CMMI Implementation in Manufacturing Processes

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Israel Aircraft Industries (IAI)

- Largest industrial company in Israel
  - 15000 employees, 2.3 B$ annual sales
- Involved in Development, Production, Maintenance and Service of Aerospace Systems
  - A large part of the annual sales are from Manufacturing, Maintenance and Service activities
- IAI divisions are ISO9000 and AS9100 certified
- Started SW-CMM based development process improvement efforts in 1992
- Started CMMI based efforts in 2002

Israel Aircraft Industries Groups and Divisions

Corporate Initiatives for Process Improvement

Competitiveness Ability Improvement (CAI)

- Production & Manufacturing Process Improvement
- Acquisition Process Improvement

System & Software Development Processes and Methodologies

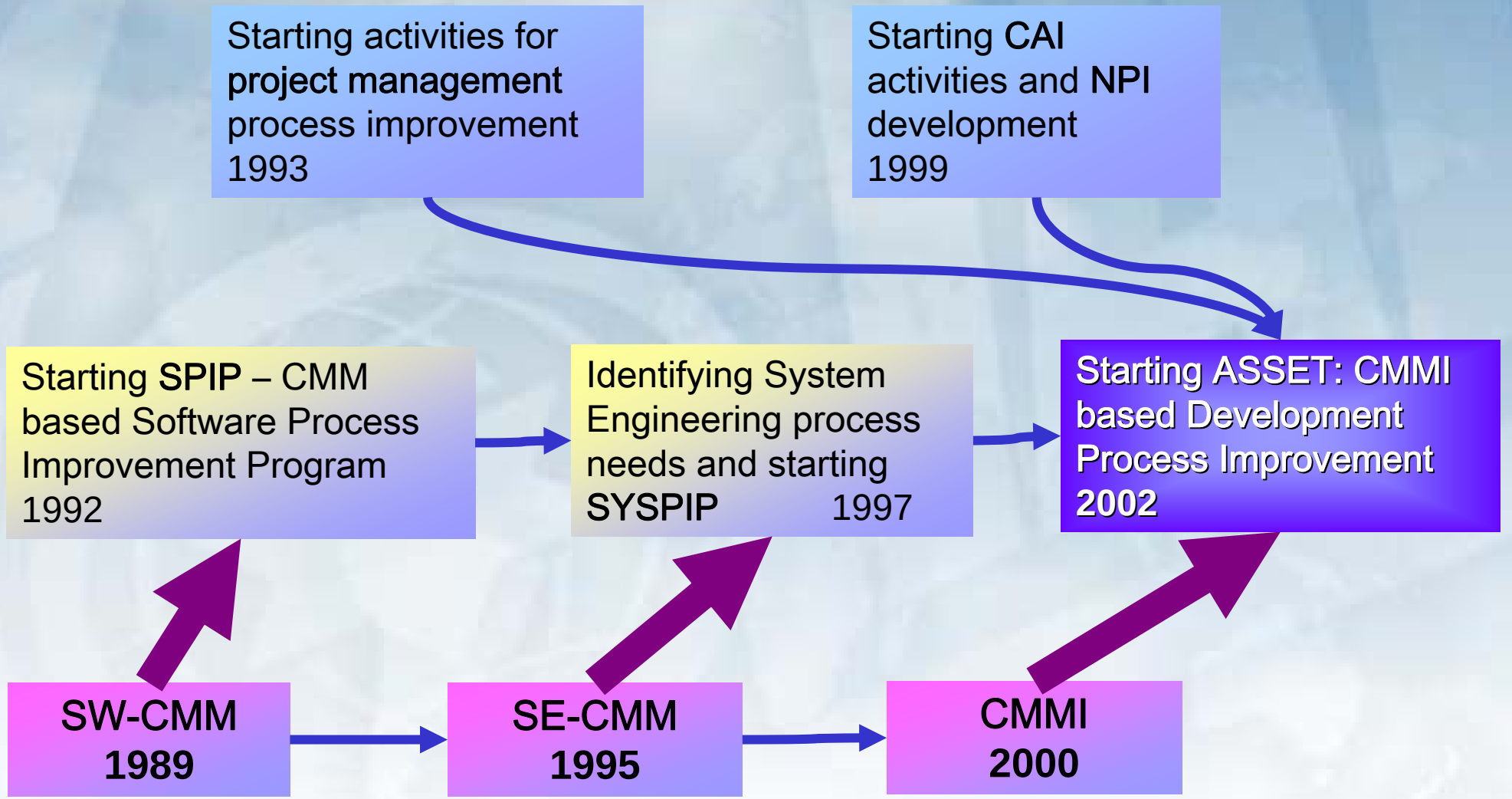
New Product Introduction (NPI)

IAI Uniform Project Process Framework

Quality Management

- Increase Quality
- Increase Sales
- Increase Profit

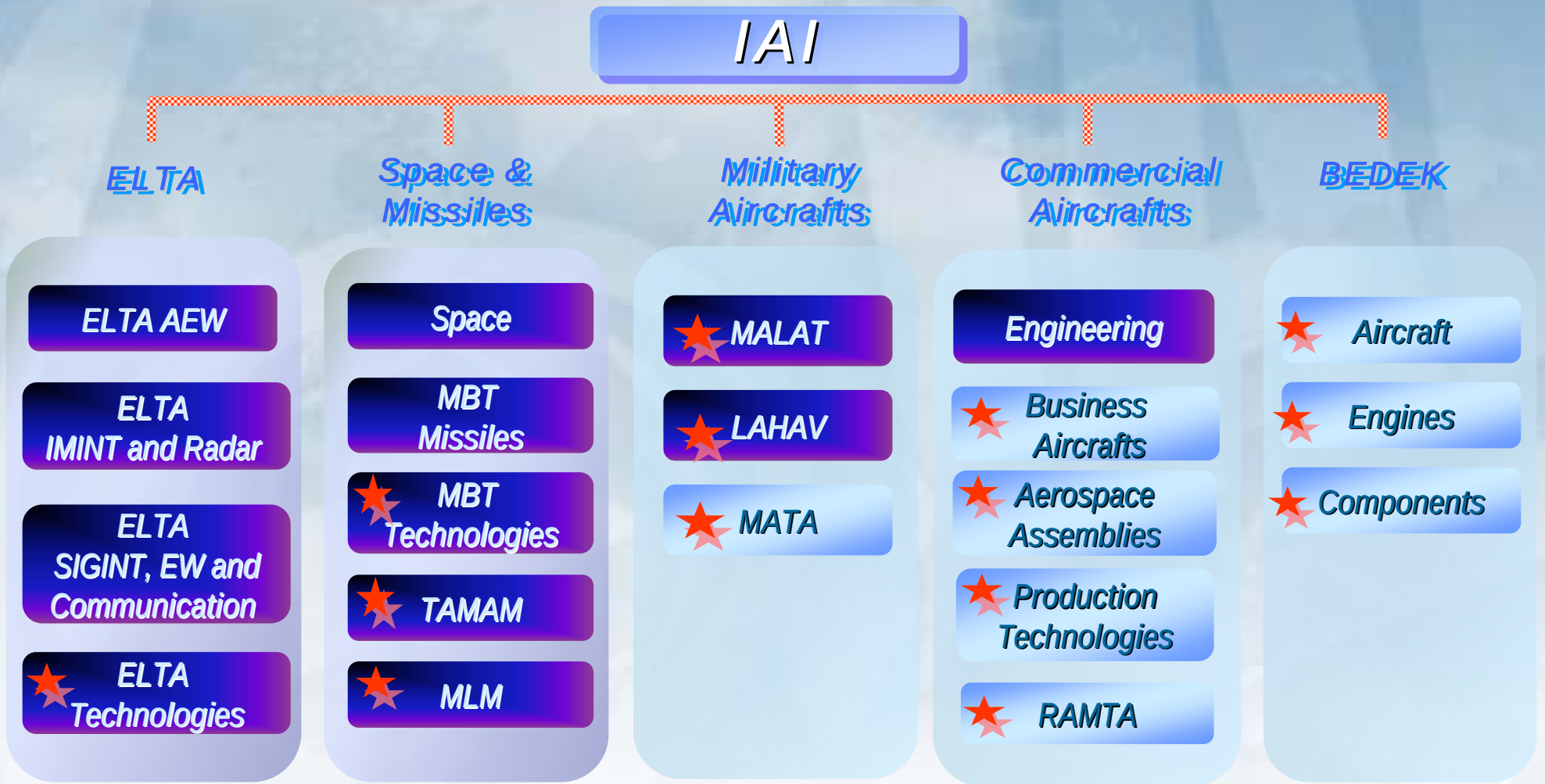
Israel Aircraft Industries Process Improvement Path -1



Israel Aircraft Industries process improvement path -2

- Process improvement efforts are coordinated at the corporate level and sponsored by the company VP of Operations
- Many infrastructure assets are developed at the corporate level and are adapted by the groups and divisions. Other assets are developed within the groups and divisions
- Process improvement implementation is conducted at the group and division level and sponsored by the group or division management
- Initially, CMMI based Process Improvement efforts were focused on Development Processes, while CAI (Competitiveness Ability Improvement) efforts were focused mainly on Manufacturing Processes

CMMI Implementation in IAI



CMMI Based Process Improvement Activities

Significant manufacturing activity

Using CMMI for Manufacturing Process Improvement

- CAI provides a collection of techniques for attaining higher Quality and Productivity while CMMI provides a framework for conducting integrated Process Improvement activities in an organization
- Most (if not all) CMMI Process Areas seem to fit Manufacturing as well as Development
  - Project Management Process Areas
  - Process Management Process Areas
  - Support Process Areas
  - Integrated Product and Process Development
  - Engineering Process Areas (?)
- IAI decided to include manufacturing processes in CMMI implementation scope in one of its divisions - LAHAV

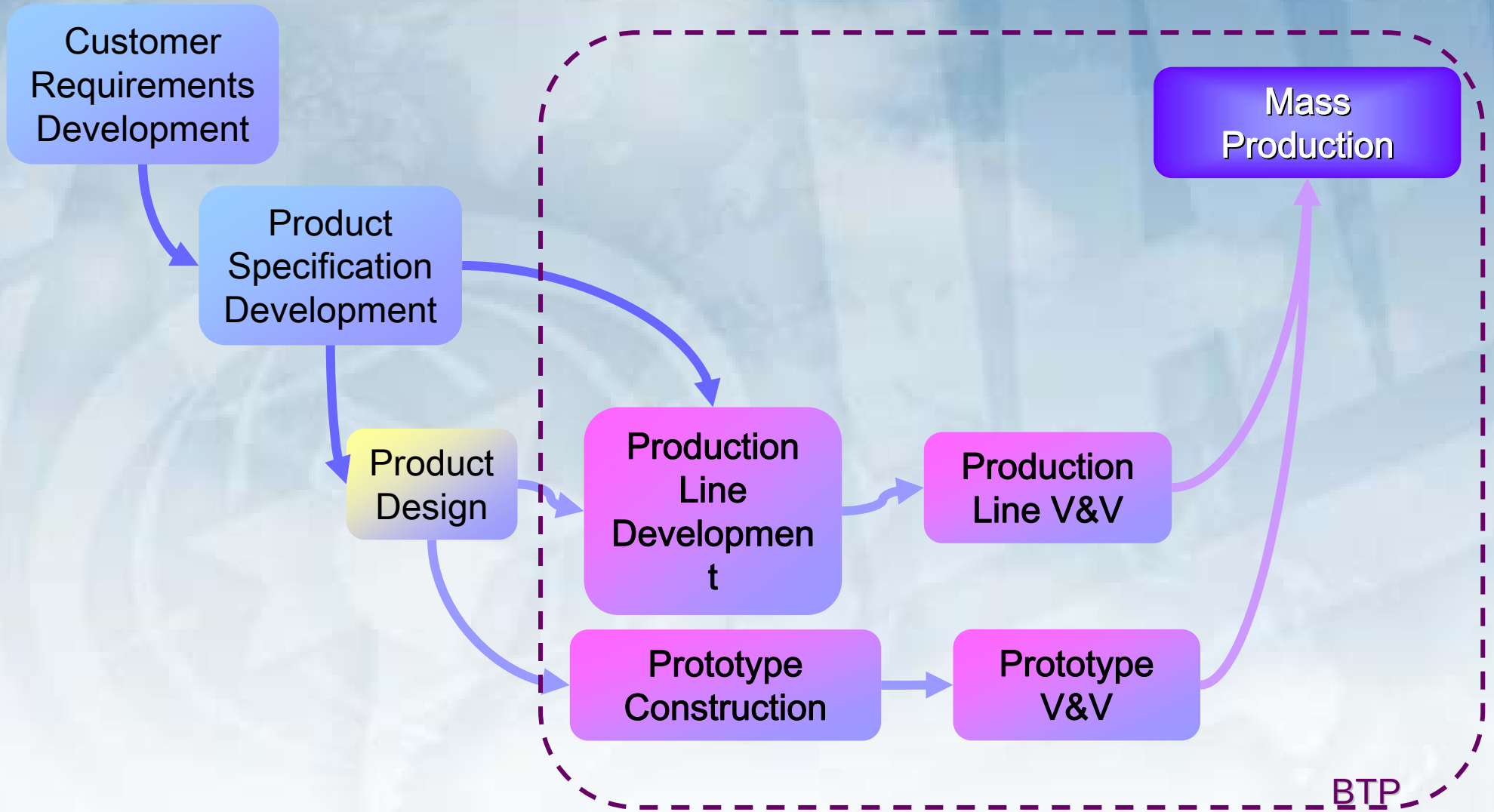
Applying CMMI in Manufacturing

- Applying Project Management, Process Management and Support Process Areas in Manufacturing is obvious
- Question:
  - How should Engineering Process Areas be interpreted and implemented in Manufacturing?
- Answer:
  - Production Engineering, including production infrastructure development
  - Addressing problems and managing changes in products and production line

Types of Manufacturing Projects

- Build To Spec (BTS)
  - The product specification is provided by the customer and the project has to design the product, design and build the production line, and manufacture products according to customer order
- Build To Print (BTP)
  - Complete product design is already available – either supplied by the customer or from previous BTS project, and the project (sometimes) has to design, build or change the production line infrastructure, and manufacture units according to customer order

BTS and BTP projects' Context



Applying CMMI in Manufacturing
Build to Spec (BTS) Projects

- Customer Requirements are defined mainly in terms of Product Specification
- Based on Product Specification, the product is designed, integrated and tested. The production line requirements are developed, and the production infrastructure is designed, integrated and tested
- The “developed product” includes not only the product to be manufactured, but also the production line infrastructure
- CMMI implementation is focused on both product design and Production Engineering Processes
- The production line infrastructure may serve manufacturing of several products in several production projects

Applying CMMI in Manufacturing
Build to Spec (BTS) Projects - Examples

- RD SP1.1: Elicit Needs
  - Analysis of Product Specifications and Stakeholders needs and expectations
- RD SG3: Analyze and Validate Requirements
  - Simulation of Product Design and the Production line
- TS SP1.2 + RD SP3.1: Operational Concepts and Scenarios
  - Product Operational Scenarios and Product Line Production Scenario
- TS SP3.2: Develop Product Support Documentation
  - Includes Production Line Support Documentation
- VAL: Validate the Product
  - Validation of the product prototype & production line using predefined scenarios
- PP and PMC: Plan and Monitor the Project
  - Product Engineering Management and Mass Production Management

Applying CMMI in Manufacturing

Build to Print (BTP) Projects

- Customer Requirements are defined mainly in terms of Product Technical Package
  - Drawings, Part Lists, etc.
- Based on Product Technical Package, the production line requirements are developed, and the production infrastructure is designed, integrated and tested
- The “developed product” is actually the production line infrastructure, and CMMI implementation is focused on Production Engineering Processes
- The production line infrastructure may serve manufacturing of several products in several production projects

Applying CMMI in Manufacturing
Build to Print (BTP) Projects-Examples

- RD SP1.1: Elicit Needs
  - Analysis of Product Design and Stakeholders needs and expectations
- RD SG3: Analyze and Validate Requirements
  - Simulation of the Production line
- TS SP3.2: Develop Product Support Documentation
  - Includes Production Line Support Documentation
- PI SP3.4: Package and Deliver
  - Packaging and delivering the product
- VAL: Validate the Product
  - Validation of the production line using pre-defined scenarios
- TS SP1.2 + RD SP3.1: Operational Concepts and Scenarios
  - Product Line Production Scenarios
- PP and PMC: Plan and Monitor the Project
  - Product Engineering Management and Mass Production Management

Lessons Learned -1

- CMMI can be applied to manufacturing projects
  - Usually all Process Areas are applicable and can appropriately be interpreted for manufacturing processes
  - When some Process Areas seem to be non applicable for manufacturing, the Continuous Representation can be used
- Although manufacturing processes are very different from development processes, they are still part of the division set of standard processes
- When manufacturing activities represent a significant portion of the activities in the division, they should be included in the CMMI implementation and appraisal scope, due to their significant contribution to the division's business

Lessons Learned -2

- Some Process Areas are easier and more natural to implement in manufacturing, such as:
  - Measurement and Analysis
  - Causal Analysis and Resolution
  - Quantitative Project Management
  - Organization Process Performance

Recommendations (1)

- When an organization starts to implement CMMI practices and plans CMMI process appraisals, it should not refrain from including “non developmental” processes, like manufacturing, in the scope, especially when these processes are responsible for a significant amount of the organization’s revenue
- In BTP projects the production line processes should be evaluated as well as the manufactured product

Thank You

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