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 2017¹⁶ (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

**QAT**
- Monitor projects
- Monitor “watch list”
- Annual Report
- Use triggering rules

**DIR**
**Define:**
- Performance Indicators
- Policy, rules & tools
- Triggering criteria (e.g. for corrective action)

**Agency MIRPs**
- Establish measurement objectives during planning
- Measure & report performance indicators during monitoring phase

**Dashboard**
- Use
- Populate *(Tableau)*
- Create & maintain

**Flow-down to vendors**
- Gov’t leadership & Public Views
- Monthly Reports For “watch list”
- Industry stds & best practices

DIR – Dept. of Info. Resources
QAT – Quality Assurance Team
MIRP – Major Info. Resources Project
# Herb’s Initial “Watch List” *

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

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)

Project Performance Indicators

<table>
<thead>
<tr>
<th>Cost</th>
<th>• Earned Value approach using the Cost Performance Index (CPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule</td>
<td>• Earned Value approach using the Schedule Performance Index (SPI)</td>
</tr>
<tr>
<td>Scope</td>
<td>• Measuring requirements volatility and number/impact of change requests</td>
</tr>
<tr>
<td>Quality</td>
<td>• Different metrics reported throughout project lifecycle according to Quality Management Plan</td>
</tr>
</tbody>
</table>

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 Implications (a position paper)*; H. Krasner & B. Futrell, July 12, 2017
Schedule Measurement

• Required
  – SPI = \textbf{EarnedValue}/\textit{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 \textit{Measuring Information Technology (IT) Project Performances in Texas: House Bill (HB) 3275 Implications (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 your quality management plan
    - Up to you to define what quality means and establish measurable 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 +.

Caper Jones III, 2009

function point = ~ 60 SLOC program module (lang. dependent)
What is IT Software Quality (general)?

- **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

**Underlying aspects:**
- Structural quality
  - E.g. complexity
- Aesthetic quality
  - E.g. appearance
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
## Sample MIRP Quality Register

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

<table>
<thead>
<tr>
<th>Performance Factor</th>
<th>Top 10%</th>
<th>Bottom 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity (fcn pts./mo.)</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Delivered quality (% defects removed)</td>
<td>&gt;95%</td>
<td>&lt;50%</td>
</tr>
<tr>
<td>Cost/Schedule Performance</td>
<td>&lt;= 10%</td>
<td>&gt;40% over</td>
</tr>
<tr>
<td>Post delivery maintenance costs (within 1st yr.)</td>
<td>&lt;1% (of total dev. effort)</td>
<td>&gt;10%</td>
</tr>
</tbody>
</table>

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

Goodhew, 1996, Achieving 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

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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 $\uparrow$ - rework/COSQ $\downarrow$ - total costs/time $\downarrow$ - successes $\uparrow$

• 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

2. Here is the new statue that the law created
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   http://it-cisq.org/it-quality-measurement-implications-for-large-it-projects-in-texas
   • Scope measurement: http://it-cisq.org/it-quality-measurement-implications-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/
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.
12. Magic Quadrant for Application Security Testing, Published: 19 March 2018 ID: G00327353, Analyst(s): Ayal Tirosh, Dionisio Zumerle, Mark Horvath
14. Bombardier Transportation COSQ case study -