Systems Engineering Concepts and Their Relationship to First-Time Quality

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Abstract

The underlying goal of Systems Engineering is to promote First-Time Quality of all of our products. As obvious as this sounds, we seldom hear of it – time for awareness! Managers can learn and add value to their programs with some basic understanding of this relationship.

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My presentation will focus on the three main areas which make up the “Total Quality Costs”: “prevention”, “detection” and “failure”, with failure being subdivided into “internal” and “external”. We will take the processes that make up the Systems developmental “V” and show how they contribute to the reduction of rework costs and promote first-time quality.

Outline

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- Introduce myself and background
  - Quality Engineering
    - Cost of Quality (CoQ) Discipline
  - Systems Engineering
- CoQ Definitions
  - Prevention
  - Appraisal (Detection)
  - Loss (Failure)
- SE Engineering Life Cycle
  - Life Cycle Stages
    - Left side of V is all about First-Time quality
    - Iterative in Nature
- Tie in these Two Concepts
  - Prevention and the Left side of the V
  - Detection and the Iterations

Introduction

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- Quality Assurance 1989
  - MIL-Q-9858
  - Revamped Cost of Quality (CoQ) Program
- Systems Engineering 2004
  - Sector/Site Process/Procedure Consolidation Efforts
- SE Concepts belong to CoQ Prevention and Appraisal Categories
  - Left side of “V” is Prevention
  - Right side is Appraisal
    - All errors found during any type of formal review or testing causes rework, which is considered “Loss”

CoQ Terms and Definitions

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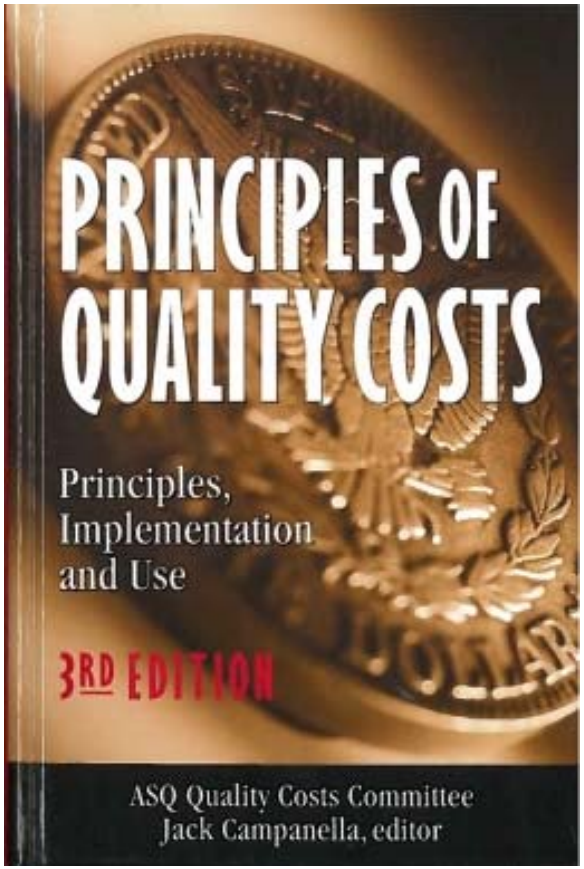
- Prevention
  - The cost of all activities specifically designed to prevent poor quality in products or services. [1]
- Detection (Appraisal)
  - The costs associated with measuring, evaluating or auditing products or services to assure conformance to quality standards and performance **requirements**[1].
- Loss (Failure)
  - The costs resulting from products or services not conforming to **requirements**[1] or customer/user needs.
    - Internal
      - Failure costs occurring prior to delivery or shipment of the product[1].
    - External
      - Failure costs occurring after delivery or shipment of the product[1].



SE Engineering Life Cycle Stages [2]

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LIFE CYCLE STAGES	PURPOSE	DECISION GATES
CONCEPT	Identify stakeholders' needs Explore concepts Propose viable solutions	**Decision Options** **Execute next stage** **Continue this stage** **Go to a preceding stage** **Hold project activity** **Terminate project**
DEVELOPMENT	Refine system requirements Create solution description Build system Verify and validate system	
PRODUCTION	Produce systems Inspect and test [verify]	
UTILIZATION	Operate system to satisfy users' needs	
SUPPORT	Provide sustained system capability	
RETIREMENT	**Store, archive, or dispose of the system**	

Systems Engineering V Models[2]

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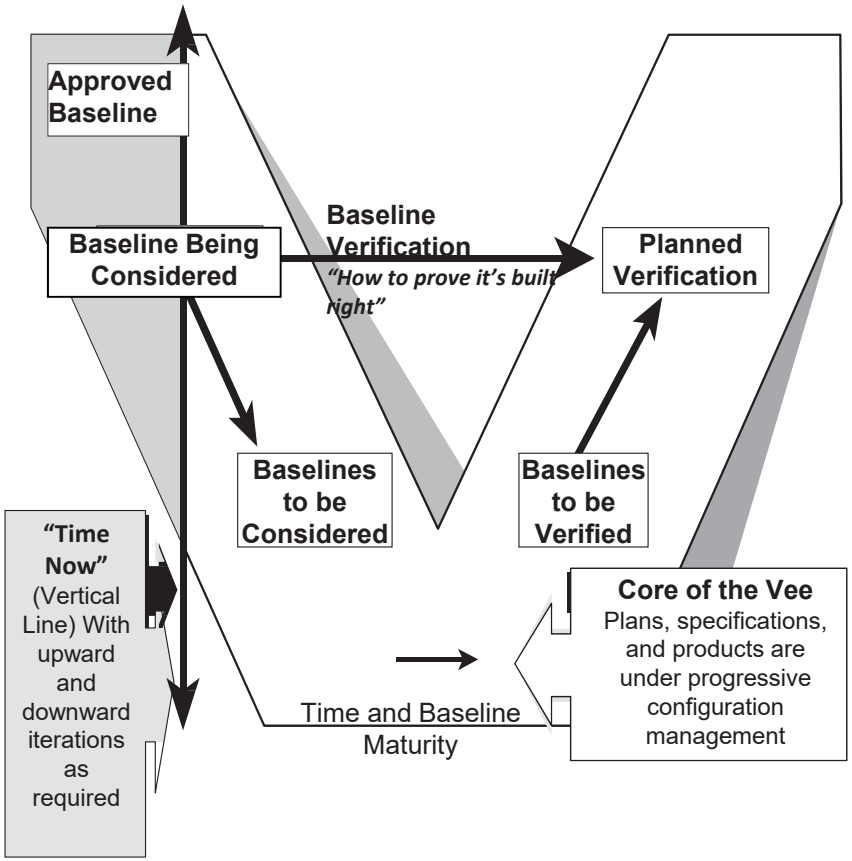

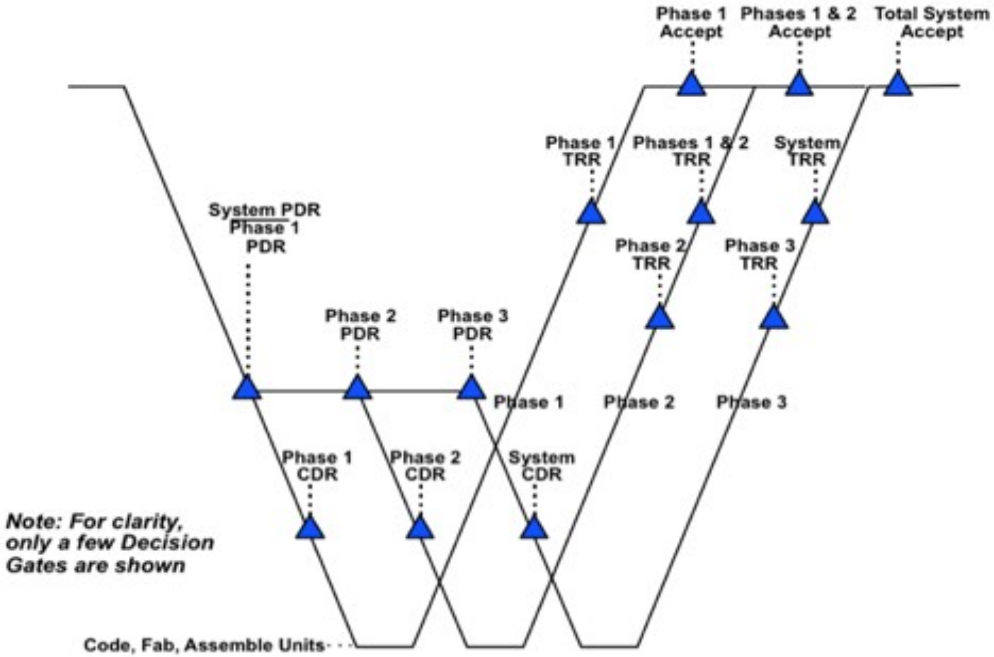

Do You See a Difference? The Similarities?

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Figure from INCOSE Handbook[2]

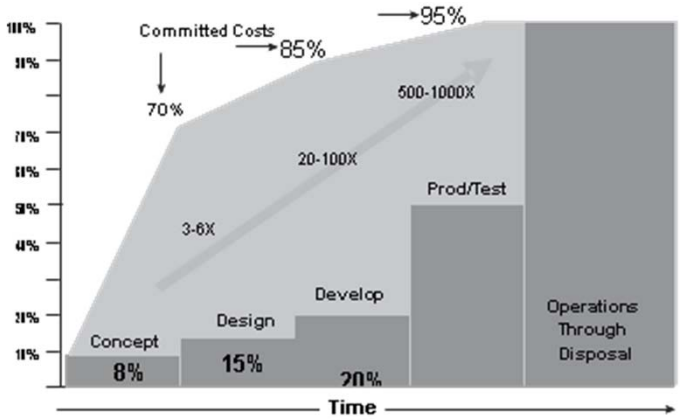
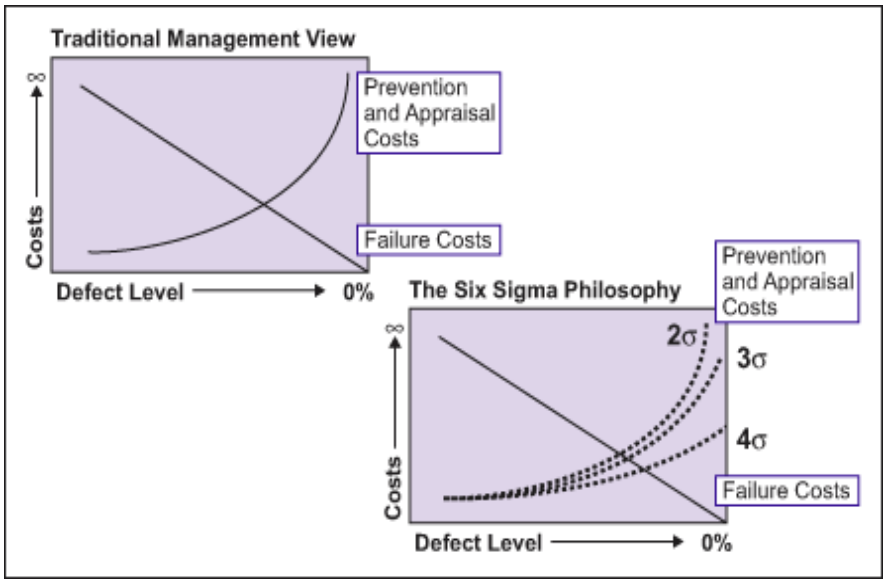


Figure from CoQ Principles Book[1]

Figure 3: Traditional Management View vs. Six Sigma Philosophy



Program Costs Over Time as they Relate to Rework Costs

Conclusion

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An inherent byproduct of good Systems Engineering is to promote First-Time Quality in all of our products

This presentation has shown you the relationship between Systems Engineering processes, how they promote first-time quality, and how this results in reduced rework and therefore reduced cost.

This presentation focused on the three main areas which make up the “Total Quality Costs”: “prevention”, “detection” and “failure” and how they relate to Program Life Cycle.

I have shown you the processes that make up the Systems developmental “V” and how they contribute to the reduction of rework costs and promote first-time quality.

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Questions?

Reference Material

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1. Principles of Quality Costs: Principles, Implementation and Use; 3rd Edition; ASQ Quality Costs Committee; 1999

2. BKCASE Editorial Board. 2016. *The Guide to the Systems Engineering Body of Knowledge (SEBoK)*, v. 1.7. R.D. Adcock (EIC). Hoboken, NJ: The Trustees of the Stevens Institute of Technology. Accessed 12/10/2016. www.sebokwiki.org.

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