic Model (IT System) to map Critical Technology Elements (CTEs) into a product



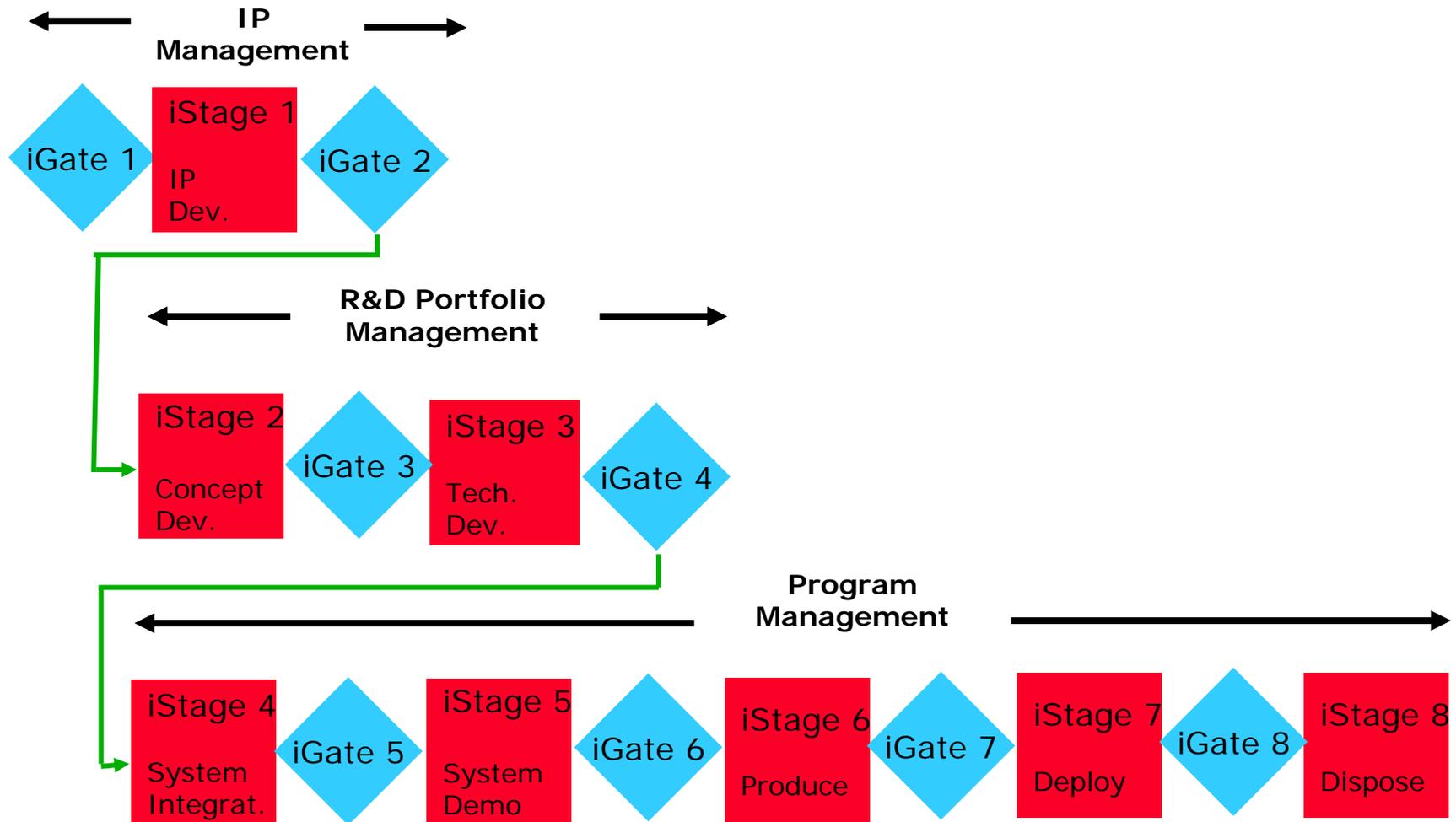
# iManager: Technology Insertion & Integration Activities

Create a Technology specific iManager model by PULLING CTEs from tManager; create iManager models for each system component of a product, and integrate these CTEs in to the product by PUSHing into individual systems.



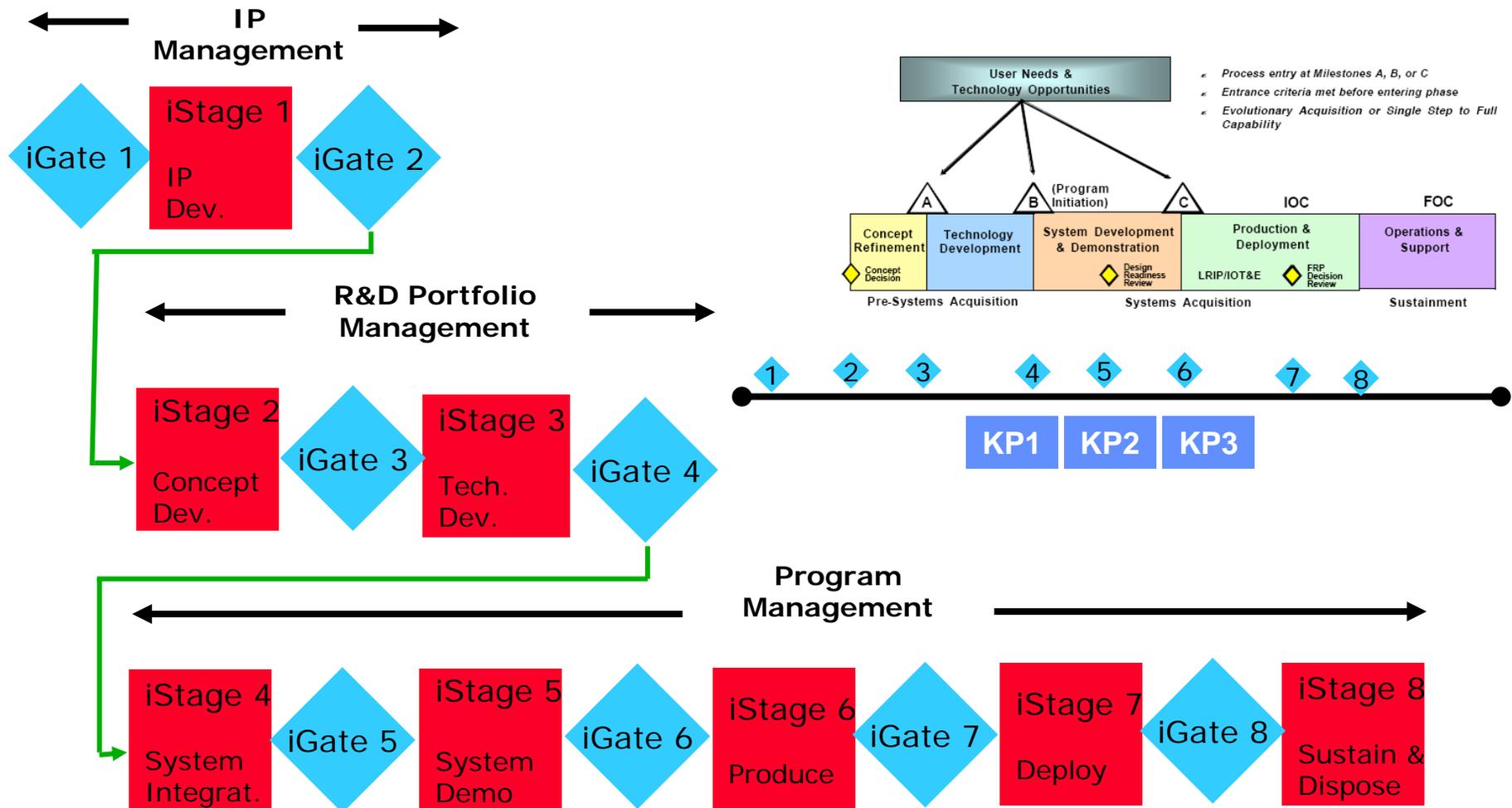
# TechIP: iGate/iStage Framework

IP, R&D Portfolio & Program Management should be linked



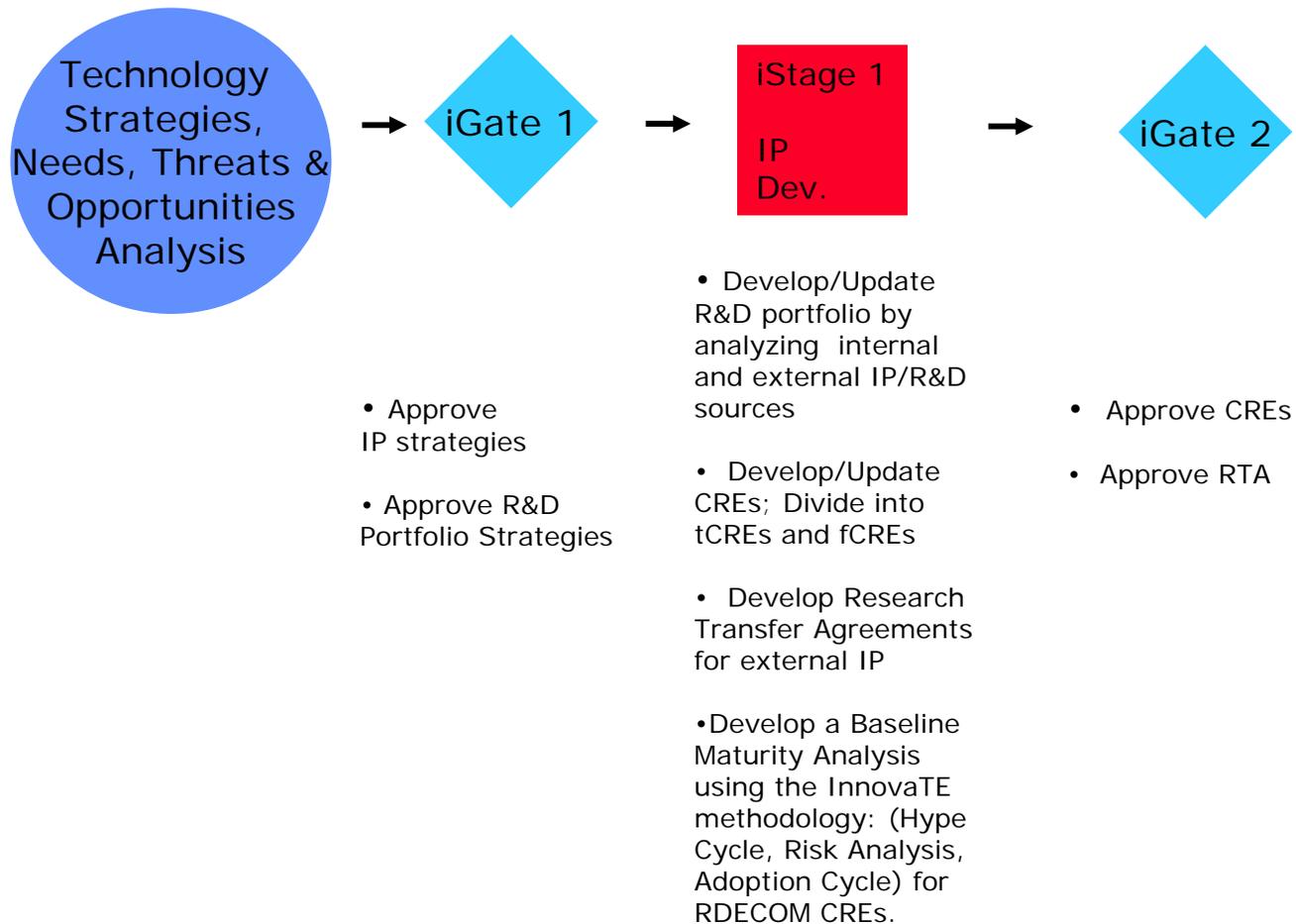
# TechIP: iGate/iStage Framework

## iGate/iStage & DoD Acquisition Management Framework



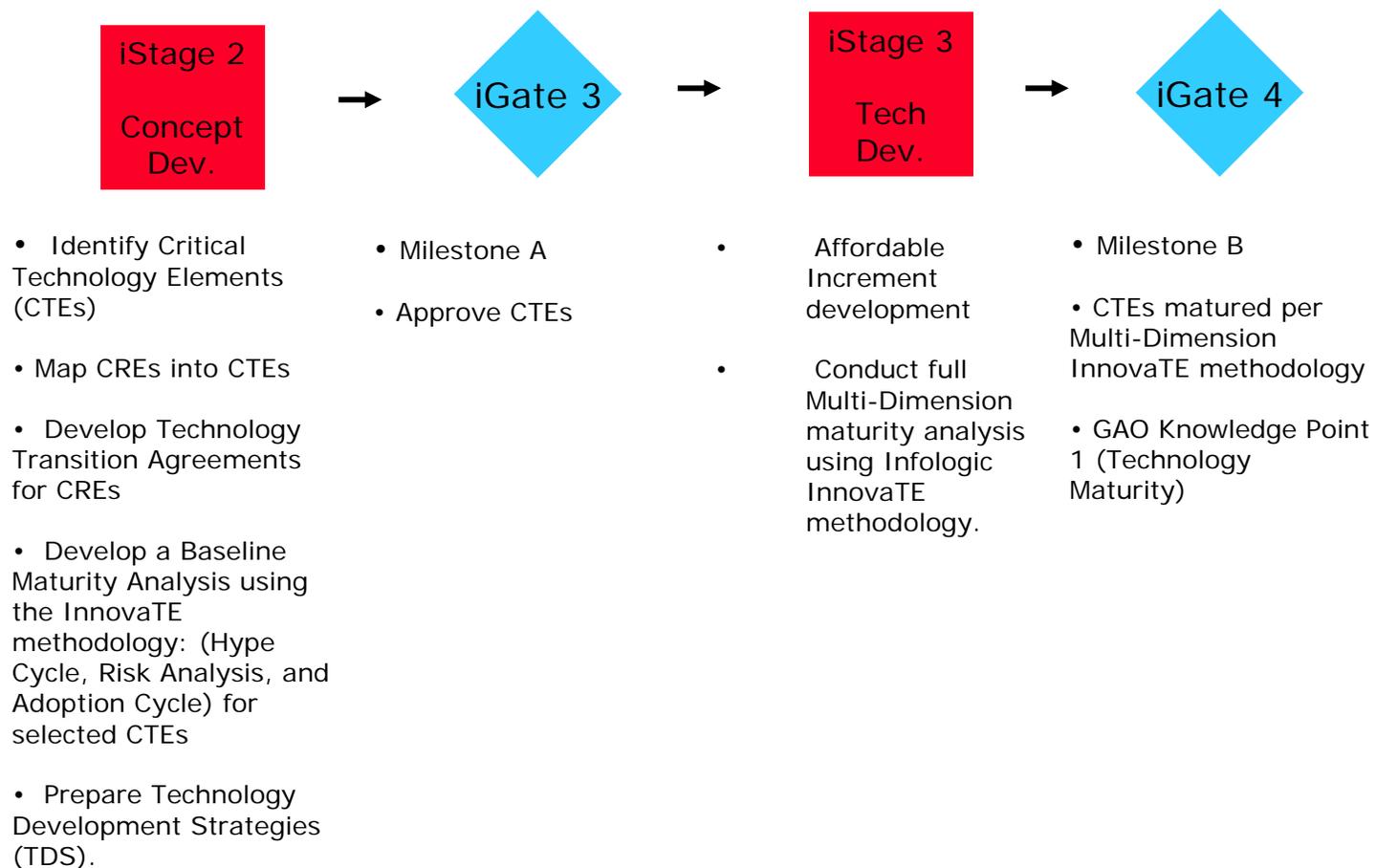
# TechIP: IP Management

## IP Management: iStage 1



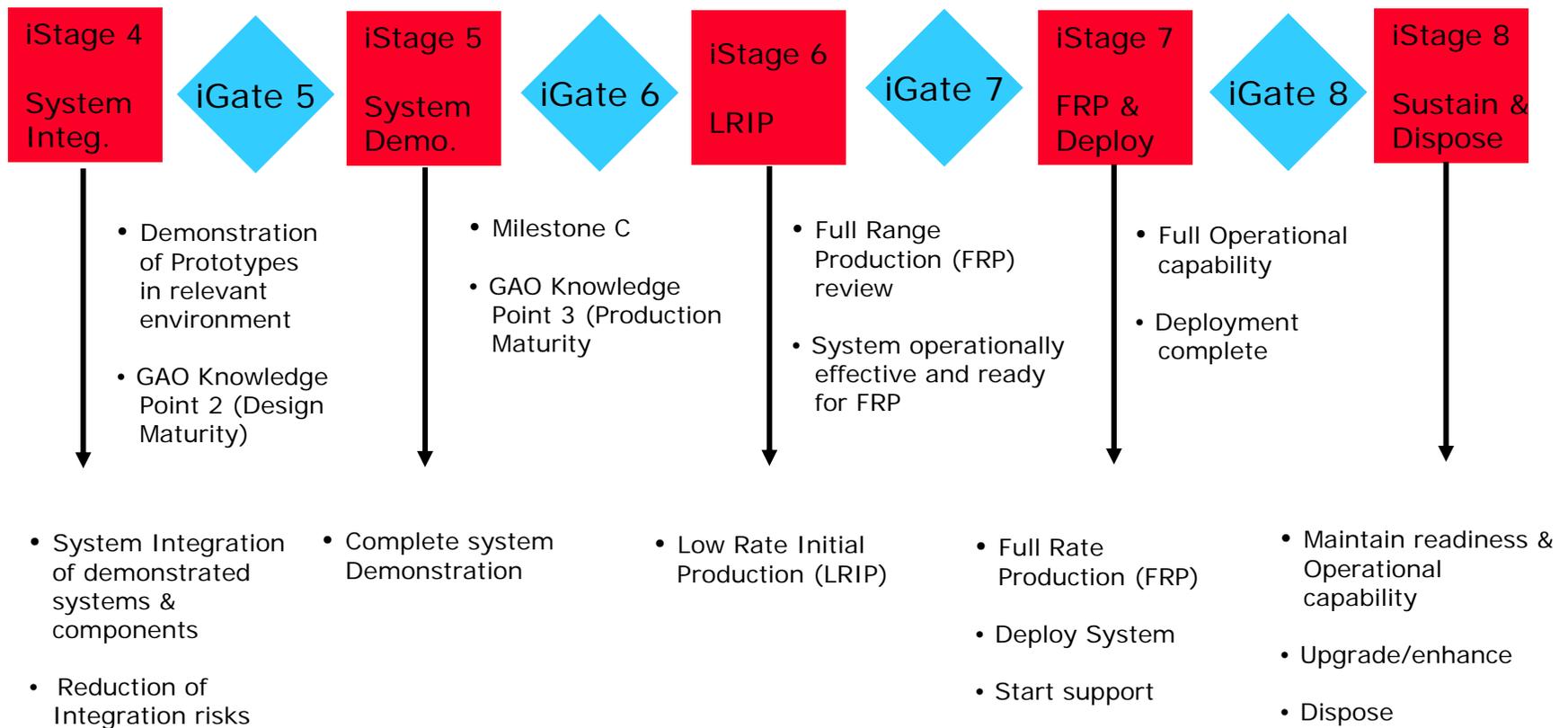
# TechIP: R&D Management

## R&D Portfolio Management: iStage 2 and iStage 3



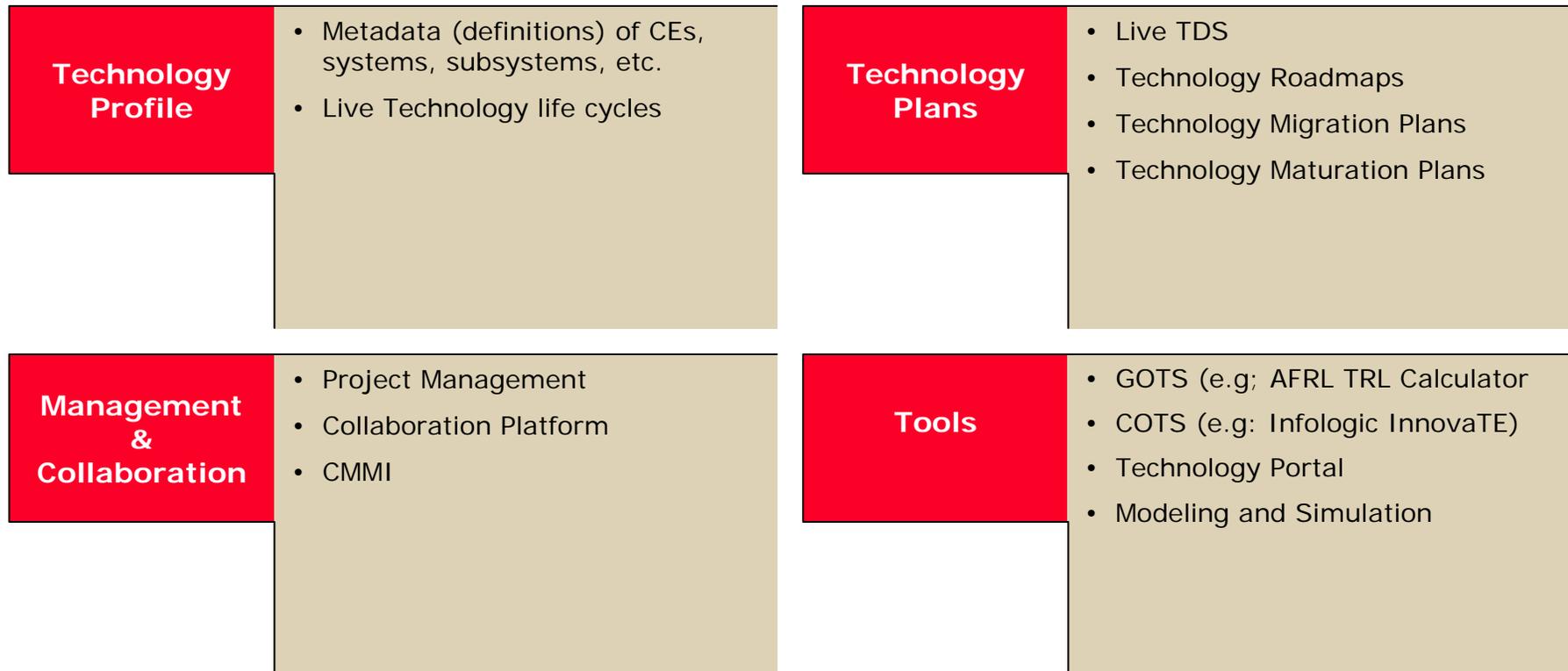
# TechIP: Program Management

## Program Management: iStage 4 thru iStage 8



# pManager : Overview

The objective of pManager (which is a set of processes and software tools) is to manage the technologies identified by the tManager and iManager components of TechIP



# Agenda: Execution

## ART to SCIENCE ?

**I. Innovation Management:** Innovation Agenda for Public and Private Organizations: Concerns, Needs and Strategies, Why Innovation Management Art?, Need to convert to Science. Define an Innovation Management Model.

**II. Innovation Management: DoD R&D and Technology Management Process**

Develop a framework which incorporates DoD Acquisition Management framework (e.g: TRLs), Force Transformation strategies (e.g: Evolutionary Acquisition), GAO Recommendations (e.g: Knowledge-based Acquisition), DoD Community concerns & suggestions (e.g: Multi-Dimension Maturity Analysis), and Industry best practices (e.g: the Gate Process, CMMI, Technology Hype Cycle and Adoption Cycle).

**III. Knowledge-Based Gate Process:** An Art to Science process which may be employed by DoD R&D organizations and Program Managers to manage technologies through their life cycle. Introduce an Innovation Management methodology: TechIP ( Technology Insertion Plan )

**IV. Execution:** Strategies to implement the Framework and Process.

# Business Model Implementation Agenda

## Convert the ART of Innovation Management into SCIENCE

### ■ Secure Sponsorship & Develop Plans

- Senior executive & line management, and R&D management commitments
- Develop a business model and associated implementation plans

### ■ Start with Existing Practices

- Align existing “best practices” (e.g.: TRLs, CMMI, Six Sigma) and software tools with the new business model, and put “teeth” and “rewards” into these practices

### ■ Migrate to a Business Model

- Develop or acquire necessary tools and processes to fully implement the model

### ■ Communicate & Coordinate

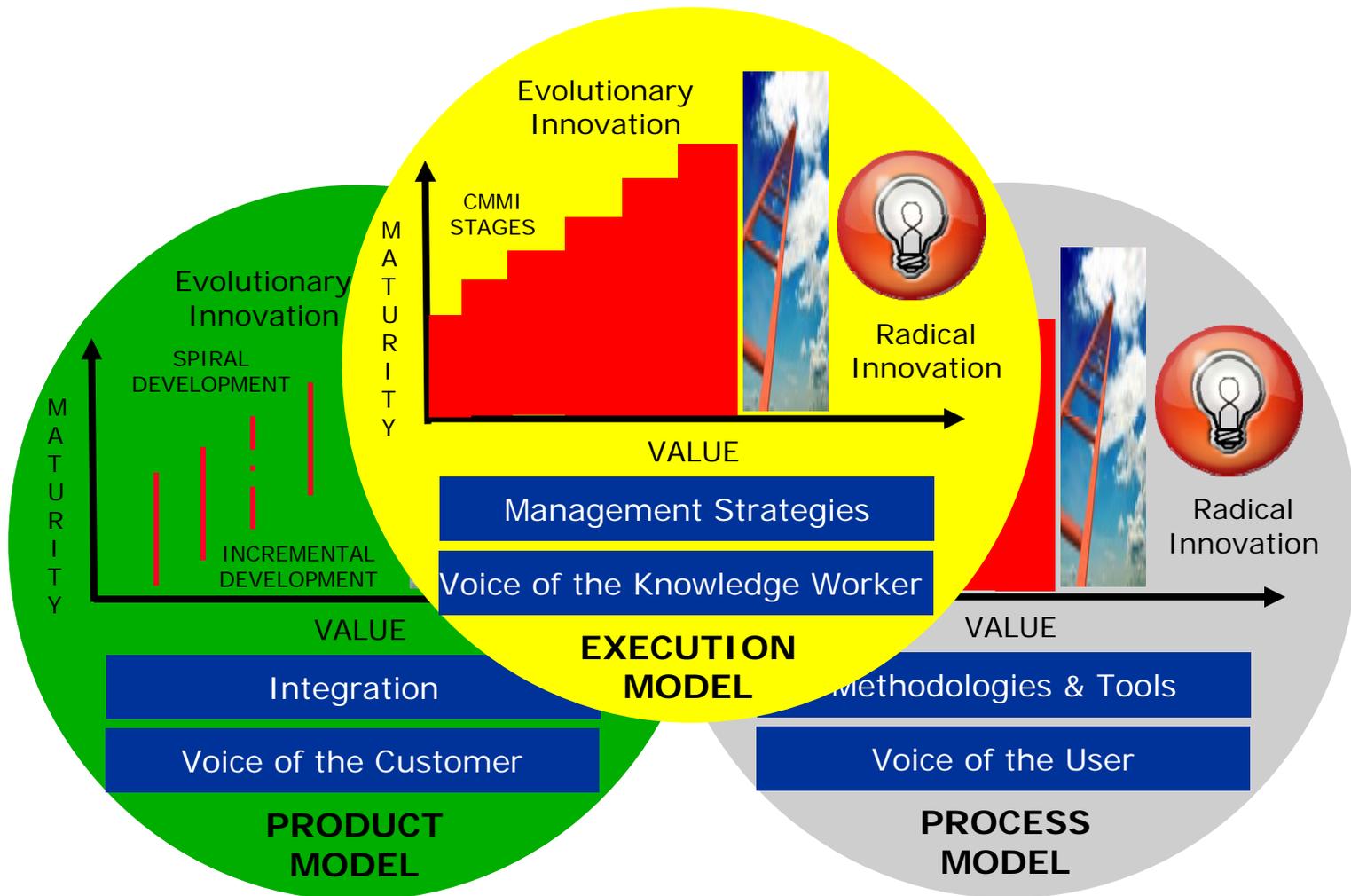
- Keep all stockholders in loop

### ■ Track Progress

- Continuously “perfect” the model by adding values to your “best practices” processes and eliminating “wasteful” processes.

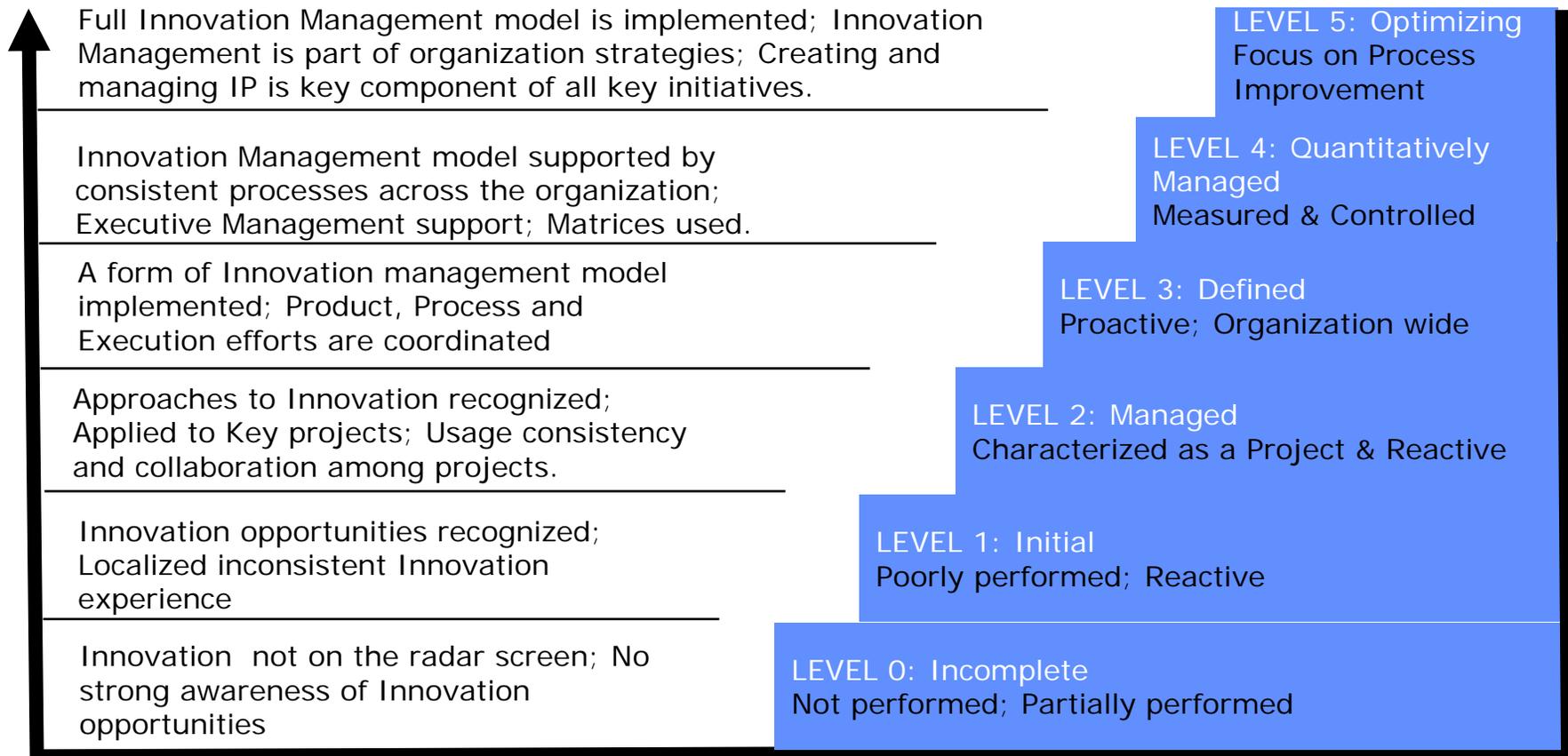
# Goal: Innovation Management Model

**Innovation Maturity = f (Product, Process, Execution)**



# Execute: Innovation Management Model

**Innovation Management is a Process and should be matured using the CMMI methodology**



# Agenda to Conclusions

## ART to SCIENCE ?

**I. Innovation Management:** Innovation Agenda for Public and Private Organizations: Concerns, Needs and Strategies, Why Innovation Management Art?, Need to convert to Science. Define an Innovation Management Model.

**II. Innovation Management: DoD R&D and Technology Management Process**

Develop a framework which incorporates DoD Acquisition Management framework (e.g: TRLs), Force Transformation strategies (e.g: Evolutionary Acquisition), GAO Recommendations (e.g: Knowledge-based Acquisition), DoD Community concerns & suggestions (e.g: Multi-Dimension Maturity Analysis), and Industry best practices (e.g: the Gate Process, CMMI, Technology Hype Cycle and Adoption Cycle).

**III. Knowledge-Based Gate Process:** An Art to Science process which may be employed by DoD R&D organizations and Program Managers to manage technologies through their life cycle. Introduce an Innovation Management methodology: TechIP ( Technology Insertion Plan )

**IV. Execution:** Strategies to implement the Framework and Process.

## A Final Word

### **Innovation Management – Rocket Science ?**

**“Innovation doesn’t just happen because it is directed or discussed or considered to be an imperative; innovation happens because organizations commit to the disciplines, practices, culture and processes that support and sustain innovation”**

Gartner - Managing Innovation: Primer, 5/2006

**WILL TO ACT & EXECUTION is a Rocket Science!**

**Call to Action:**

**Don’t just EMBRACE Innovation Management,  
but EXCEL in Execution by converting the ART  
of Innovation Management in to SCIENCE !**

# Open Innovation and Technology Maturity Analysis

**U.S. Department of Defense (DoD)  
R&D and Technology Management**

Questions, Comments & Suggestions  
Please contact:

**Has Patel**  
**Infologic, Inc.**  
[has.patel@infologic.com](mailto:has.patel@infologic.com)  
(888) 325 0500 Ext. 100



I Rest My Case !



**INFOLOGIC**  
*The logical approach to harness innovation*

INFOLOGIC, INC.  
1048 Irvine Avenue #624  
Newport Beach, CA 92660  
[www.infologic.com](http://www.infologic.com)