

Quality Cost Management – PNSQC 2009

Can you afford **high-quality** software?

Can you afford **low-quality** software?

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Main Message:

As managers you have a clear choice:

Invest in prevention

OR

Constantly react to problems

“An ounce of prevention is worth a pound of cure.”

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If you choose the **reaction path**,

- Your customers, staff, and business will suffer.
- Your quality costs will eat **30-70%** of your revenue (mostly “**failure**” costs).

If you choose the **proactive path**,

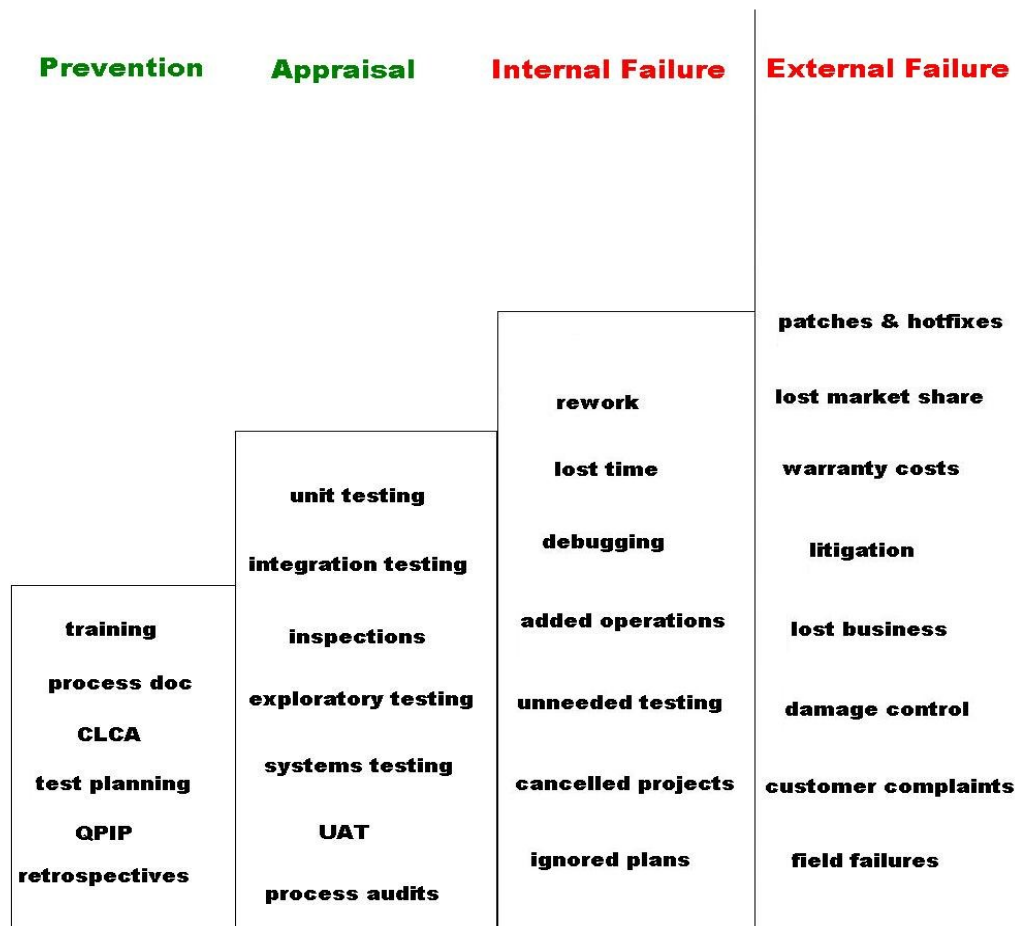
- Your customers, staff, and business will prosper.
- Your quality costs will eat **10-20%** of your revenue (mostly “**system**” costs).

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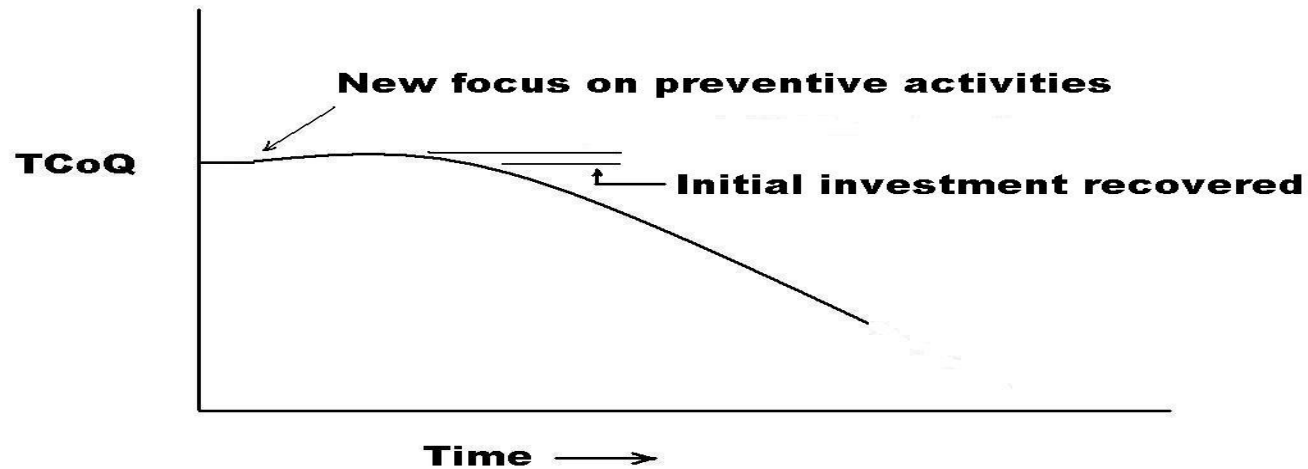
- **Prevention**
 - Problem avoidance activities
- **Appraisal**
 - All manner of evaluations / quality control
- **Internal failure**
 - Activities related to problems discovered in-house / pre-release
- **External failure**
 - Activities related to problems that customers discover

Total Cost of Quality (TCoQ) = Sum of the above

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Deming: **Constancy of purpose...**

- for **continual improvement** of products and service to society,
- allocating resources to provide for **long range needs** rather than only short term profitability,
- a plan to become competitive, **stay in business**, and to provide jobs.

Source: Deming, J. Edwards; Out of Crisis, 1982, MIT Press

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Other industries...

- Police work
 - Community policing → less punishment
- Medicine / Health
 - Wellness programs → less ER treatment

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Other industries (cont.)

- Manufacturing
 - Supply-chain mgmt → less inspection
- Traffic safety
 - Root-cause analysis → fewer fatalities

Why not software?

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Some companies **do** use numbers well

- Controlled experiments
- Statistical process control (SPC)
- Metrics:
 - driven by goals (quality, schedule, scope, cost)
 - plotted as X-bar R charts
- Risks anticipated and contingencies budgeted
- Systematic software process improvement

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Some examples of organizations that are serious about software process improvement...

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ROI – Software Process Improvement

- **Lockheed:**
 - projects at higher levels of maturity were 3 to 5 times more productive than CMM Level 1 projects
- **U.S.A.F:**
 - SPI ROI of 6.35X
- **IBM Toronto:**
 - 10X reduction in delivered defect rates,
 - productivity up by 240%,
 - rework reduced by 80%

Source: Dr. Herb Krasner Published in *Software Process Improvement*, IEEE Computer Society Press, 2001, ISBN 0-7695-0999-1, pp 519-539
<http://www.compaid.com/cailInternet/casestudies/krasner-spiroi.pdf>

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ROI – Software Process Improvement

- **Texas Instruments:**
 - 60% productivity improvement over 2 years,
 - 10X reduction in delivered defect rate over 3 years,
 - 12% annual cycle time reduction
- **Boeing I.S.:**
 - project estimates within 20%,
 - cycle time improved 36%,
 - staff support needs down 62%,
 - staff size reduced 31%,
 - customer satisfaction score up 10%,
 - \$5.5 M saved in 1996 alone

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ROI – Software Process Improvement

- **Bellcore:**
 - defects 10X lower than industry average,
 - customer satisfaction from 60 to 91% in 4 years,
 - achieved 9 hr. cutover to add 888 to 800 system with **no reported defects**
- **Motorola:**
 - 3X productivity improvement,
 - 3X cycle time reduction,
 - 7X quality improvement

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ROI – Pair programming

- Additional overhead was 15%
- Resulted in a 15% reduction in defects
- Break even? No.
 - The time saved was **15 times more** than the “lost productivity” cost
- That’s a **1,500% ROI**.

Source: [Alistair Cockburn and Laurie Williams](#)

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Some companies **do not** use numbers well

- Tend to blame people for problems
- Have no idea about their real quality costs
- Metrics limited to defect counts
- Risks anticipated but no triggers or action plans
- Haphazard improvement at best

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Deming:

“We can **no longer live with** commonly accepted levels of delays, mistakes, defective materials and defective workmanship.”

“Acceptable Quality Level” mindset → chaos, poor morale, failure

Typical Quality Control – 3Fs

- Failures

– F F F **F** F FF F F FF FFF FFF FF F

- Faults

– B B B B BB BBBB BB B B BB BB B B BB BB

- Fixes

Typical Quality Control – 3Fs

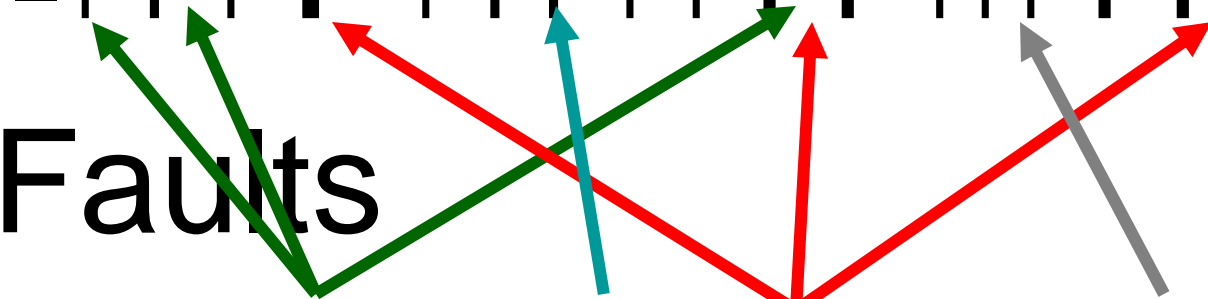
- Failures

- F F F **F** F F F F F F F F F F F F F F F F

- Faults

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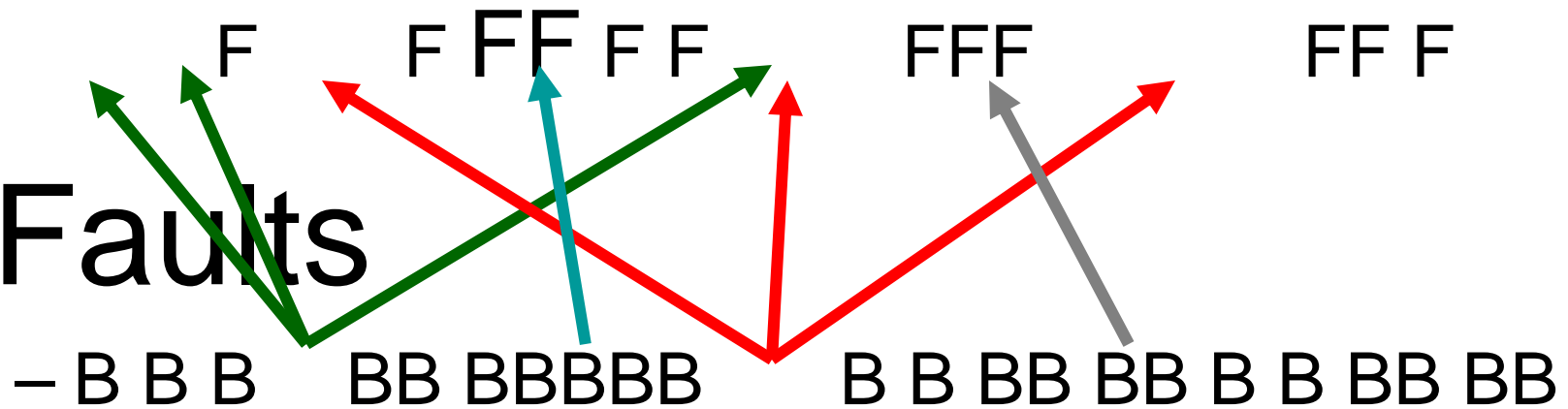
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Typical Quality Control – 3Fs

- Failures

- Faults



- Fixes

Typical Quality Control – 3Fs

- Failures

– F F F **F** F FF F F **FF** FFF **FFF** FF F

- Faults

– B B B **B** BB BBBBB **BB** B B BB BB B B BB BB

...but similar bugs come back

Typical Quality Control – 3Fs



Whack-a-mole management

- ... lures people in because it works in the **short term**
- ... is more concerned with **looking good** than with *being good*.
- ... always ends by making things **worse**

Source: [Whack-a-Mole Management](#), Show Leadership/Coyote's Journal, June 2008.

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Digging deeper...effectively addressing root causes:

- Uncomfortable for firefighters, most testers, and other whack-a-molers.
- Many engineers, being introverts, would rather solve single problems than engage in participate in...
 - Team-building
 - Collaboration
 - Systems thinking

BUT:

- When you eliminate root causes, the defects don't come back.
- Your organization realizes Juran's continual payback for each process improvement.

And you need to lead the way.

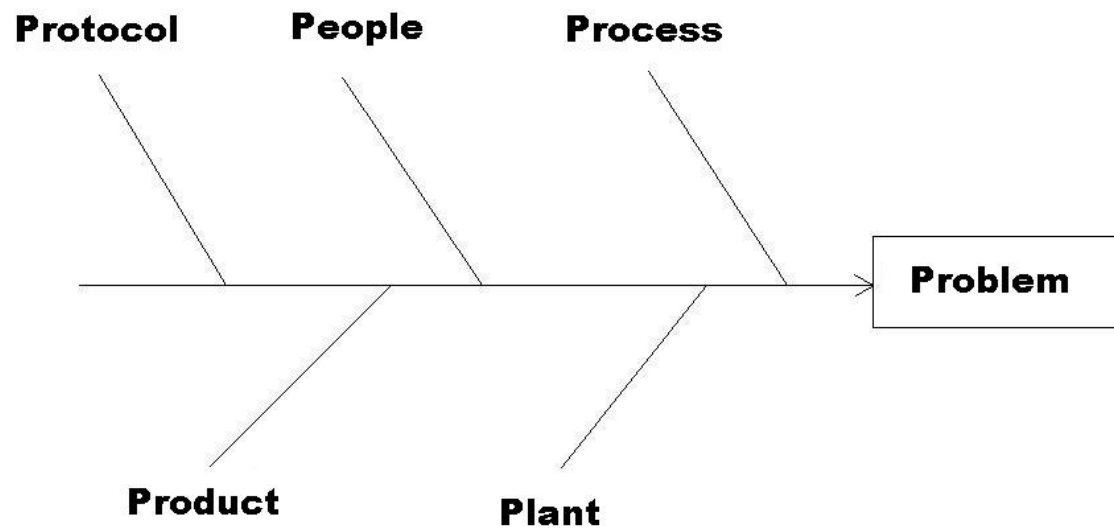
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- Digging deeper is scary...but there are methods.
- Strive toward maturing your organization ala Toyota
 - mass collaboration
 - culture that values criticism
 - people who stop the line are rewarded
- Find failure patterns and apply proven improvement techniques
 - Root-cause analysis
 - 5 Why's
 - Ishikawa (fishbone) diagramming
 - mind-mapping, etc.
- Pay people for correcting process and protocol problems.

See Diana Larsen and Esther Derby's Agile Retrospectives, 2008

Creating, finding, and fixing product defects is not engineering.

Fishbone diagramming



Digging Deeper

- Failures

- F F F **F** F FF F F FF FFF FFF FF F

- Faults

- B B B B BB BBBB BB B B BB BB B B BB BB

- Root causes

- CCC C C CC C CC CCC CC CCC

Digging Deeper

- Failures

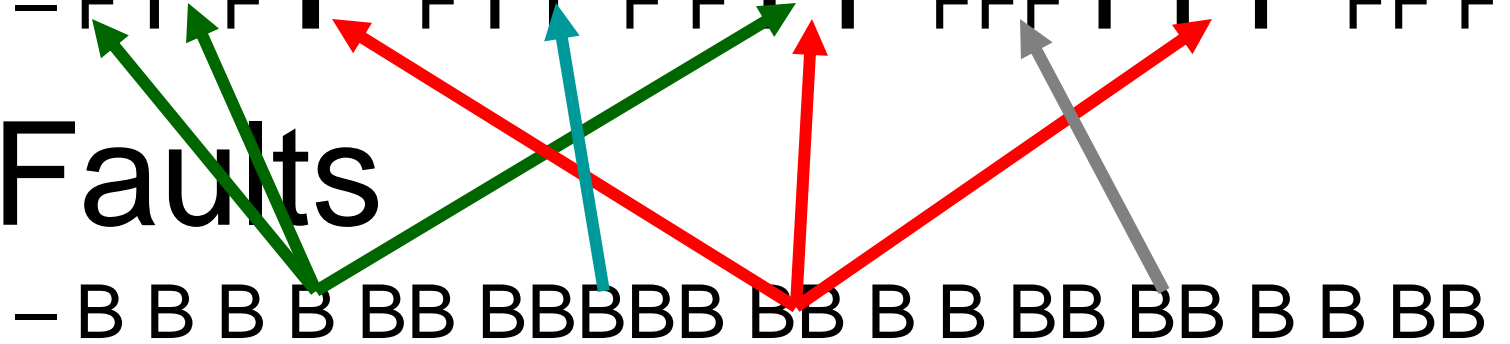
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- Faults

- B B B B BB BBBB BB B B BB BB B B BB BB

- Root causes

- CCC C C CC C CC CCC CC CCC



Digging Deeper

- Failures

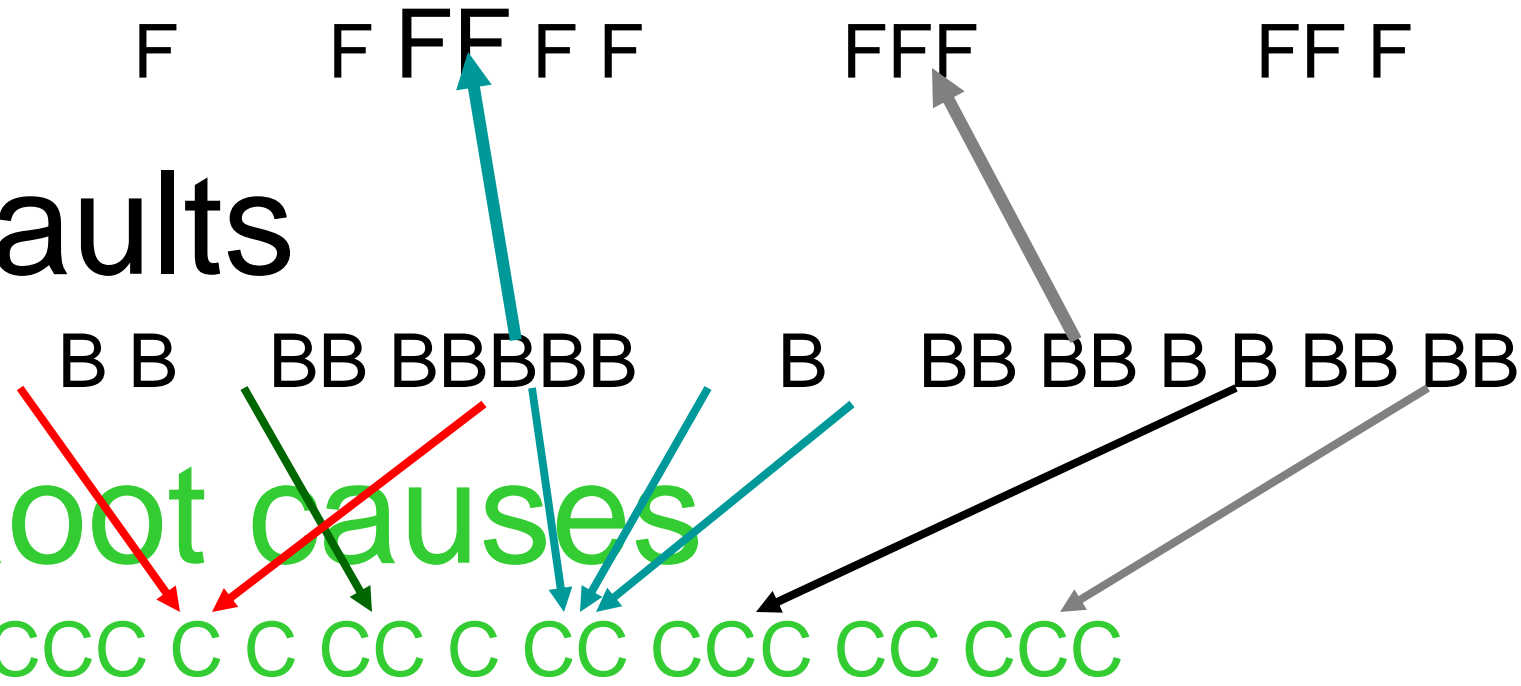
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- Faults

B B BB BBBBB B BB BB B B BB BB

- Root causes

- CCC C C CC C CC CCC CC CCC



Digging Deeper

- Failures

F F F F F F F F F F F

- Faults

B B B B B B B B B B B B B B B B B

- Root causes

- C C C C C C C C C C C C C



Digging Deeper

- Failures

F F F F F F F F F F F

- Faults

B B B B B B B B B B B B B B B B B B B

- Root causes

- C C C C C C C C C C C C C

Digging Deeper

- Failures

F F 😊 😊 F F 😊 😊 F F F

- Faults

B B BB 😊 😊 😊 B 😊 😊 B 😊 BB 😊

- Root causes

– 😊 😊 😊 C 😊 😊 C 😊 😊 😊 CC 😊 CC 😊 😊

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Constantly react to problems

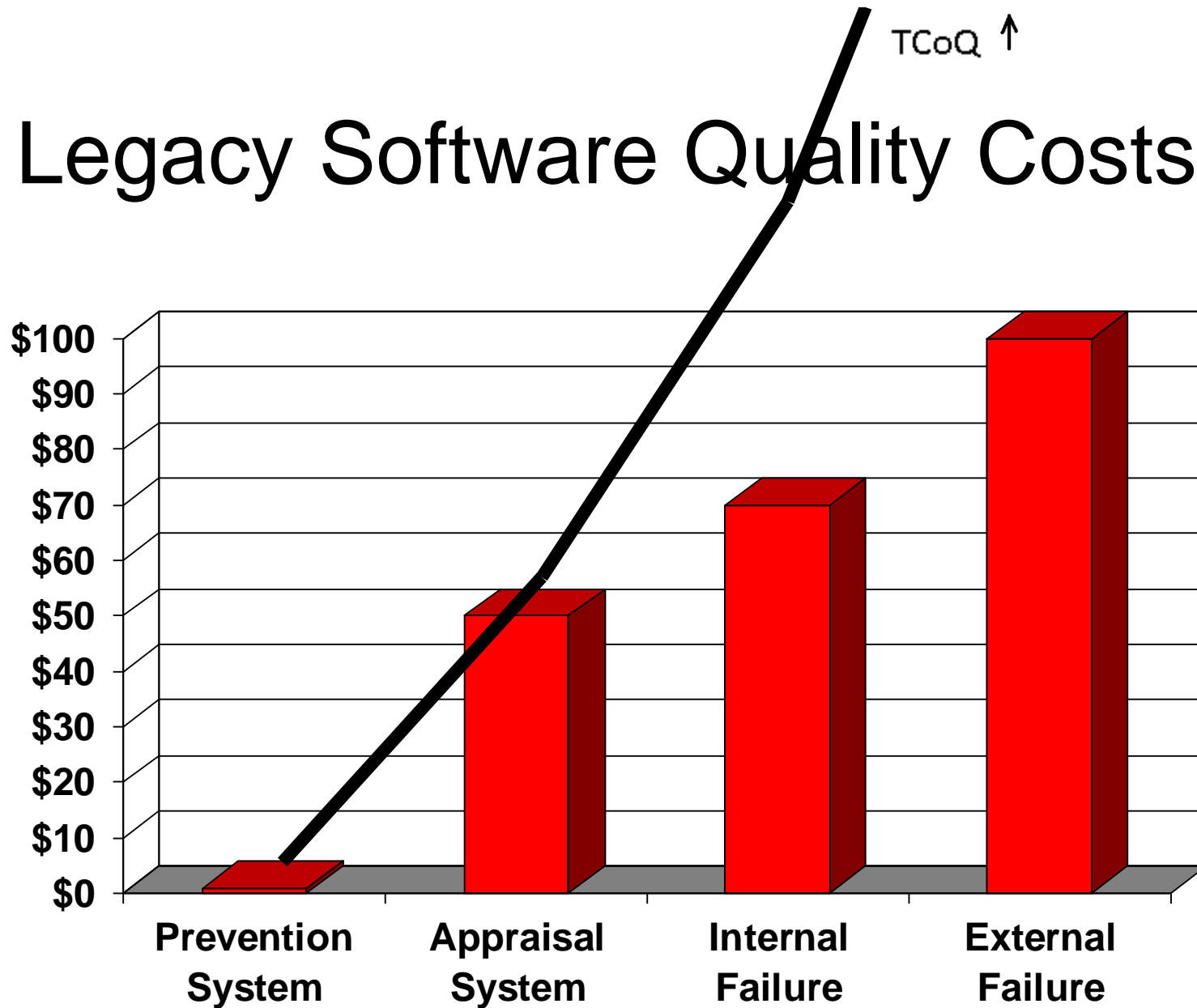
“A stitch in time saves nine.”

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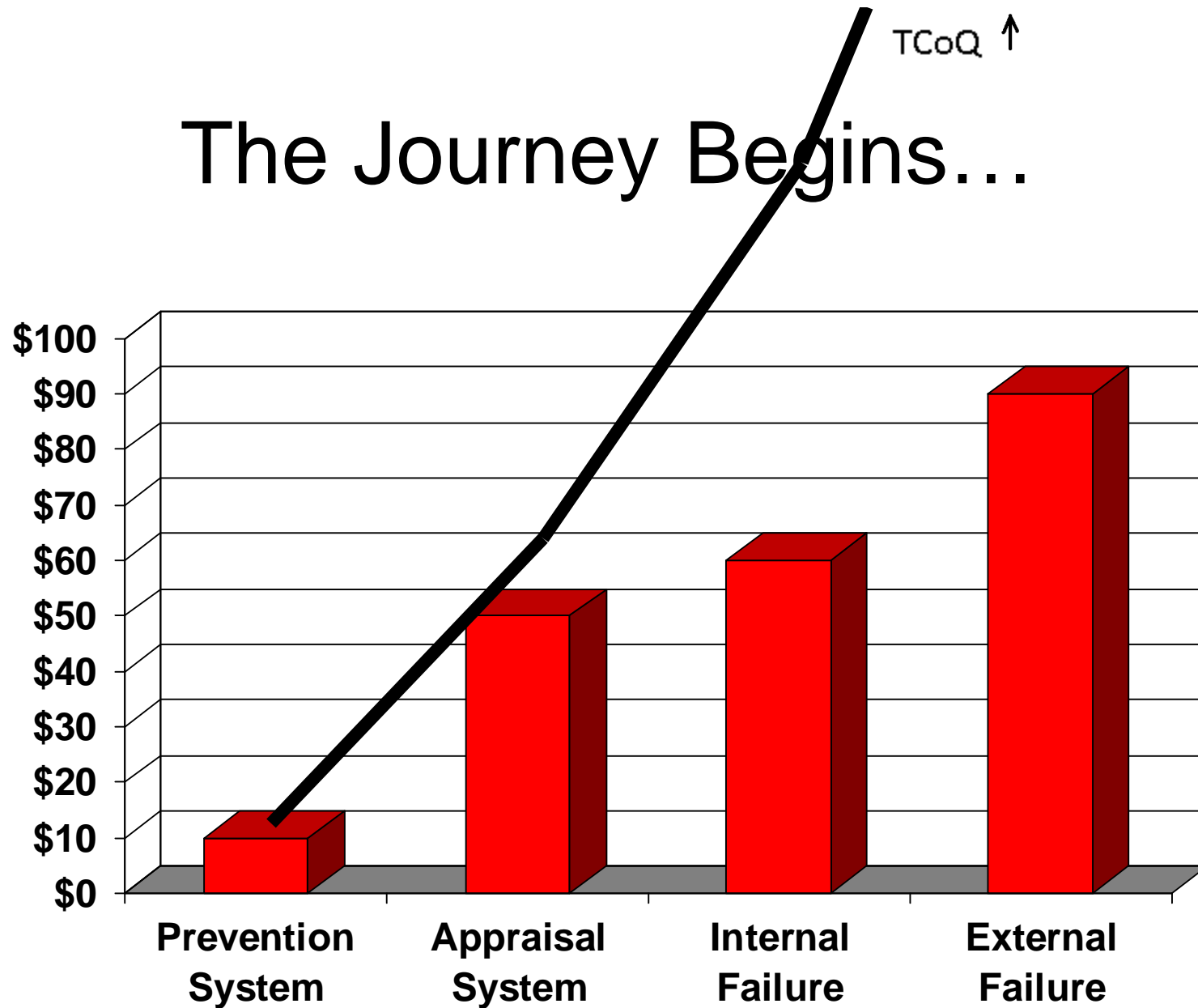
The End

Unless you wanna see the TCoQ flip deck...

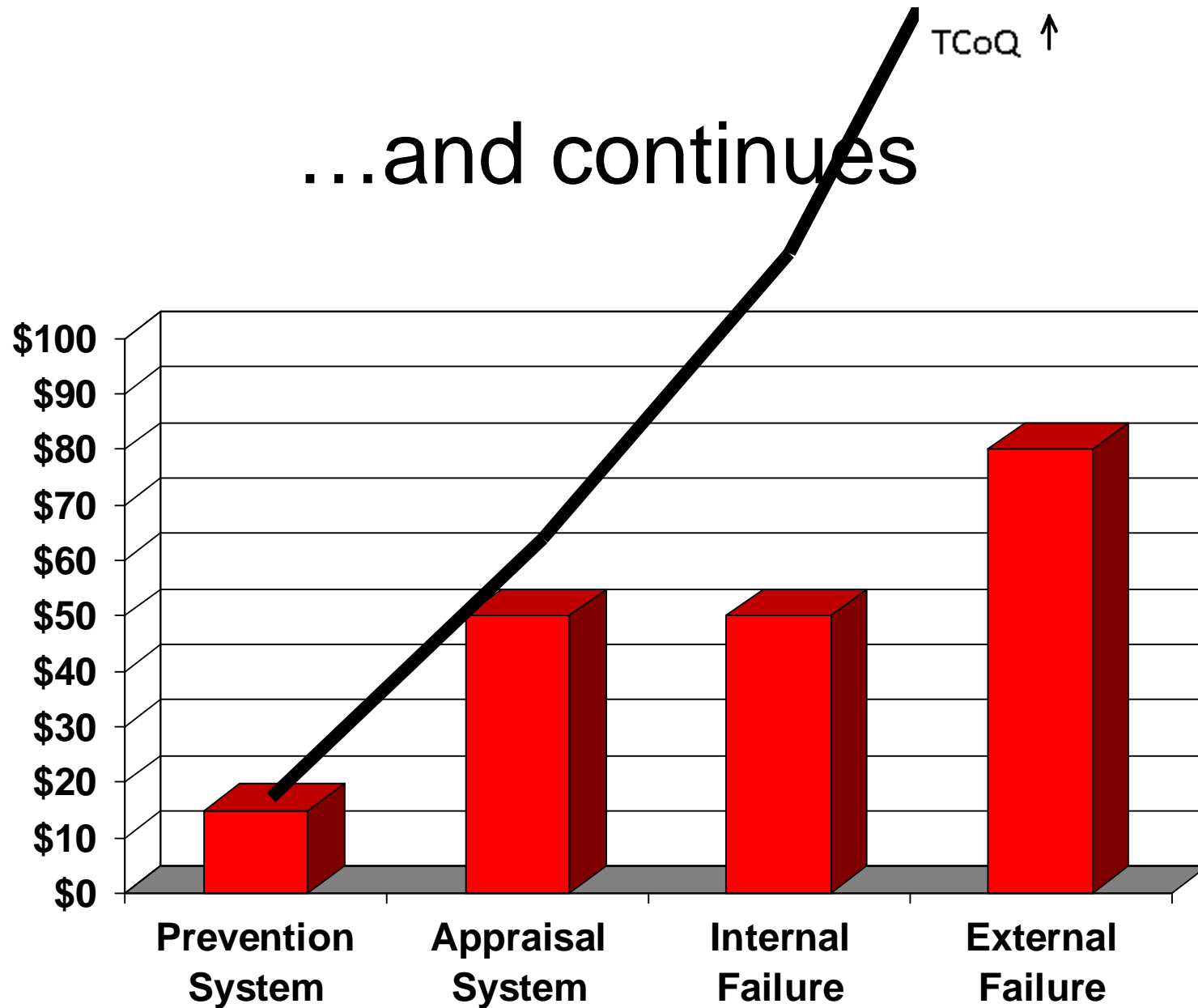
Legacy Software Quality Costs



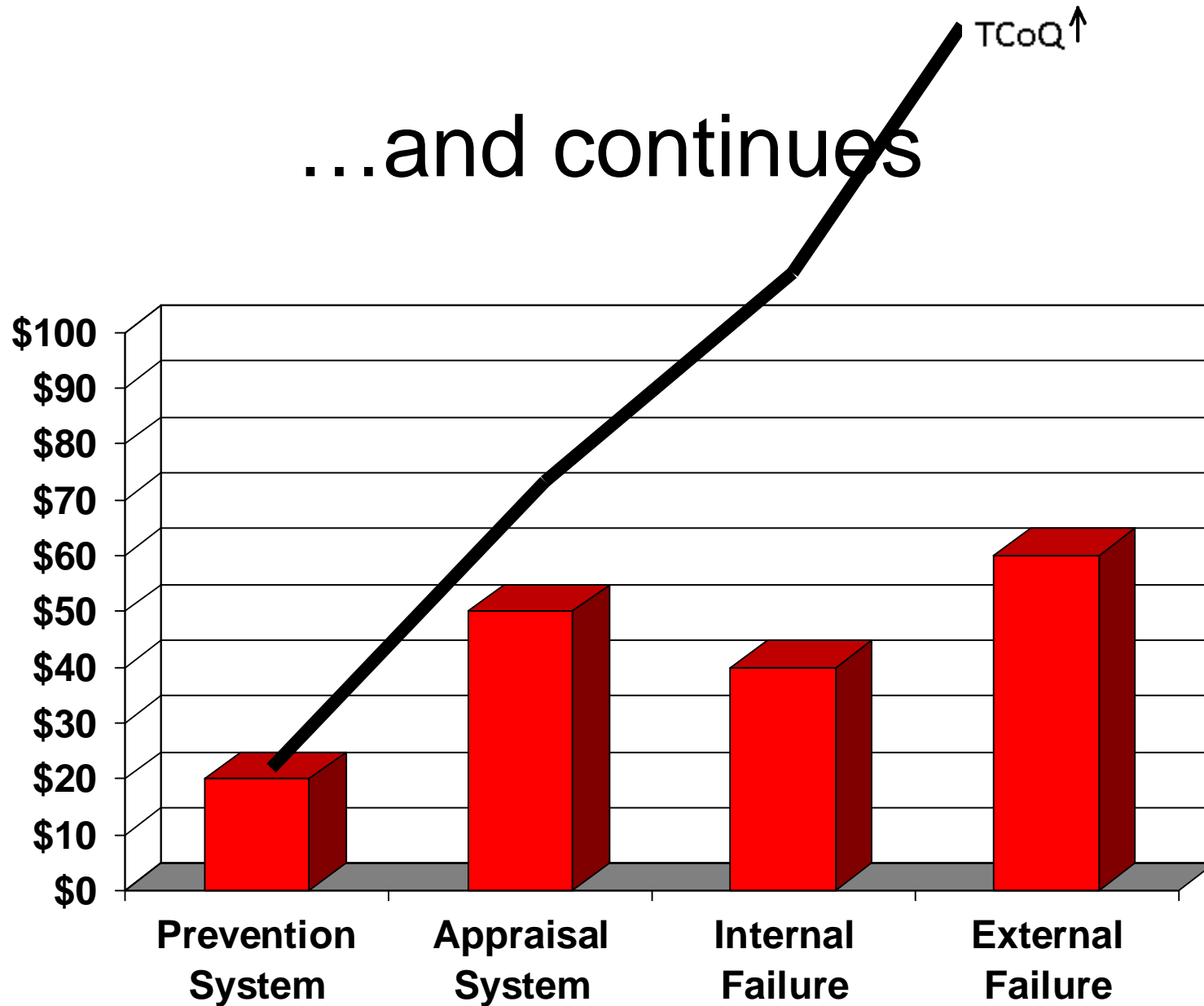
The Journey Begins...



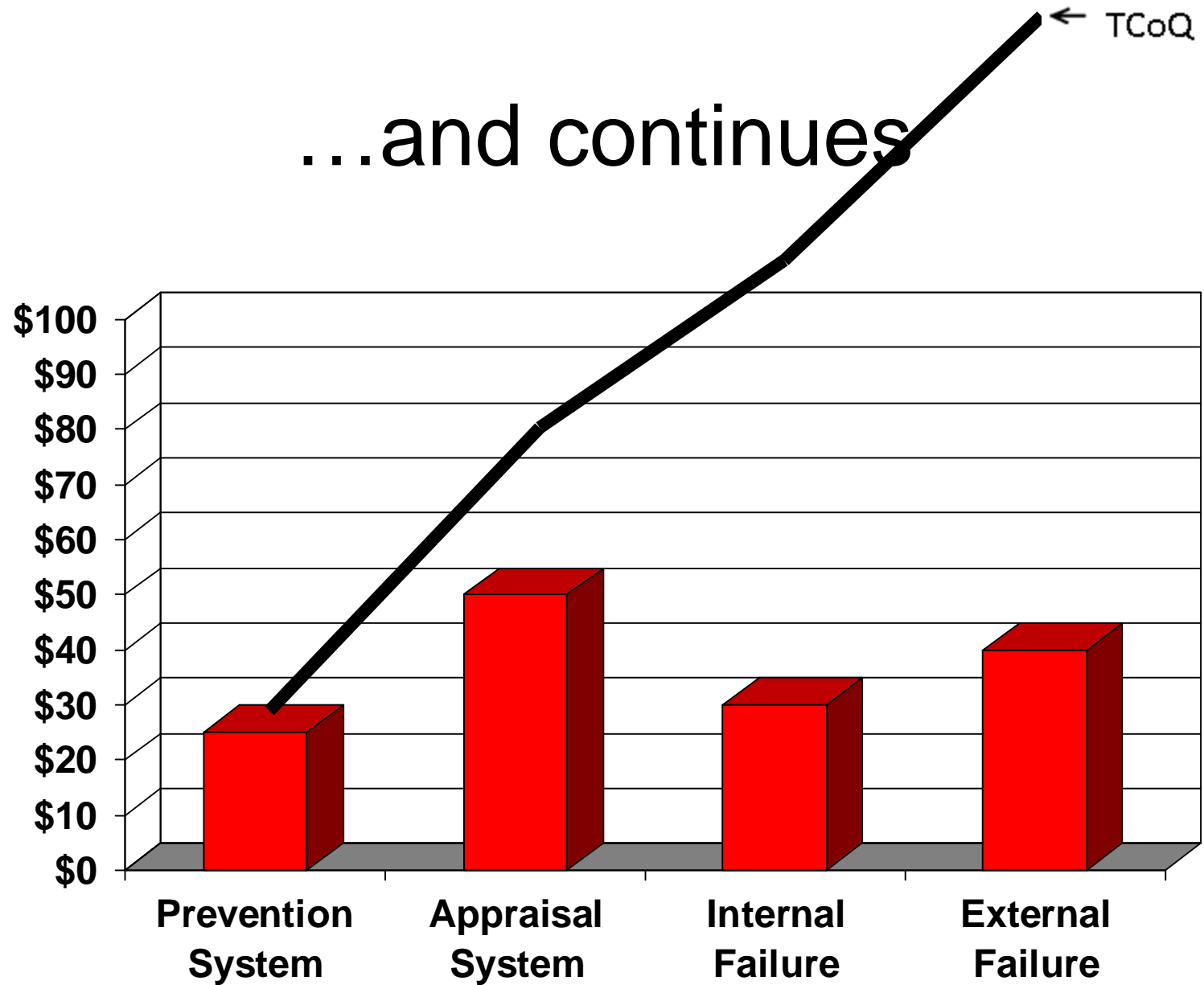
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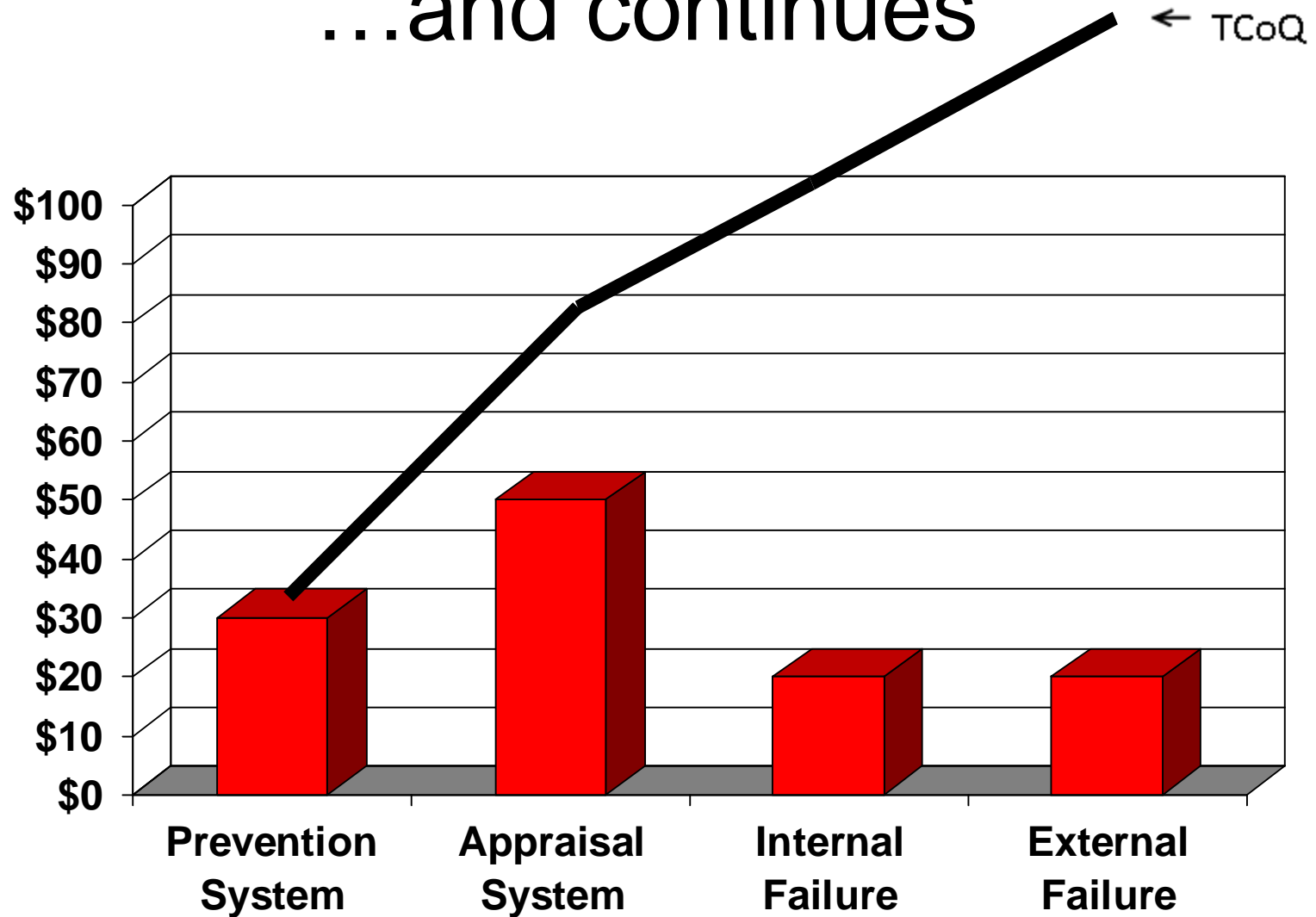
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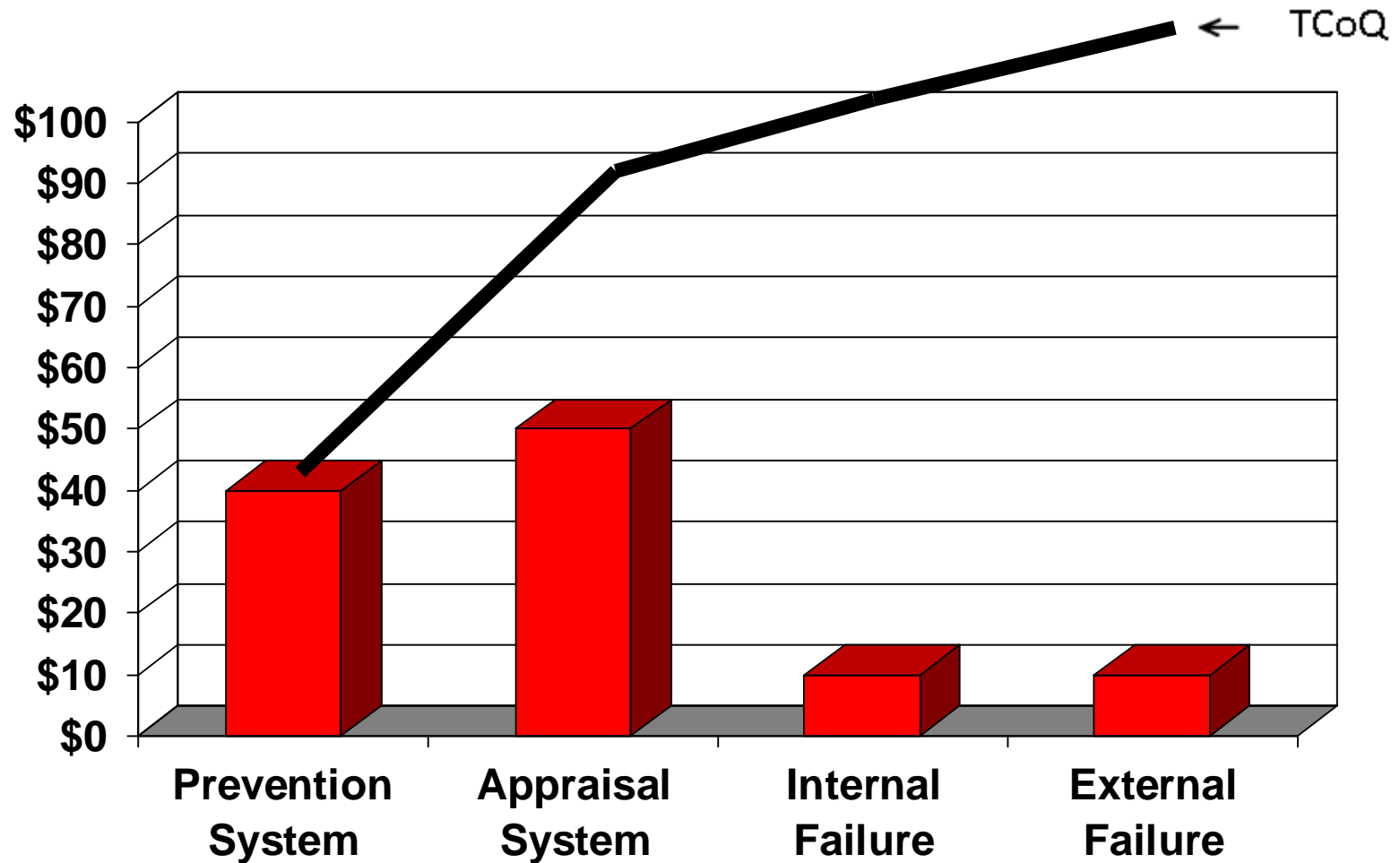
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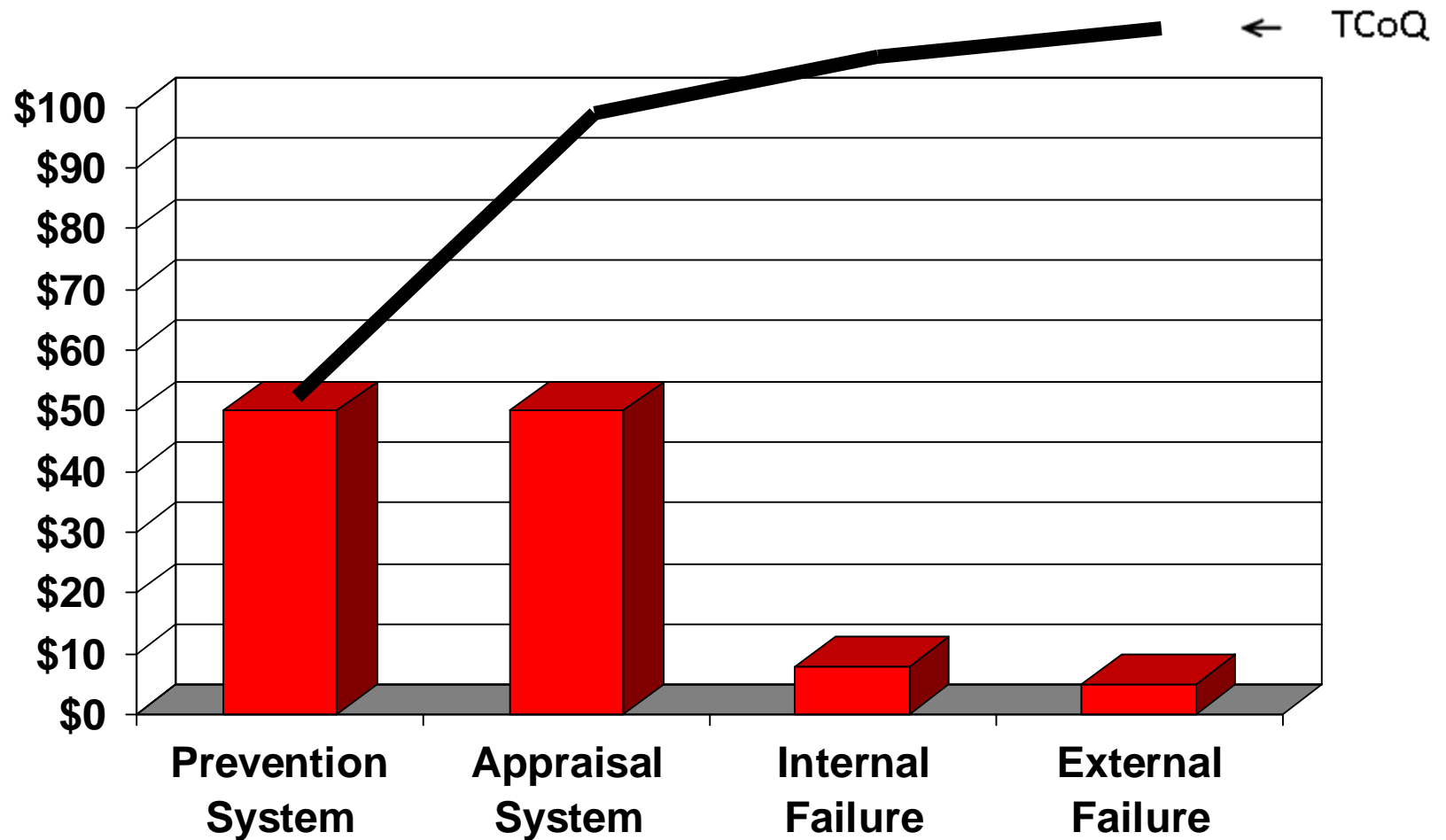
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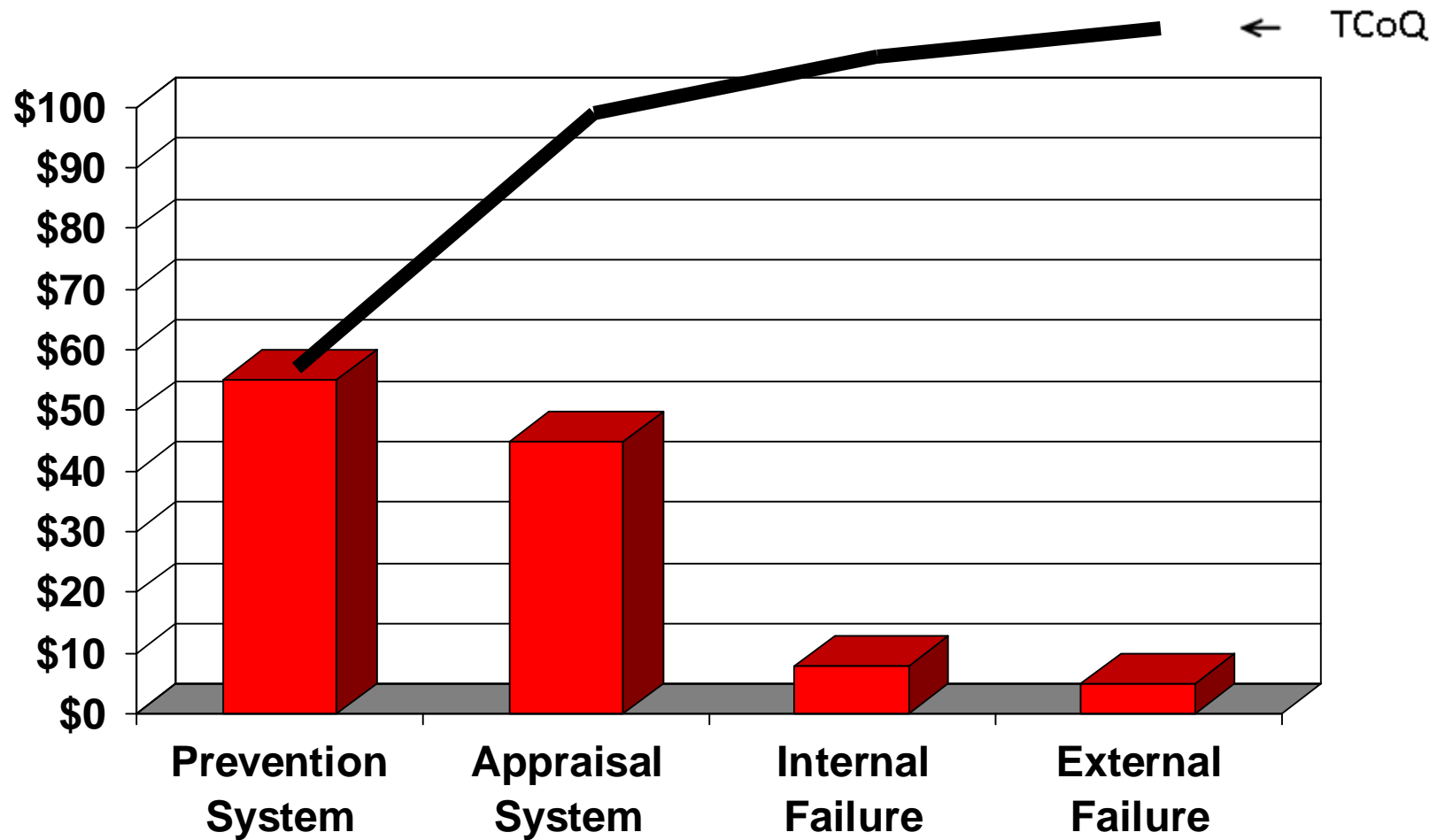
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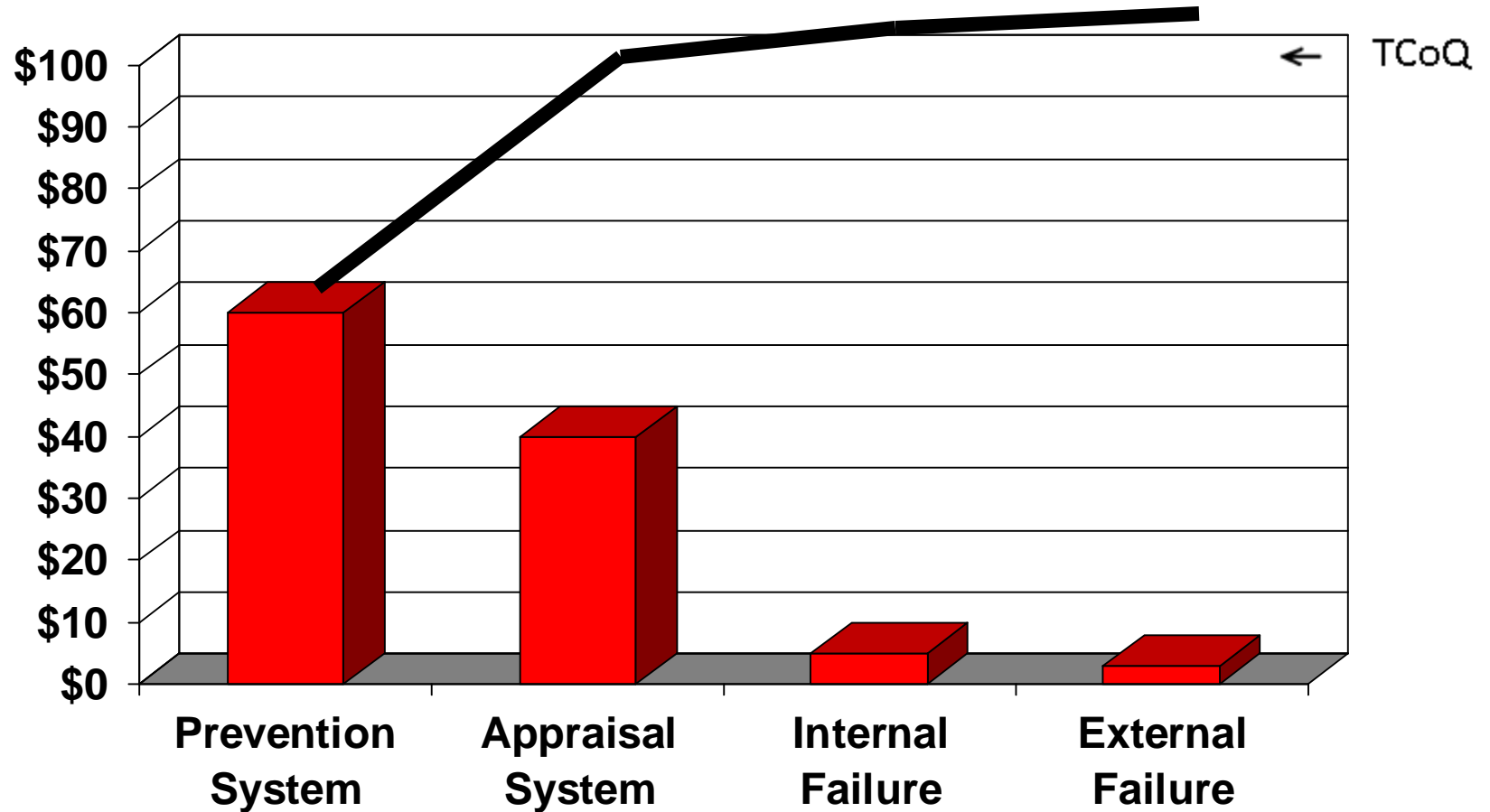
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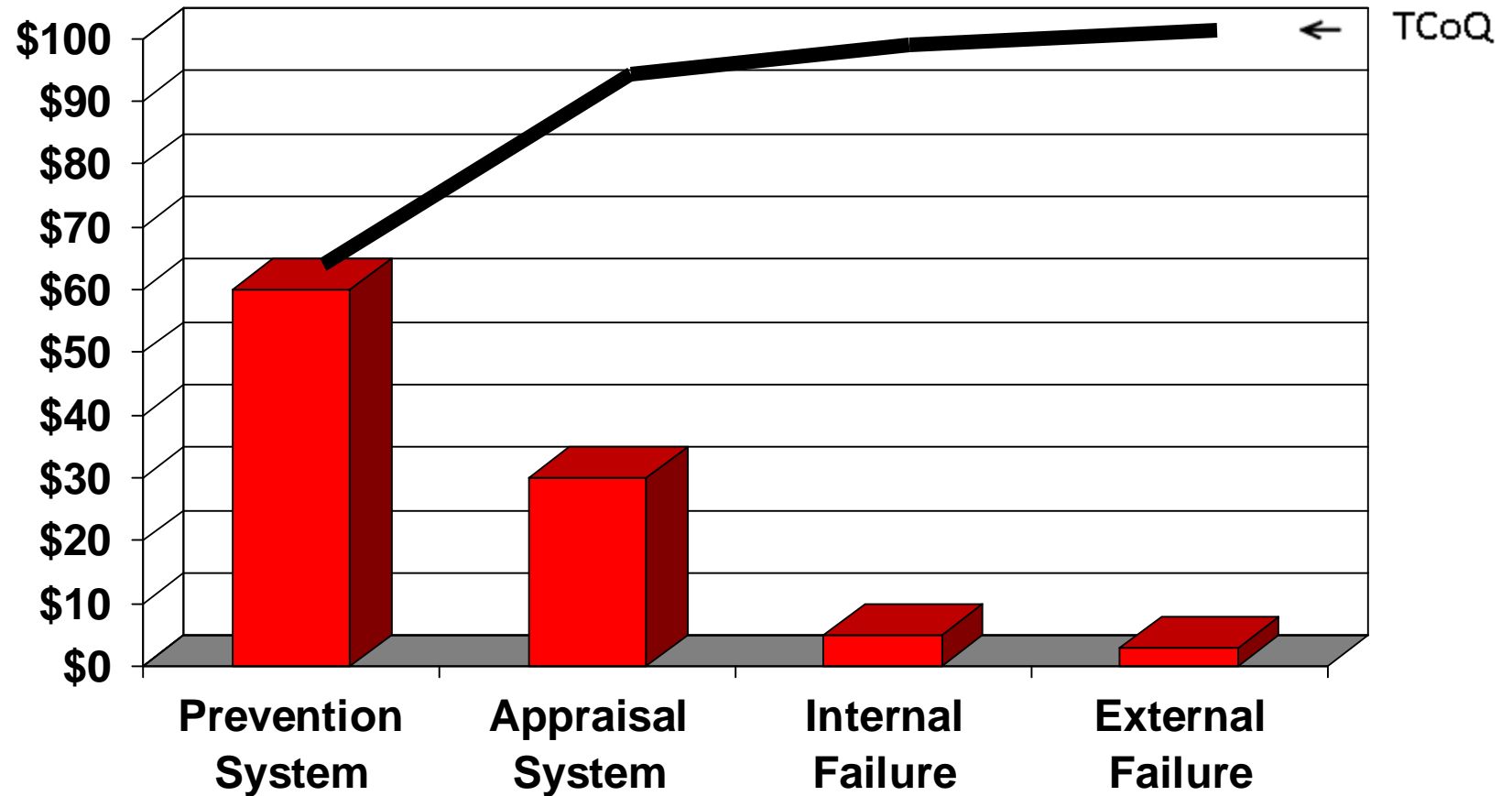
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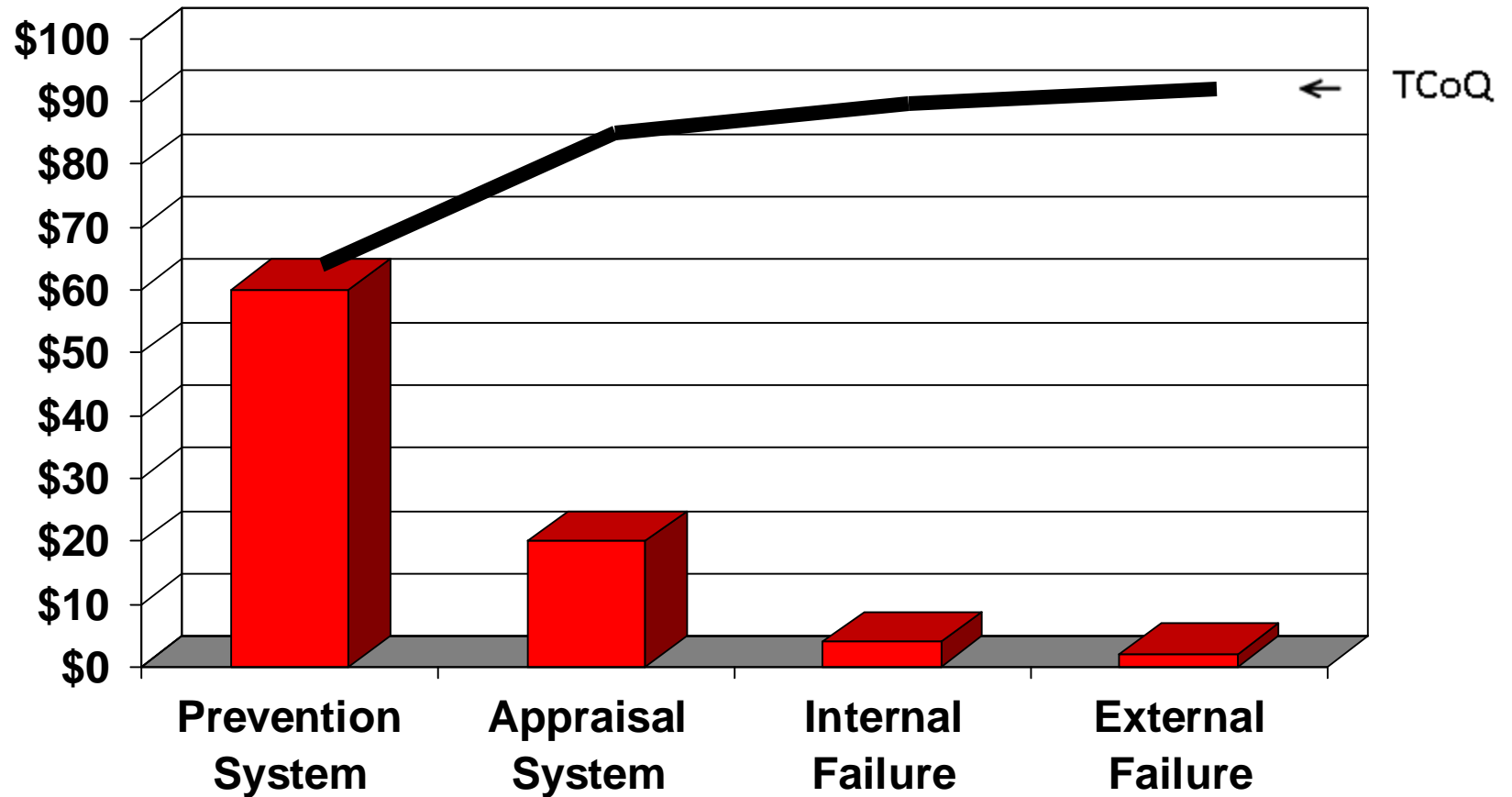
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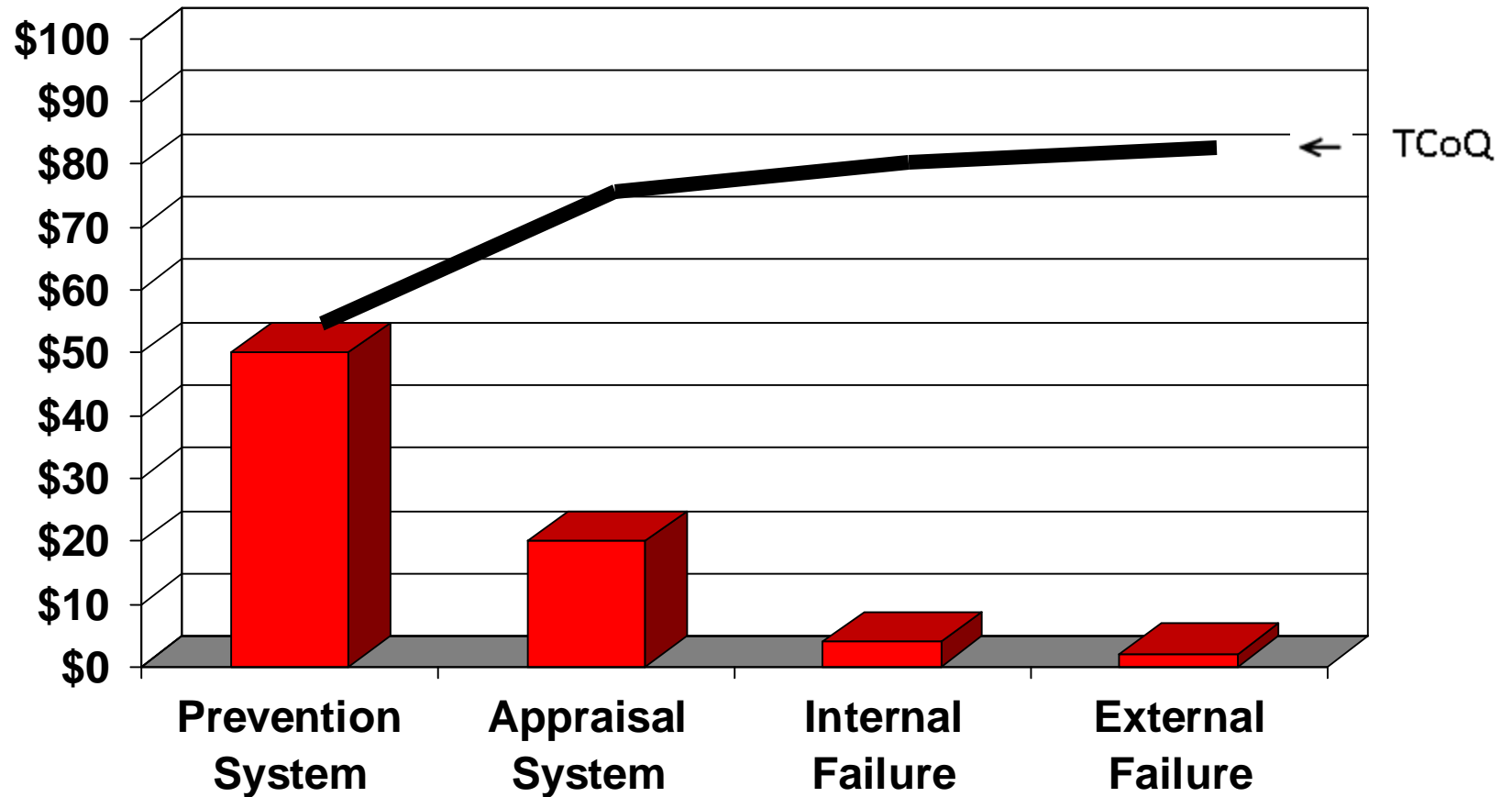
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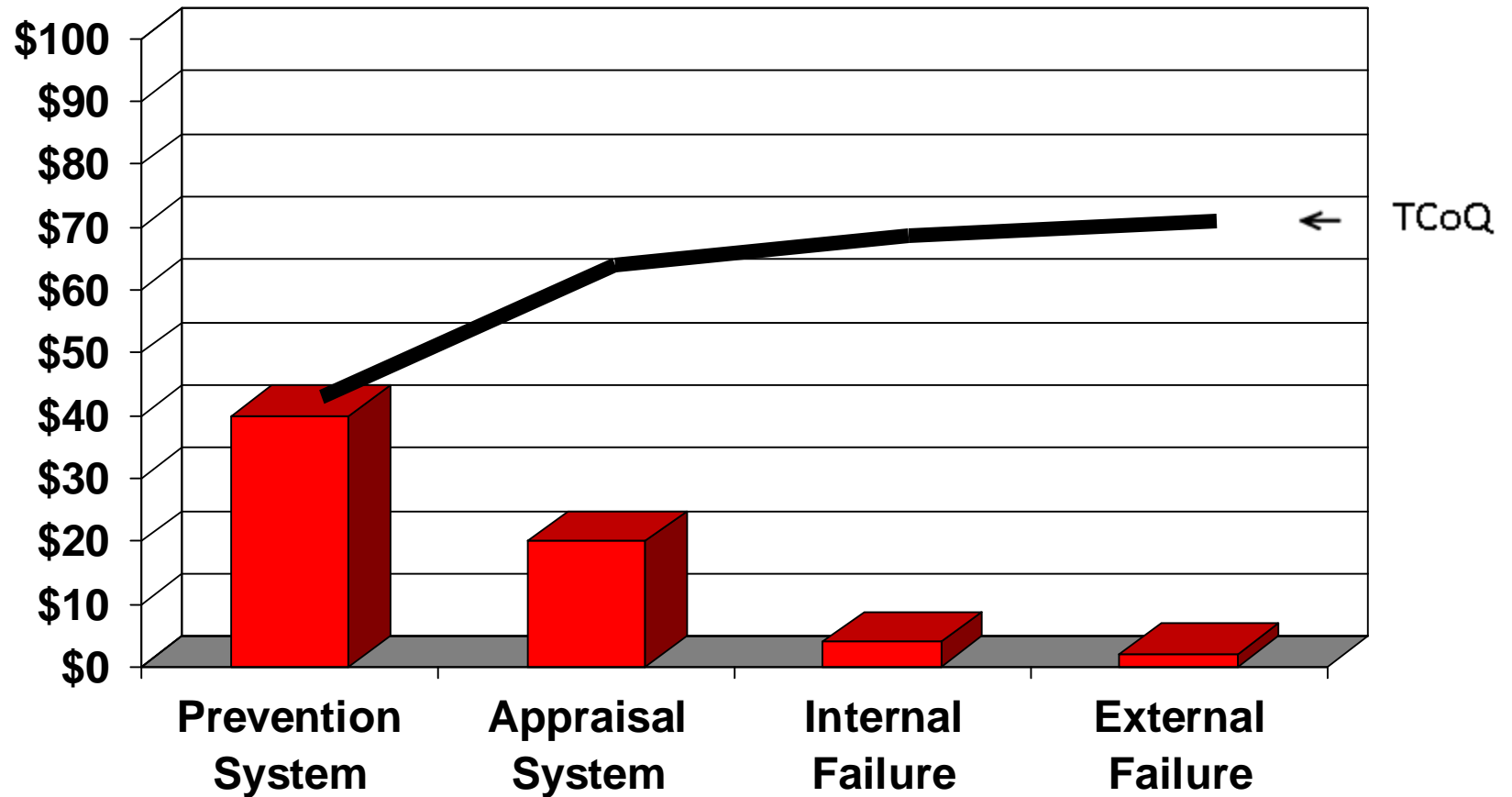
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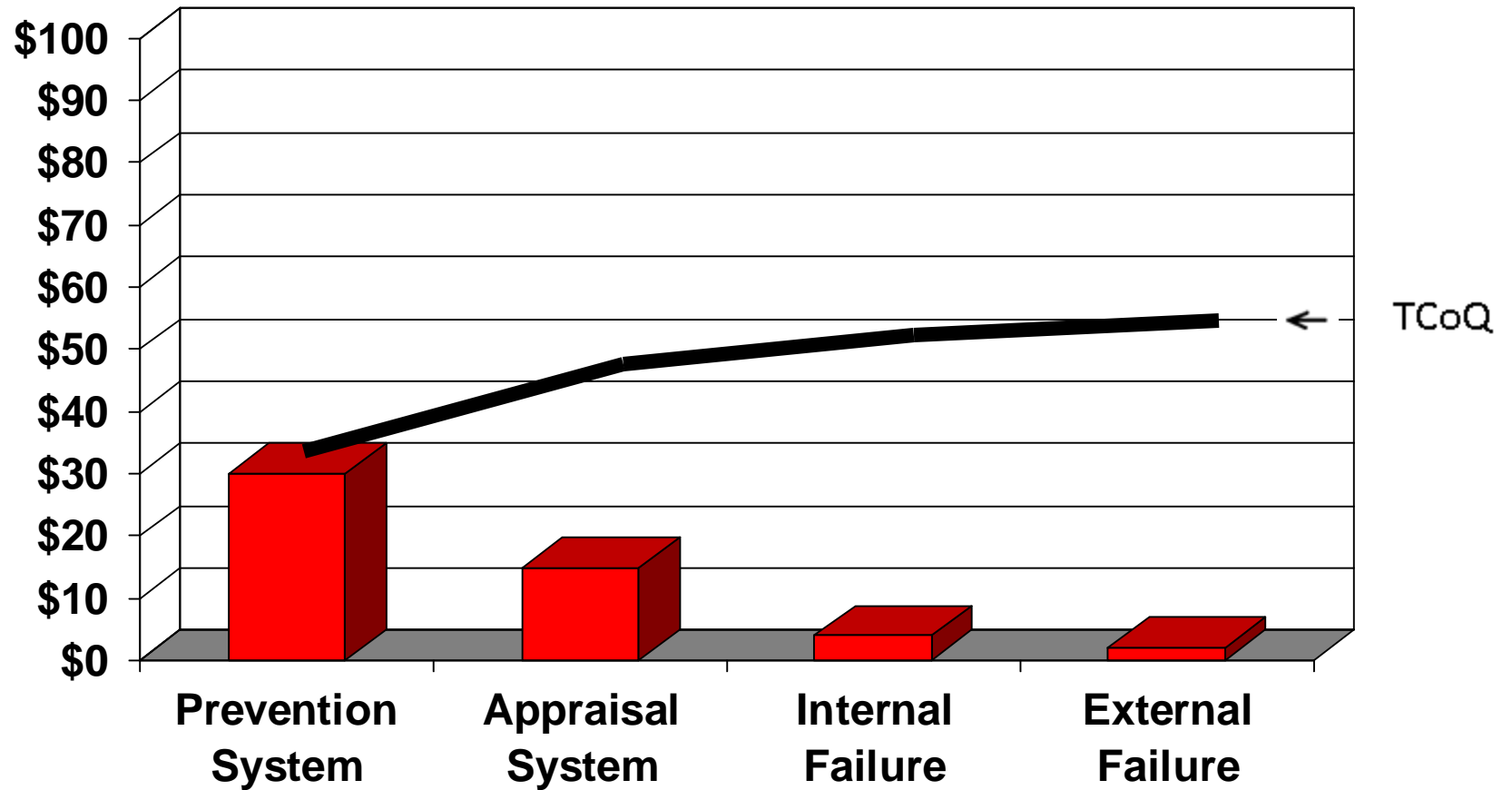
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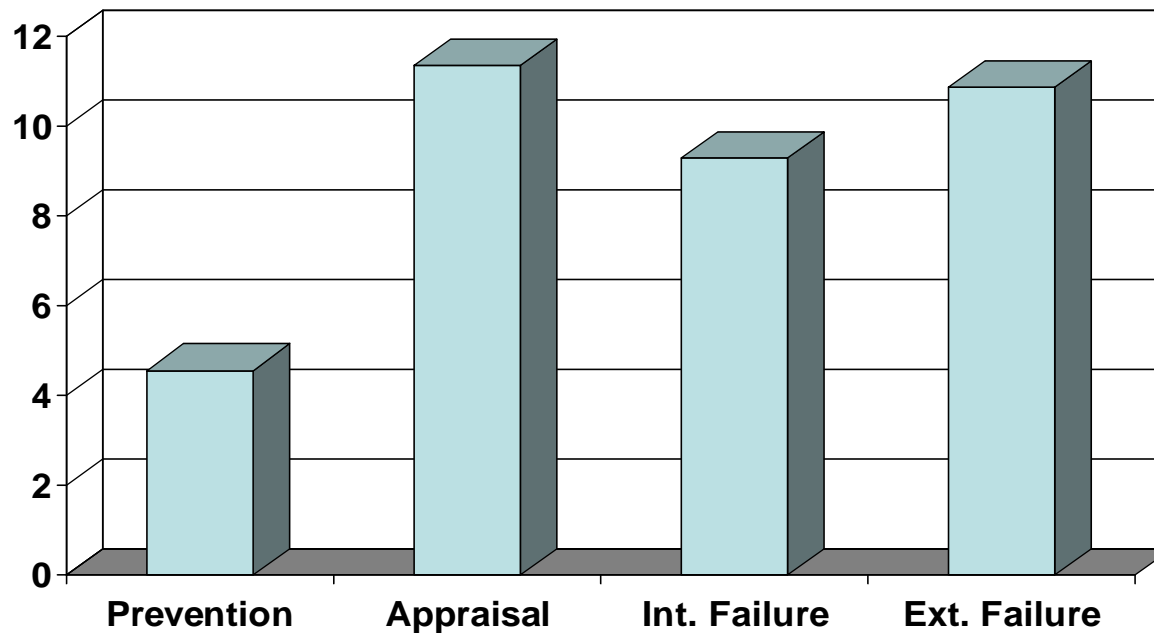
Could that be right?

- 1980s US manufacturing TCoQ = 25-40%
- 1980s Japanese manufacturing = 2-5%
- Current US software TCoQ = 10-70%
- Best software TCoQ* = 10-20%
- What about your company?

*Source: Herb Krasner, private communication

McAfee Agent CoQ

- UOM = average hours/week
- Very preliminary data - **QA, Dev, Sustaining groups only**
- Survey itself had a bug that caused over-reporting



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Home work:

Determine possible root causes for your most important problem (MIP).