# New (?) Measurements for IT Projects: Leveraging Industry Best Practice

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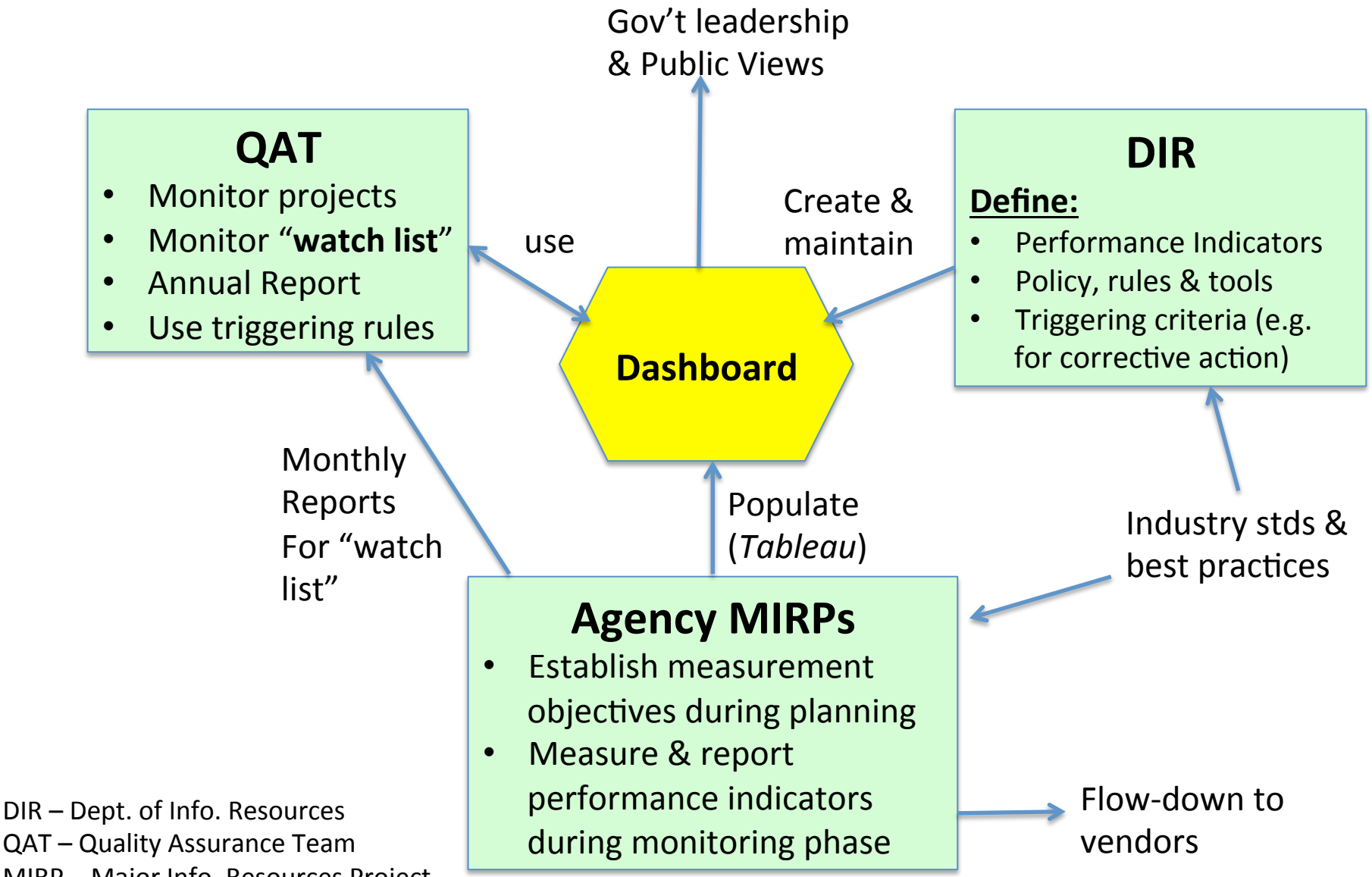
# Objectives

- My agenda
  - Assess the current situation and opportunity context
  - Discuss the emergence of HB 3275 and related developments – what they really mean
    - Motivation: *What gets measured, gets improved*
    - Discuss required and recommended measurements of MIRP performance indicators
    - Introduce the key concepts of quality and cost of quality; and why they are so important to focus on now
  - Discuss how we can:
    - Determine the best approaches to pursue
    - Leverage IT best practices & stds for significant results

# Our Situation

- IT projects have a reputation for being difficult to forecast & control.
- TX state government spending on IT ~ **$2.8B** in 2017[16] (CA=$7B)
- Texas state agency IT projects (from DIR & QAT reports)
  - 2/3 of all major IT projects were *off track*; worse in 2017
  - 1/2 of all IT projects had high cybersecurity/legacy failure risks
  - Lack of early visibility into serious problems (e.g. Tx HAC)
- **HB 3275:** Agency major IT projects will now measure & report on performance indicators for: **cost, schedule, scope & quality**
  - These measurements **can** be used to drive down costs and better control risks; & improve project performances over time.
  - Value proposition: The later you find and fix anomalies/problems/deficiencies/defects the more costly it will be
- Our Challenge: come to consensus, and take action for optimum effect; rather than just do the minimum

# What HB 3275 Requires of You




DIR – Dept. of Info. Resources
QAT – Quality Assurance Team
MIRP – Major Info. Resources Project

# Herb's Initial "Watch List" *

| AGENCY | PROJECT | COMMENT |
|---|---|---|
| Commission on State Emergency Communications | State-level Digital 9-1-1 Network | Early warning indicators |
| Department of Family and Protective Services | Information Management Protecting Adults and Children in Texas (IMPACT) System Modernization | Early warning indicators |
| Health and Human Services Commission | Enterprise Data Warehouse (EDW) and Enterprise Data Governance | Early warning indicators |
| Health and Human Services Commission | Women Infants and Children (WIC), WIC Information Network (WIN) | Way late, over cost |
| Office of Attorney General | Texas Child Support Enforcement System (TXCSES 2.0) Initiative (T2) | ~100% over cost, late |
| Teacher Retirement System | TRS Enterprise Application Modernization | Way late |

Feel free to add to this list or disagree with my assessment

* The Krasner Team Report, Dec. 15, 2017

# DIR Preview of Coming Measurements Req'd (reportedly in summer time)


| | |
|---|---|
| Cost | • Earned Value approach using the Cost Performance Index (CPI) |
| Schedule | • Earned Value approach using the Schedule Performance Index (SPI) |
| Scope | • Measuring requirements volatility and number/impact of change requests |
| **Quality** | • Different metrics reported throughout project lifecycle according to Quality Management Plan |

http://dir.texas.gov/View-Resources/Pages/Content.aspx?id=16

# Cost Measurement

- Required
  - CPI = **EarnedValue**/ActualCost (<=1 is good)
- Other recommended
  - ECAC = BAC/CPI
  - TCPI (to-complete CPI)
  - Cost variance = EV - AC
  - Contingency reserve depletion rate

Earned value analyses needs to be against quality work products delivered rather than $$ spent.

CPI – Cost Performance Index
ECAC – Estimated Cost at Completion
BAC – Budget at Completion

See ***Measuring Information Technology (IT) Project Performances in Texas: House Bill (HB) 3275 Imp***lications *(a position paper); H. Krasner & B. Futrell, July 12, 2017*

# Schedule Measurement

- Required
  - SPI = **EarnedValue**/PlannedValue (<= 1 is good)
- Other recommended metrics
  - Schedule Variance (SV) = EV - PV
  - Estimated Time at Completion (ETAC)
  - Contingency reserve depletion rate
  - Schedule risk

Earned value analyses needs to be against quality work products delivered rather than time consumed.

See ***Measuring Information Technology (IT) Project Performances in Texas: House Bill (HB) 3275 Imp***lications *(a position paper); H. Krasner & B. Futrell, July 12, 2017*

# Scope Measurement

- Required
  - Requirements volatility
    - Requirements changed between baselines
  - Scope change frequency and impact
    - Frequency/impact of change orders and change requests
- Additional recommended
  - Balanced scorecard (multi-faceted)
  - System size
  - Effort growth rate
  - WBS size
  - Scope anomalies, problems and deficiencies
  - Requirements quality (e.g. SMART) & satisfaction

**See** *Scope Measurement on Large IT Projects in Texas: A Position Paper*
By Herb Krasner, Don Shafer and Linda Shafer, February 2, 2018

# Quality Measurement

- You should have some measurable quality goals
  - **Put into <u>your</u> quality management plan**
    - **Up to you to define what quality means and establish measureable objectives**
    - Needed for: planning, specifying, developing and evaluating the system
    - Using the *quality register template* to specify goals/measures
      - see my recommended sample (coming up)
- The most difficult to define, measure and manage; but the most rewarding[1] if done properly
- What standards & best practices should we rely on?

**See *IT Quality: Measurement Implications for Large IT Projects in Texas***
By Herb Krasner, Don Shafer and Linda Shafer, November 8, 2017

# The Importance of IT SW Quality

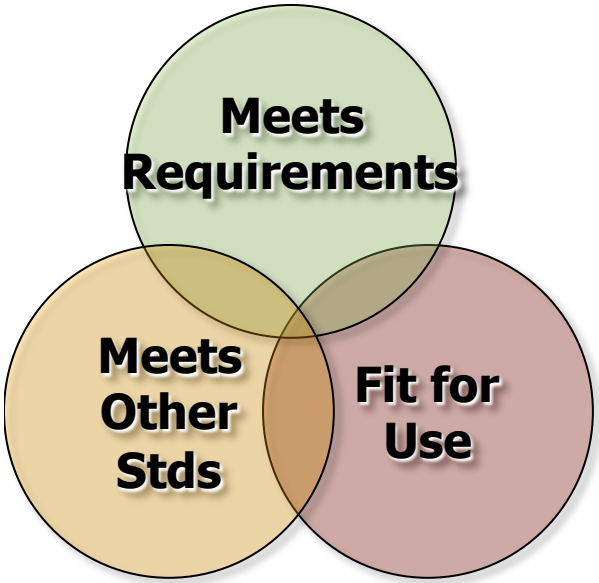
- Software is blamed for more major business problems than any other man-made product.
- Poor software quality has become one of the most expensive topics in human history:
  - > $150 B per year in U.S.
  - > $500 B per year world wide
  - 15-30% of total corporate revenues in low maturity shops
  - Finding & fixing deficiencies is the largest expense item on most IT projects
- For U.S. software:
  - Average quality is ~ 5 defects per *function point*, with ~ 85% of these being removed prior to delivery.
  - Best results have defects below 2 per *function point* combined with 99.6% removal efficiency.
  - Projects often fail at levels of 7 +.



function point = ~ 60 SLOC program module (lang. dependent)

# What is IT Software Quality (general)?

Hard to define



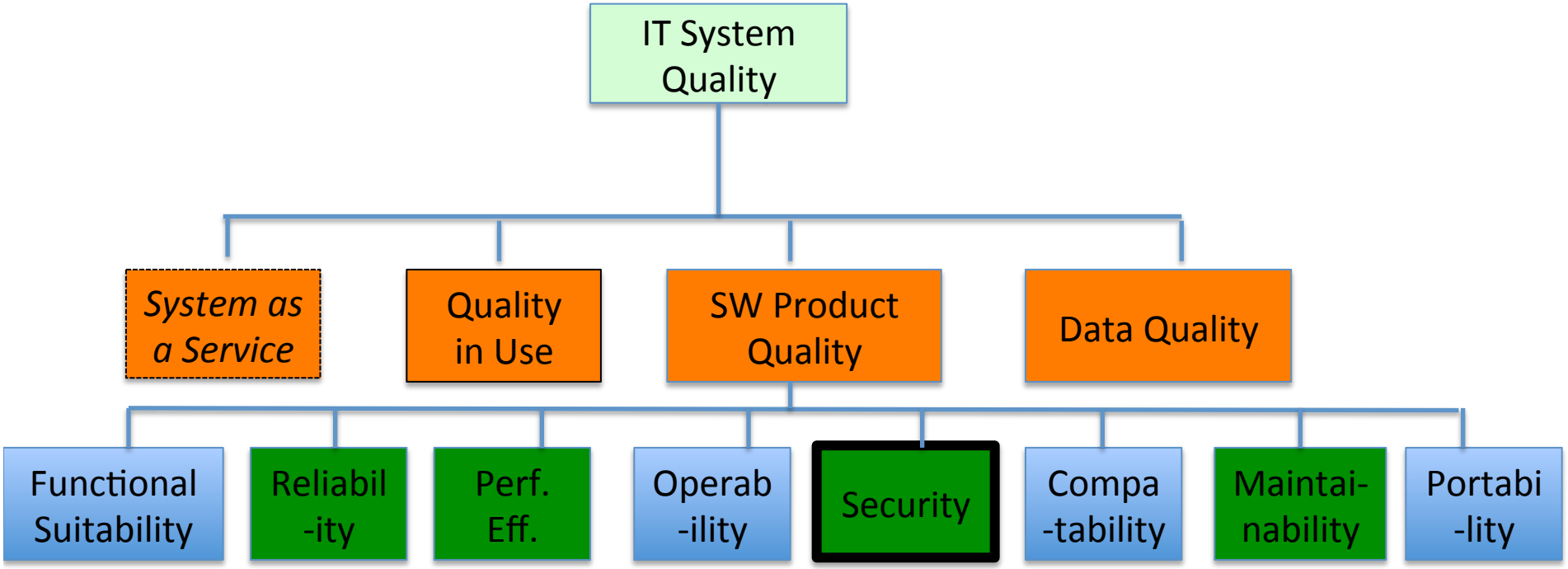

**Underlying aspects:**

- **Structural quality**
  - E.g. complexity
- **Aesthetic quality**
  - E.g. appearance

- **Conformance to requirements**
  - The requirements are clearly stated and the product must conform to it
  - Any deviation from the requirements is regarded as a defect
  - A good quality product contains fewer defects
- **Fitness for use/purpose**
  - Fit to user expectations: meet user's needs
  - A good quality product provides better user satisfaction
- **Meets standards**
  - In many industries and organizations certain external and internal standards must be complied with
  - A good quality product conforms to required standards of quality/ process

# ISO 25000: Standard IT Quality Metrics

Evolved from ISO 9126




- CISQ: has defined automatable measures of **software quality attributes** that can be measured in source code -> assured, trusted systems
  - conforms to ISO 25010 quality characteristic definitions
  - supplements ISO 25023 with source code level measures
- Deployment: OMG -> ISO -> Policies -> certification -> regulation -> tools -> procurement

# *Sample* MIRP Quality Register

Herb's version

| Quality Objective | Quality Standard | Priority | Weight | Tracking Tool or Measure |
|---|---|---|---|---|
| Functional Suitability | ISO 25023 | | | Functional: completeness, correctness, appropriateness |
| Usability | ISO 25023 | | | User: effectiveness, efficiency, satisfaction |
| **Security** | ISO 25023, **CISQ** | | | **CISQ Security Metric**, Security defects, cybersecurity vulnerability index |
| **Reliability** | ISO 25023, **CISQ** | | | **CISQ Reliability Metric**, Reliability defects, MTTF, availability |
| **Performance Efficiency** | ISO 25023, **CISQ** | | | **CISQ Performance Efficiency Metric**, Performance defects, Other performance metrics: response time, capacity, throughout, etc. |
| **Maintainability** | ISO 25023, **CISQ** | | | **CISQ Maintainability Metric**, maintainability defects |
| Compatibility | ISO 25023 | | | *Plug-and-play ability*, etc. |
| Portability | ISO 25023 | | | Adaptability, etc. |
| Data quality | ISO 25024 | | | Data: accuracy, completeness, consistency, credibility, currentness, etc. |
| Quality in Use | ISO 25022 | | | Agency/organization: effectiveness, efficiency, enablement, system value, riskiness; service quality (as needed. E.g. SLAs) |
| Development process quality | CMMI-dev | | | CMMI process maturity, Defect Removal Effectiveness (DRE), Sigma level |

# Best Vs. the Worst IT Performers

- IBM sponsored benchmarking survey of 363 European software organizations
- Covered 15 countries (Germany and UK represent over half the sample) and over a dozen industries (banking, insurance, manufacturing, IT and Distribution most heavily represented)

**well defined, adaptable development process, with a proactive quality mgt. focus**

| Performance Factor | Top 10% | Bottom 10% |
|---|---|---|
| Productivity (fcn pts./mo.) | 25 | 5 |
| Delivered quality (% defects removed) | >95% | <50% |
| Cost/Schedule Performance | <= 10% | >40% over |
| Post delivery maintenance costs (within 1st yr.) | <1% (of total dev. effort) | >10% |

Goodhew, 1996, Acheiving real improvements in performance from SPI initiatives, the European SEPG Conference, June 26, 1996

# *Strategic* IT Quality Metric to Consider

- Cost of IT Software Quality (**COSQ**)[1,6]
  - an accounting technique to enable our understanding of the economic tradeoffs involved in delivering good quality software (as well as, the cost of poor quality software).
  - A major portion of the Total Cost of Ownership of an IT system
  - Adapted to the unique nature of software in the 1990s[6].
  - Many organizations have used this approach to measurably and significantly improve
    - Case studies and client success stories are available [14]
  - **US industry wide study of CPSQ is *coming soon (Sept.)***
    - Would love to do a similar study of Texas someday

see Krasner, H. 1998 (v1), **2018 (v2)**

# Conclusions/Takeaways

- Now you know what HB 3275 intends. What will you recommend to your organization?
- Performance metrics↑ -> rework/COSQ↓ -> total costs/time↓ -> successes↑
- Focus on quality
  - IT software quality is difficult to define, measure & manage; but necessary & rewarding for each project
  - IT quality standards and tools are there to help
    - Would you invest in them?
    - What's your value proposition?
- This group can be the state "leaders"

# References


1. Krasner, H., Software Quality: Dispelling the Myth that Quality Software Costs More and Takes Longer, keynote speech, 4th ICSQ, 1994
2. Here is the new statue that the law created
   http://www.statutes.legis.state.tx.us/Docs/GV/htm/GV.2054.htm#2054.159
3. Krasner, H. Blog posts on IT measurement
   http://it-cisq.org/it-quality-measurement-implications-for-large-it-projects-in-texas
   - Scope measurement: http://it-cisq.org/scope-measurement-on-large-it-projects-in-texas-a-position-paper/
   - Quality measurement: http://it-cisq.org/it-quality-measurement-implications-for-large-it-projects-in-texas/
   - Project performance measurement:http://it-cisq.org/measuring-it-project-performances-in-texas-house-bill-hb-3275-implications/
4. Mitre Corp. (2012). Common Weakness Enumeration. mitre.cwe.org
5. CISQ Specifications for Automated Software Quality Measures. Needham, MA Object Management Group, Consortium for IT Software Quality. www.it-cisq.org
6. Krasner, H. and D. Houston, *Using the Cost of Quality for Software*, in CrossTalk, The War on Bugs, Vol. 11, No. 11, November, 1998, pp 6-11, see online at www.stsc.hill.af.mil/Crosstalk/crostalk.html
7. Jones, C. & Bonsignour, O., *Economics of Software Quality*, Addison-Wesley, 2012.
8. http://iso25000.com/index.php/en/iso-25000-standards/iso-25010
9. The Forrester Wave™: Vulnerability Risk Management, Q1 2018. Tools And Technology: The Security Architecture And Operations Playbook by Josh Zelonis March 14, 2018
10. The NIST Cybersecurity Framework - explains “what to do” to develop, acquire, modernize and secure IT-intensive systems, and leaves “how to do it” open to an organization to customize with practices.
11. The Forrester Wave™: Static Application Security Testing, Q4, 2017, The 10 Vendors That Matter Most And How They Stack Up, Amy DeMartine, December 12, 2017
12. Magic Quadrant for Application Security Testing, Published: 19 March 2018 ID: G00327353, Analyst(s): Ayal Tirosh, Dionisio Zumerle, Mark Horvath
13. 2018 Top Cybersecurity Threats, NopSec, www.nopsec.com
14. Bombardier Transportation COSQ case study - https://www.etsmtl.ca/Professeurs/claporte/documents/publications/Project-at-bombardier-transportation_SQP_June-2012.pdf
15. Common Vulnerability Scoring System 3.0 - https://www.first.org/cvss/
16. http://www.govtech.com/biz/Which-States-Spend-the-Largest-Portions-of-their-Total-Budgets-on-Tech.html