TOCICO CONFERENCE 2004

Integrating the TOC Thinking Process & Six Sigma

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Track: Expert E 1.3

Agenda

1. Seagate Technology – Company Overview
2. Six Sigma at Seagate
3. The Thinking Process Tools & Six Sigma
4. Results from the Thinking Process
5. Next Steps

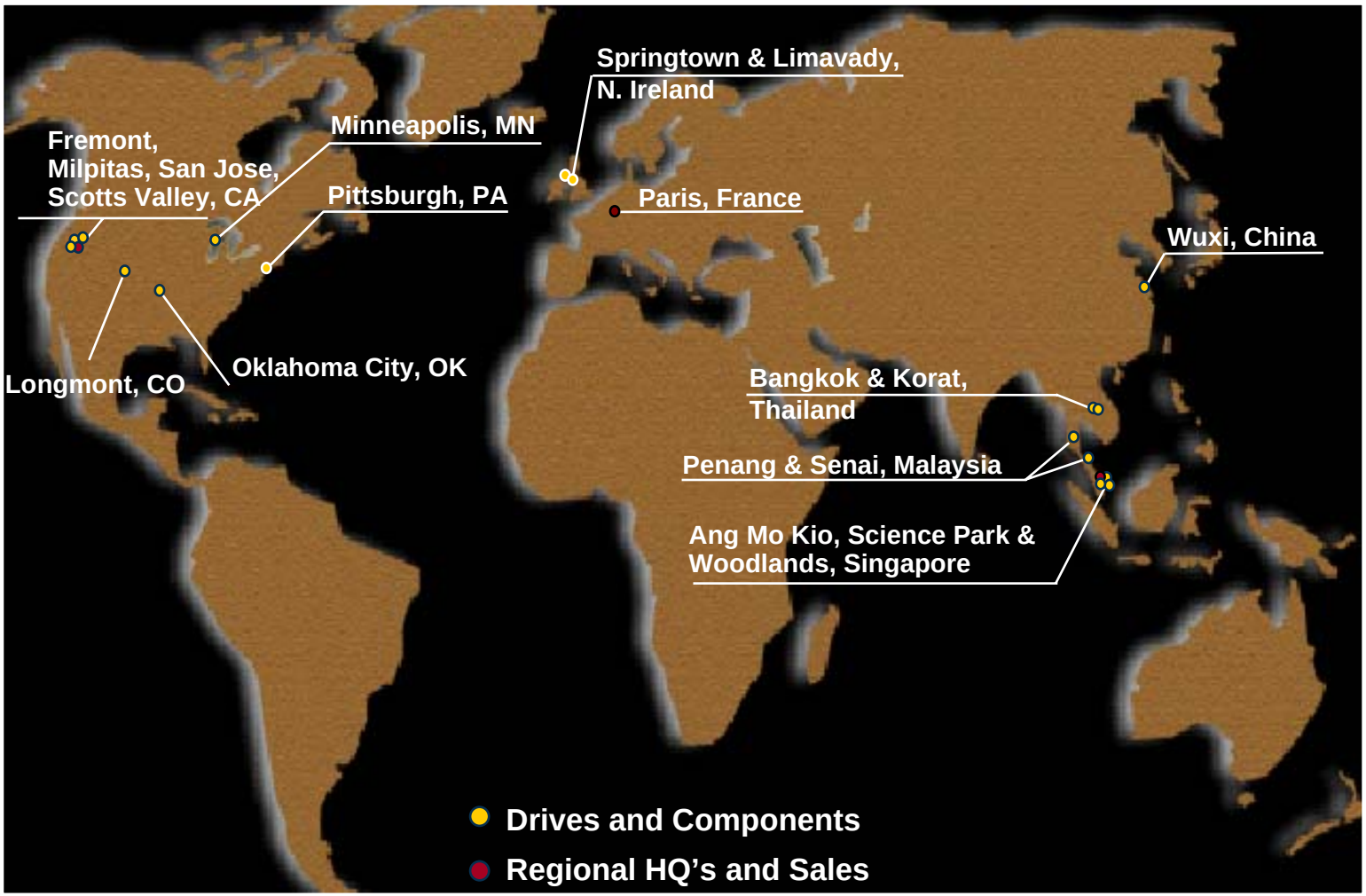
Seagate Technology

Company Overview

Company Overview

- Seagate is the world's leading provider of hard disc drives.
  - **Q4 FY2004: 18.3M drives shipped; revenue of $1.33B**
  - **Fiscal 2004: 79.3M drives shipped; revenue of $6.22B, net income of $529M**
- Provides drives for Enterprise, Desktop, Mobile Computing and Consumer Electronics applications.
- Ownership and vertical integration of core technologies: heads, media, motors, and printed circuit boards.
- Major operations and sales offices in 15 countries.
- Approximately 42,000 employees worldwide.

Seagate Global Presence



Key Customers

Six Sigma at Seagate

Six Sigma – History at Seagate

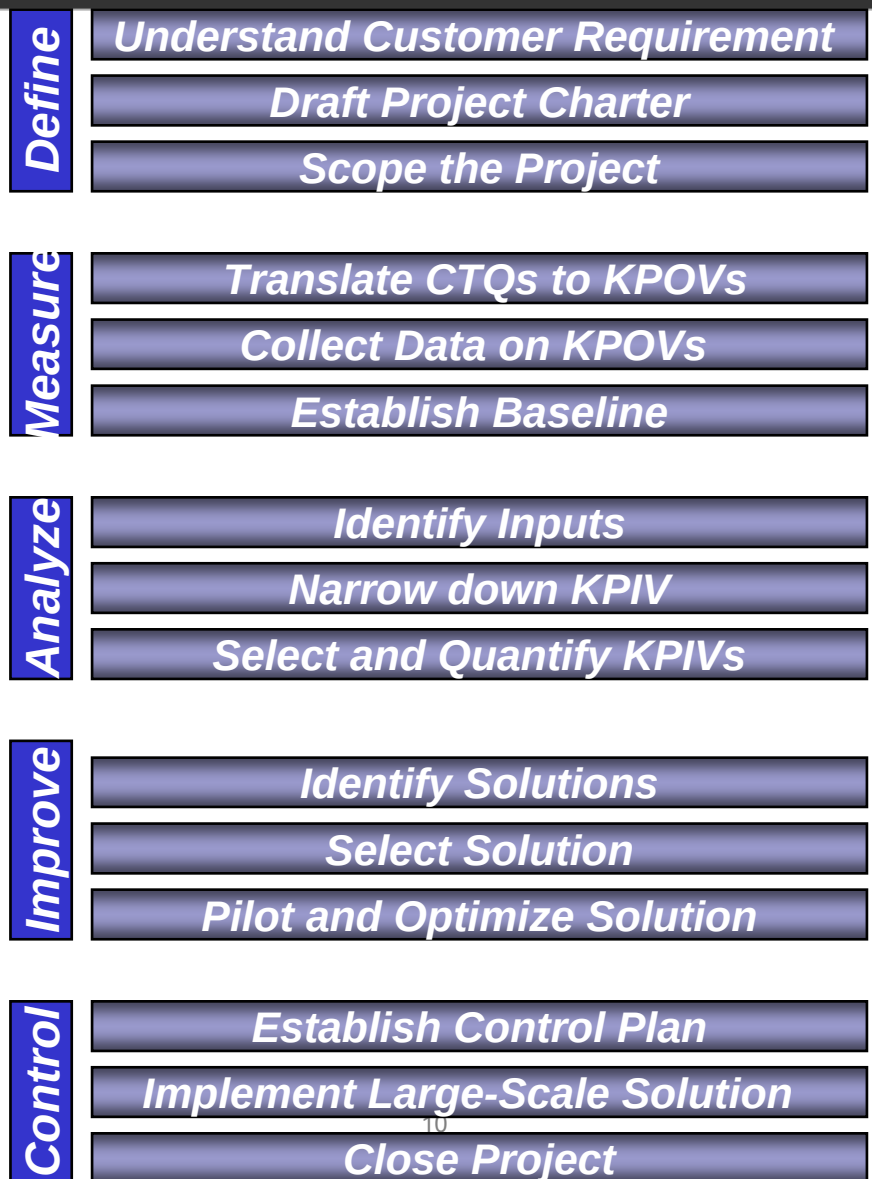
- Introduced by Board of Directors member - General Thomas Stafford
- Benchmarked General Electric
- Launched in 1998
- Implemented with help from the Six Sigma Academy
  1. Program development
  2. Training material
- First year was DMAIC methodology, followed by DFSS
- Six Sigma was launched as a Global initiative

Six Sigma Methodologies

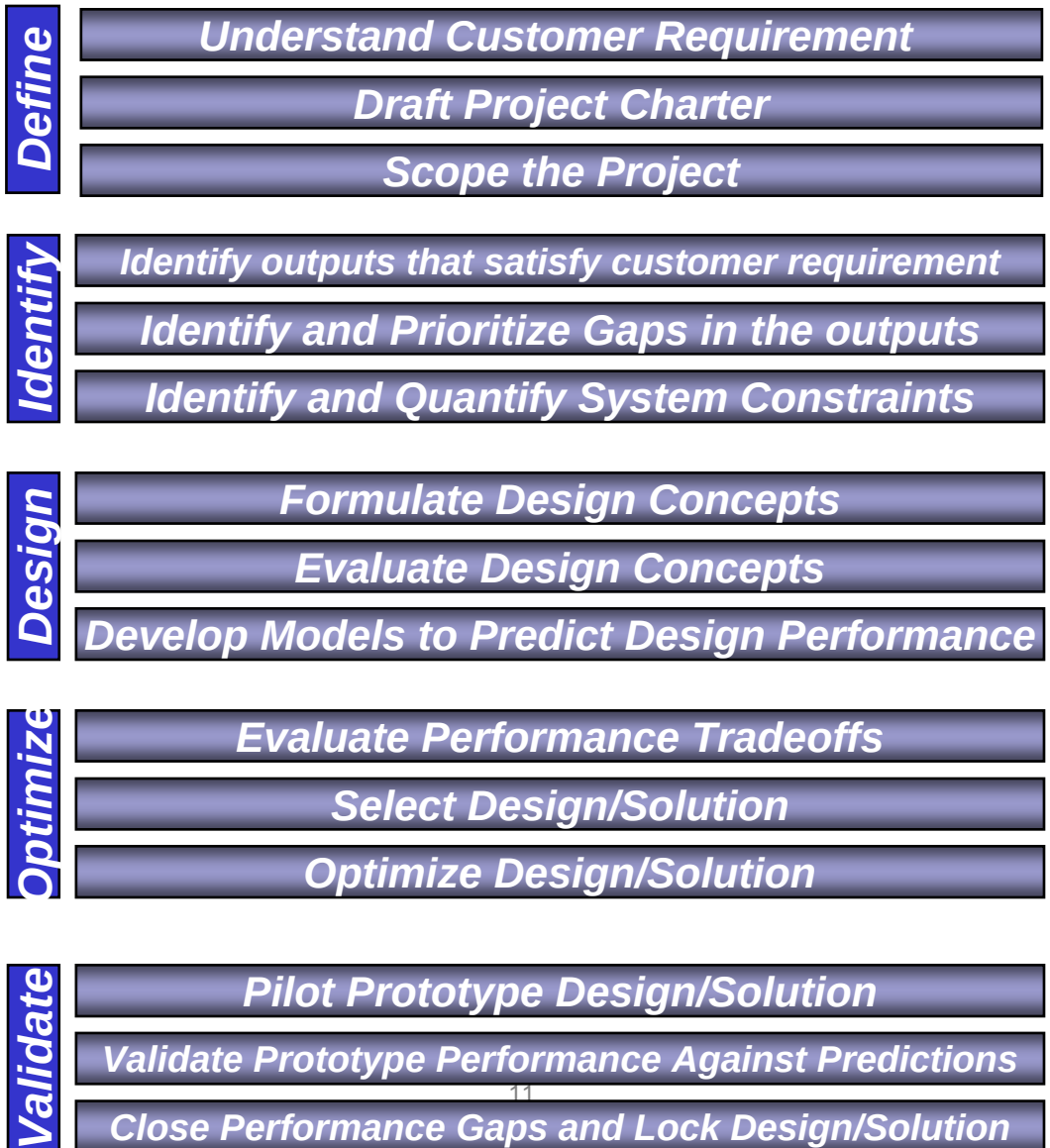
1. DMAIC Transactional & Operational
   - Define
   - Measure
   - Analyze
   - Improve
   - Control

2. DFSS (Design for Six Sigma)
   - Define
   - Identify
   - Design
   - Optimize
   - Validate

The DMAIC Phase Deliverable



The DIDOV Phase Deliverables



Six Sigma Belt Levels at Seagate

1. **Black Belt** - Execute functional and cross functional process improvements using Six Sigma methodologies full time.
2. **Brown Belt** - Execute functional and cross functional process improvements using Six Sigma methodologies as assigned by management.
3. Green Belt – Actively participates in project teams or executes small scale, functional process improvement projects as assigned by management.
4. Orange Belt – Participates in process improvement projects as a team member.

Six Sigma Measured Accomplishments

- Completed over 4,700 Six Sigma projects (includes Green, Brown & Black Belt)
- $1.2 Billion in savings
- Trained over 8,000 employees (includes Green, Brown & Black Belt)
- Incorporated Six Sigma into the transactional and design worlds

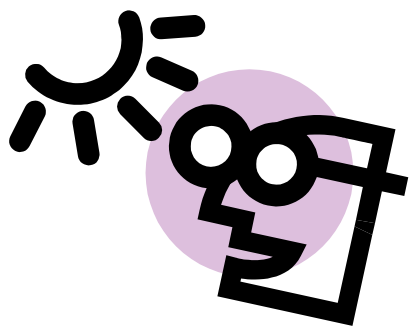
The Thinking Process Tools & Six Sigma

Weaknesses in the Training

- Too much statistical analysis in DMAIC Transactional waves.
- DMAIC Analyze stage lacked a strong effect-cause-effect tool.
- DMAIC Improve stage didn't have a tool for solution development tool.
- DMAIC Improve stage didn't have a method to resolve conflict.
- DFSS method for testing solutions was too complex.
- Project took too long to complete, average 6+ months.
- Belt don't have a way to prioritize and mine projects.

Desired Effects

- Belts have practical effect-cause-effect tools.
- Belts have tools to identify solutions for root causes to Undesirable Effects.
- Belts have a tool to resolve conflict.
- Belts can easily move from solutions to Action Plans.
- Projects are completed within three months.
- Belts have a way to prioritize projects, which drive Seagate towards “The Goal.”



Injection for Improvement

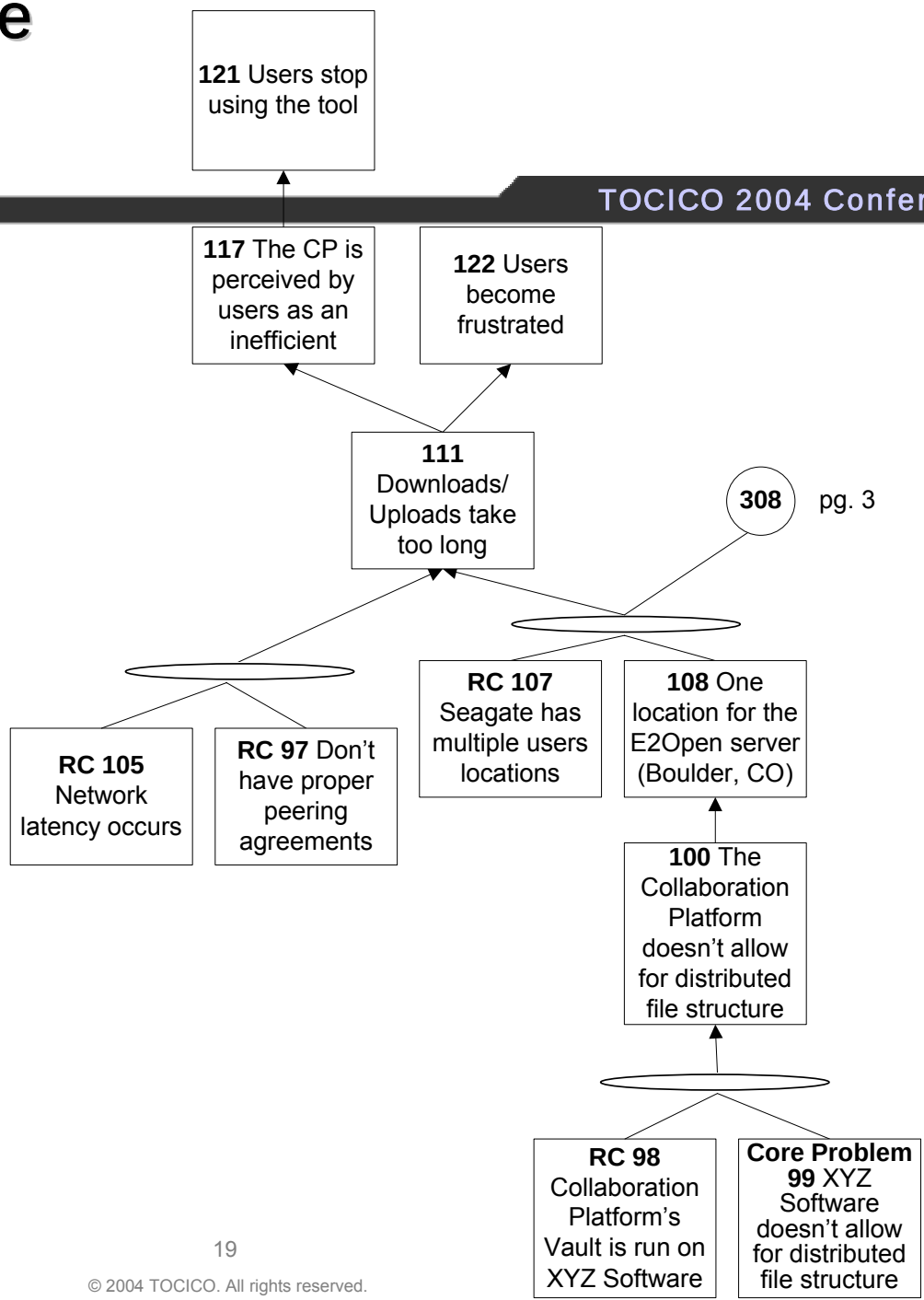
- Introduced the following TOC Thinking Process tools into Six Sigma.

1. Current Reality Tree (CRT)
2. Future Reality Tree (FRT)
3. Evaporating Cloud (EC)

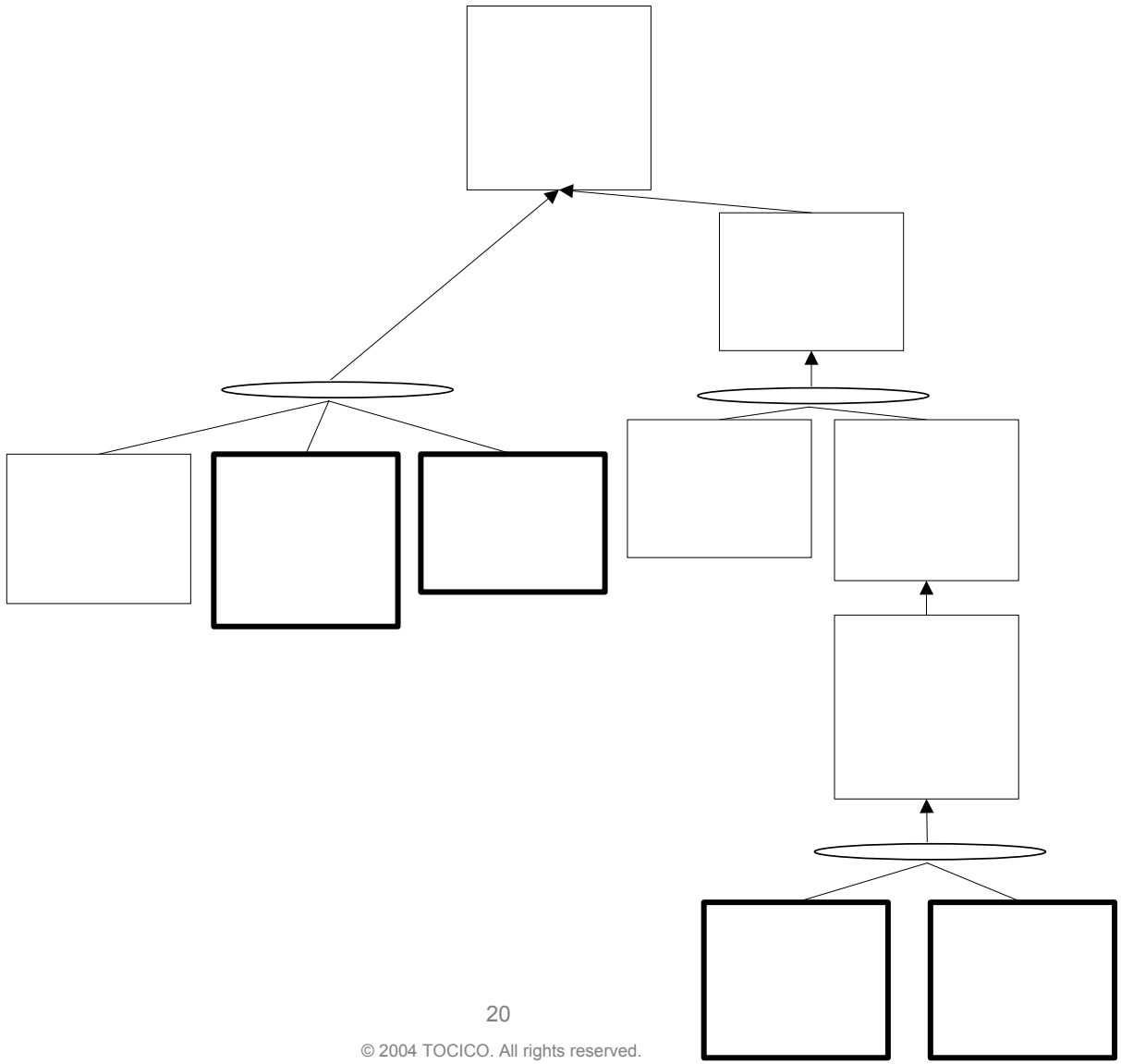
Implementing the Injection – Change Management

1. **Demonstrate the power of the Thinking Process to the Six Sigma Community.**
   - Use the Thinking Process in a Black Belt project:
   - **Project identified:** Performance of the E2Open Collaboration Platform (CP).
   - **Problem Statement:** The response time associated with the use of the CP is not meeting best in class performance. Some of the most latent transactions were recorded in Asia (2 min. 54 sec. to log on to system from Scotts Valley). This is a problem because CP users become frustrated, have their time wasted, and ultimately stop using the tool.
   - **Primary Measurement**: Launching the Platform & Downloading a 2MB from Singapore as measured by Topaz.

Snapshot from the Collaboration Platform CRT



Snapshot from the Collaboration Platform FRT



Results from the Collaboration Platform Project

Results from Singapore as measured by Topaz:

	Before	After
Launching the Platform	2 min. 54 sec.	9 sec.
Download 2MB File	1 min. 48 sec.	7 sec.

- Completed the project in record time for a Transactional Black Belt project, 2 months.
- Results of the project clearly demonstrate the power of the Thinking Process Tools!
- The Six Sigma Global Curriculum Committee decided to move forward!

Implementing the Injection

2. Where should we put the Thinking Process Tools?

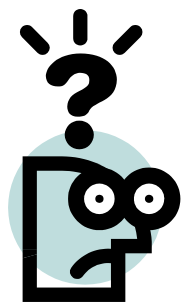
Phases: DMAIC / DIDOV	DMAIC	DIDOV
Define		
Measure / Identify		
Analyze / Design	CRT	FRT & EC
Improve / Optimize	FRT & EC	
Control / Validate		

Implementing the Injection

3. Which method of developing the tools should we use?

- Must be able to easily develop with a Global Team.
- Must be able to build with WebEx/NetMeeting and conference calls.
- Needs to be easily understood by all team members.
- Need to minimize the number of meetings required to develop the tools.

- **Current Reality Tree**
  1. EC to CRT
  2. UDEs to CRT
  3. Cause, Negative, Why Table



Implementing the Injection

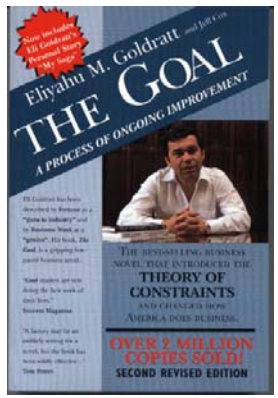
- **Chosen CRT method** - Cause, Negative, Why Table

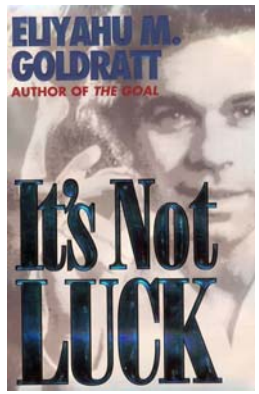
Example Table: Collaboration Platform Project:

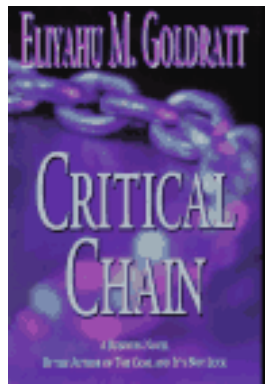
Causes	Negatives	Why
C1. Only one location for the E2Open server C1a. Traffic passes through multiple firewalls C1b. No SLA agreements with carriers	N1. Downloads & uploads take too long	W1. Users become frustrated W1a. Users stop using the CP W1b. Users waste time
C2. CP is frequently down C2a. Under performing tool	N2. Numerous complaints about latency/performance	W2. Extra load on Help Desk W2a. Help Desk costs increase W2b. Users stop using the CP W2c. Users become frustrated
C3. No compelling value proposition	N3. Limited adoption of the Collaboration Platform	W3. Not achieving CP ROI

Current Reality Tree

- **Who created it?**
- Eliyahu Goldratt







- **What is it?**

A systematic methodology of identifying root causes that negatively affect the output of a process.

Brown/Black Belt Training Slides

Six Sigma at Seagate

Development Steps – CRT

1. Define the System Boundaries & Goals
2. State the System Problem
3. Start Three Columns
4. List Negatives, Why, and Causes
5. Designate the Undesirable Effects

Brown/Black Belt Training Slides

Six Sigma at Seagate

Team activities

6. Convert All Negatives, Whys, and Causes to CRT Entities
7. Group Entities in Clusters
8. Connect the Causes, Negatives & Undesirable Effects
9. Group Related Clusters Together
10. Incorporate the Rest of the Entities

Small-group activities

From "Breaking the Constraints to World Class Performance," William Dettmer

Development Steps – CRT (continued)

- 11. Scrutinize & Finalize Connections
- 12. Look for Additional Causes
- 13. Continue Building Downward
- 14. Re-designate Undesirable Effects
- 15. Look for Negative Reinforcement Loops
- 16. Identify All Root Causes & a Core Problem
- 17. Trim Nonessential Entities

Small-group activities (these require team validation)

Brown/Black Belt Training Slides

Six Sigma at Seagate

- 18. Choose a Root Cause

Team activity

From "Breaking the Constraints to World Class Performance," William Dettmer

Implementing the Injection

- **Which method of developing the tools should we use?**
  - **Future Reality Tree**
    - UDEs to Desirable Effects
    - Root Causes to Injections
    - Injections to Desirable Effects

Building a Future Reality Tree: The Process

1. Determine the Desired Effects
2. Formulate the basic Injections
3. Identify Elements of Existing Reality
4. Insert Injections
5. Start filling in the gaps
6. Look for opportunities to build positive reinforcing loops
7. Search for possible negative branches & resolve
8. Develop action plan

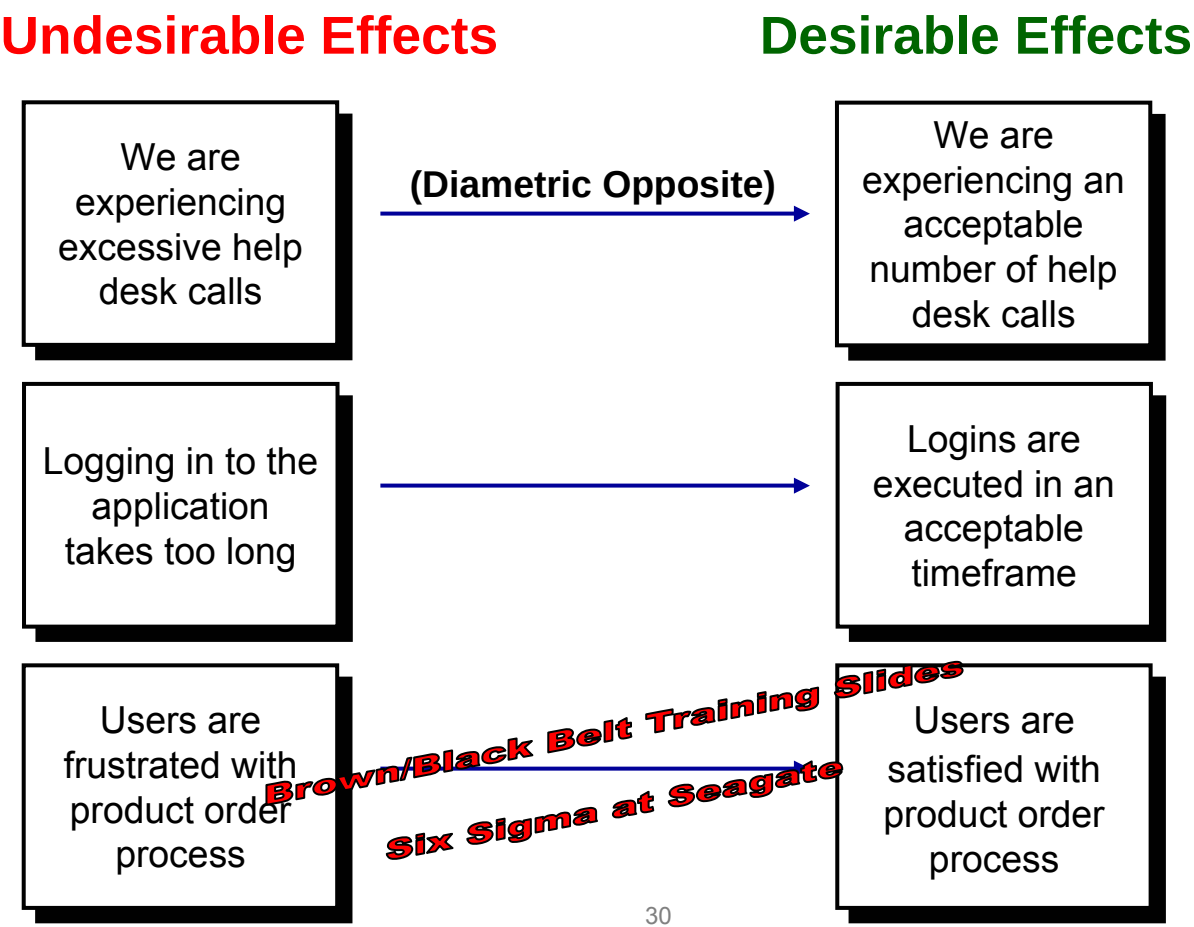
Brown/Black Belt Training Slides

Six Sigma at Seagate

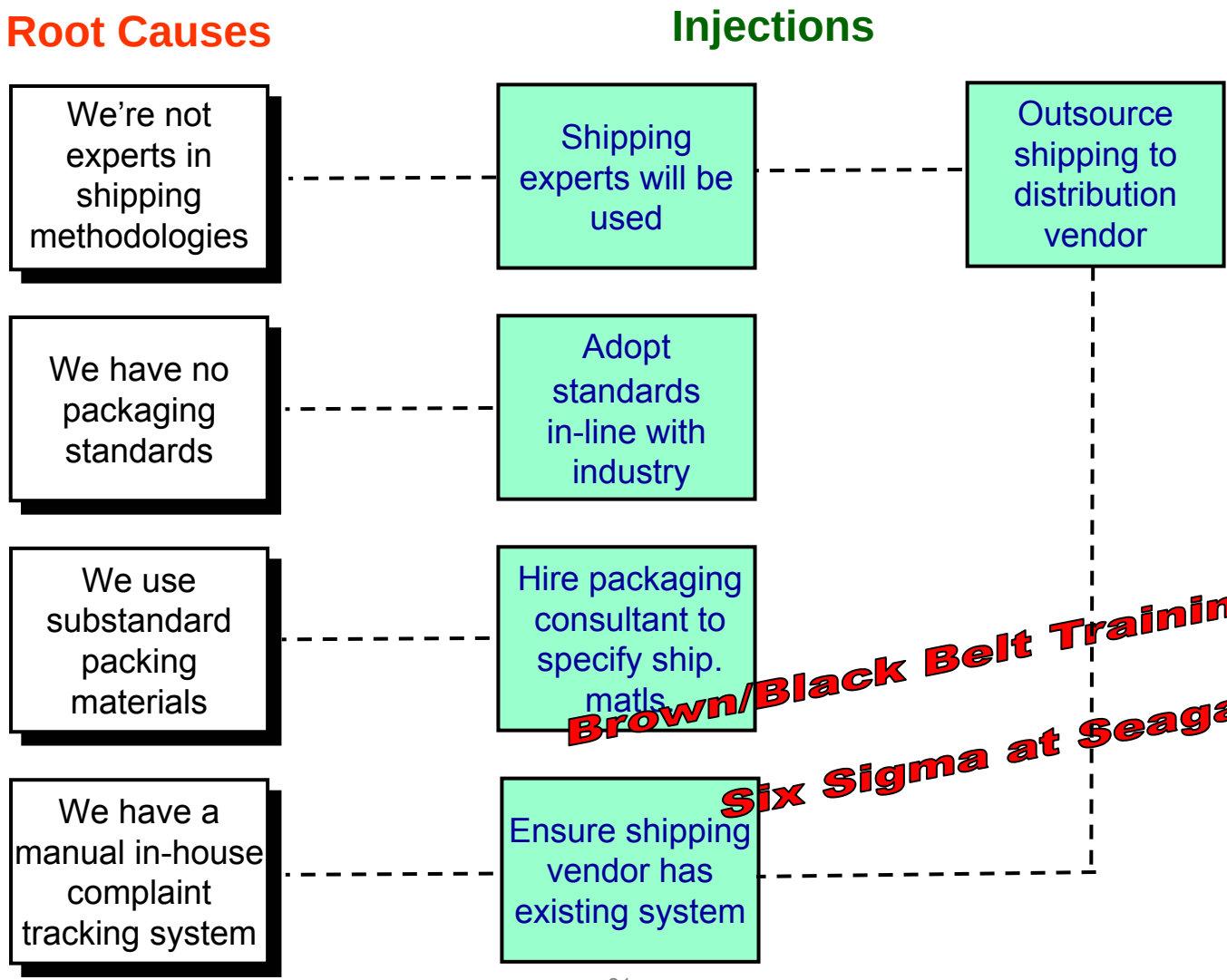
From "*Breaking the Constraints to World Class Performance*," William Dettmer

Step 1 – Determine the Desired Effects

Take the *undesirable effects* from the Current Reality Tree and convert them to the *desired effects* (diametric opposite of UDE)

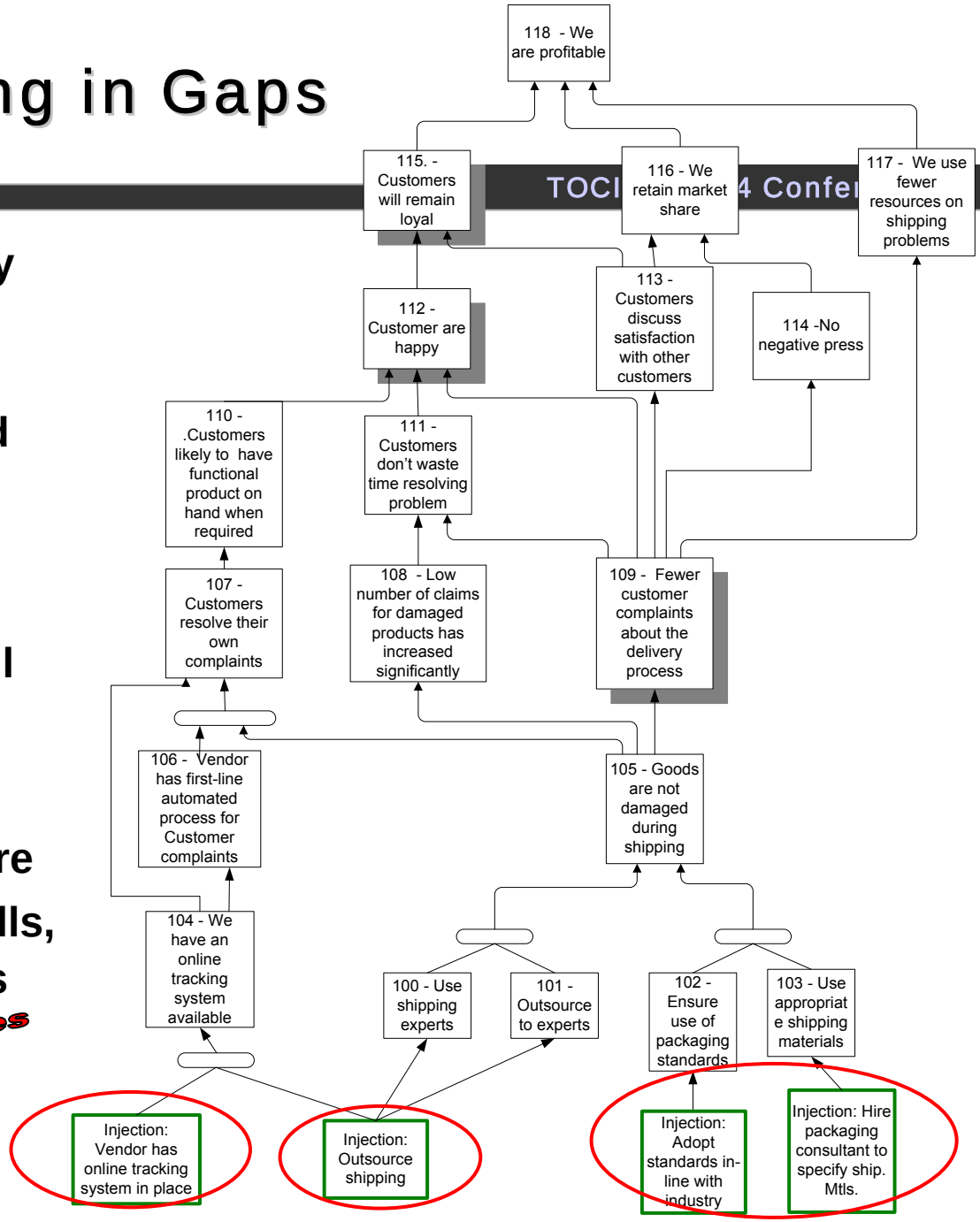


Step 2 – Formulate the Basic Injections



Step 5 – Start Filling in Gaps

- **Building upward, solidify the logic with "If-Then" statements.**
- **Hypothesize a direct and unavoidable outcome of putting the change into place.**
- **Repeat this process until you can bridge the gap to the Desired Effects.**
- **If you reach a point where upward construction stalls, consider other injections**

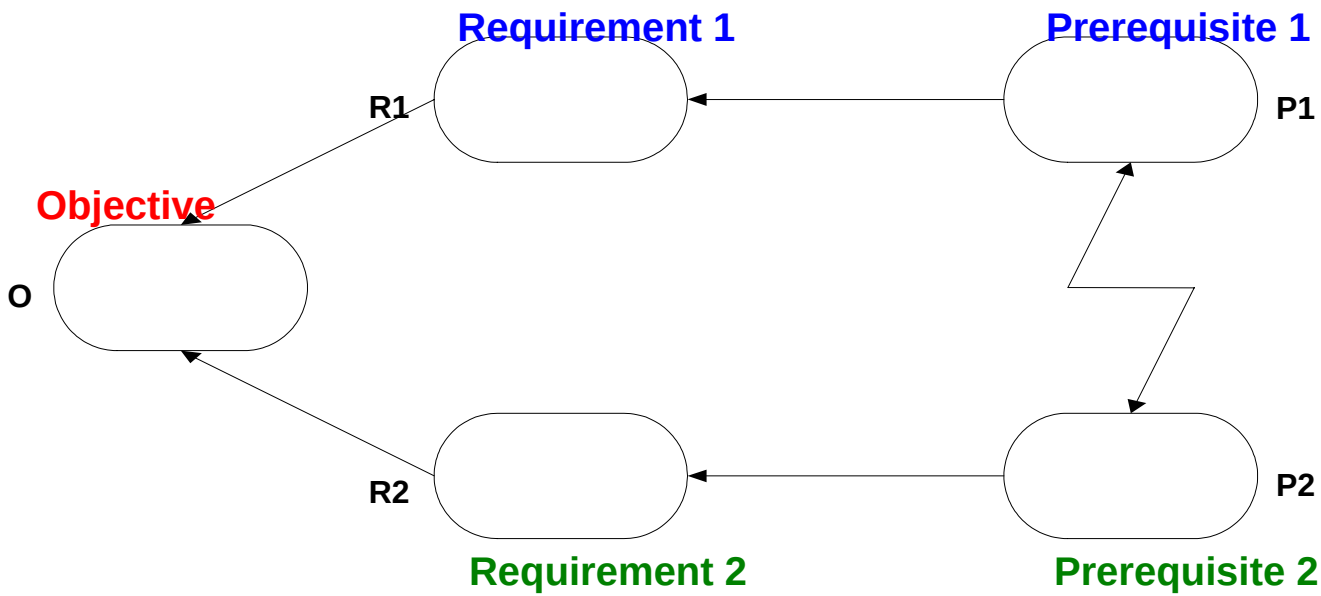


Brown/Black Belt Training Slides

Six Sigma at Seagate

Implementing the Injection

- **Which method of developing the tools should we use?**
  - **Evaporating Cloud**
    1. **Prerequisites → Requirements → Objective**



Building an Evaporating Cloud*

1. Articulate the conflict
2. Determine the requirements
3. Identify the objective
4. Polish the diagram
5. List assumptions
6. Evaluate the assumptions
7. Create Injections to Neutralize the Conflict
8. Select the best injection(s)

Brown/Black Belt Training Slides

Six Sigma at Seagate

* Development process steps modified from "*Breaking the Constraints to World Class Performance*," William Dettmer

Implementing the Injection

4. **Start the training:**
   - **Developed the training slides.**
   - **Provide Train-the-Trainer for Global Six Sigma Instructors.**
   - **Train Global Master Black Belts.**
   - **Provide refreshers classes for existing Belts.**
   - **Update training slide to reflect class feedback:**
     1. **Added a class exercises with case studies.**
     2. **Updated class examples.**
     3. **Develop tree building pocket cards.**

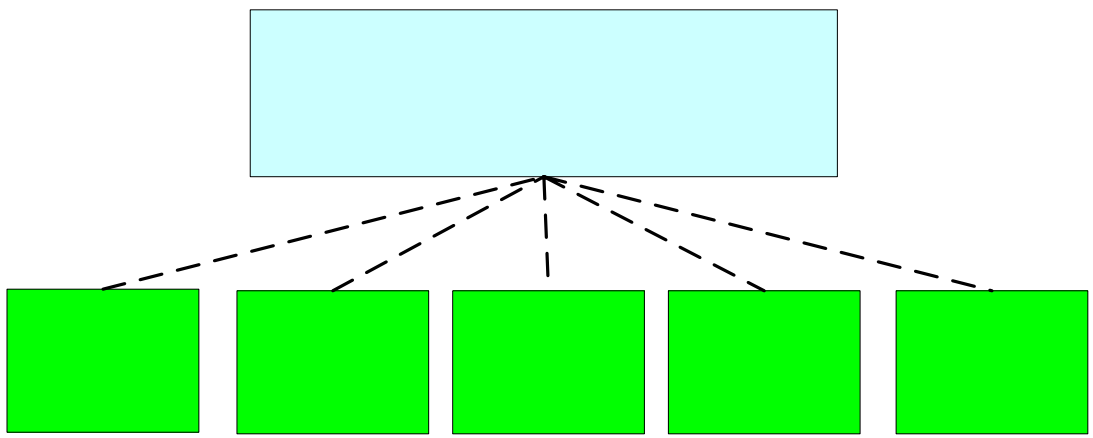
Results - Six Sigma & the Thinking Process

Integrating the TOC Thinking Process & Six Sigma

Results:

1. Project quality increased dramatically (as measured by interviews with Six Sigma Directors):
   - Projects are more focused.
   - Problems are much less ambiguous.
   - Solution paths are more clearly defined.
   - Less resistance to buy-in for proposed solutions.
2. Project completion rate increased by 80%.
3. Number of project completed with 3 months increased by 70%.
4. Graduating Transactional Belts voted CRT, FRT and EC the most useful Six Sigma tools in every wave since introduction.
5. CRT has become the primary tool used for project mining.

6. CRT & FRT are used to facilitate the Super Project concept:
   - Umbrella of project required to achieve major Desirable Effects.
   - Show cross functional relationships and links among multiple projects.



Next Steps

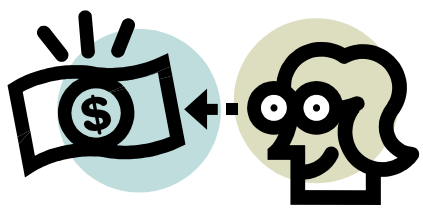
Next Step for TOC at Seagate

1. **Thinking Process:**
   - Implement Prerequisite and Transition Trees:

Phases: DMAIC / DIDOV	DMAIC	DIDOV
Define		
Measure / Identify		
Analyze / Design	EC	FRT & EC
Improve / Optimize	FRT, EC, **PRT & TT**	**PRT**
Control / Validate		**TT**

Next Step for TOC at Seagate

2. Change the primary measure for Six Sigma success from cost saving to increasing throughput.
3. Use the Thinking Process to identify and drive the correct projects Seagate should undertake (emphasis on Throughput).
4. Implement Throughput/Constraint Accounting for management decision making.
5. Move from build-to-stock to build-to-demand using Drum-Buffer-Rope.



Questions?

About Chris Zephro

Chris Zephro is a Sr. Six Sigma Master Black Belt for the Supply Chain Group at Seagate Technology. His experience includes Theory of Constraints implementations and constraint exploitation using the TOC Thinking Process and Six Sigma at companies such as Dell Computers, HP, Saturn Automotive and Skyway Freight Systems. Chris has 8 years of experience in the field of Supply Chain Management, holds an MBA in Logistics and Transportation from the University of Tennessee and has been practicing TOC for 9 years.