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Identifying and constructing leading indicators for monitoring and controlling performance of engineering projects

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PMSs (Performance measurement systems)

- Scholar theories and models
- Capabilities of Support softwares

PMSs classical models:
- Performance Measurement Matrix (1989);
- Performance Pyramid System (1991);
- Balanced Scorecard (1992, 1996);
- Integrated Performance Measurement System (1997);

Gap analysis:
1. Balanced scorecard has been used across the world, whereas many other frameworks have tended only to have regional appeal;
2. The practices in industries are not following the rapid academic rhythm.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Fitting rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-perspectives; Connected to multiple data sources; VPM; KPIs-based.</td>
<td>High fitting rates (≥ 60%)</td>
</tr>
<tr>
<td>Balanced; integrated; strategy-relevant; stakeholders focus; Dynamic; PPS; SCPMM, OM-PMSs, PMs for SMEs</td>
<td>Low fitting rates (&lt;60%)</td>
</tr>
</tbody>
</table>

SEM (Systems engineering measurement)

Characteristics:
- Providing visibility into expected project performance and potential future states;
- Providing predictive analysis based on trend information or significant correlation.

18 SE Leading indicators

<table>
<thead>
<tr>
<th>Requirements Trends</th>
<th>Risk treatment trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>System definition change backlog trend</td>
<td>Systems engineering staffing and skills trends</td>
</tr>
<tr>
<td>Interface trends</td>
<td>Process compliance trends</td>
</tr>
<tr>
<td>Requirements Validation Trends</td>
<td>Technical Measurement Trends</td>
</tr>
<tr>
<td>Requirements Verification Trends</td>
<td>Facility and equipment availability trends</td>
</tr>
<tr>
<td>Work Product Approval Trends</td>
<td>Defect/error trends</td>
</tr>
<tr>
<td>Review Action Closure Trends</td>
<td>System affordability trends</td>
</tr>
<tr>
<td>Technology Maturity Trends</td>
<td>Architecture trends</td>
</tr>
<tr>
<td>Risk Exposure Trends</td>
<td>Schedule and cost pressure</td>
</tr>
</tbody>
</table>

Preliminary mapping result after reading through it can be concluded that it’s feasible to apply some measurement methods in Systems Engineering like SE leading indicators in the general project management.

10 Knowledge areas (PMBoK)

- Project integration
- Project scope
- Project time
- Project cost
- Project quality
- Project communications
- Project risks
- Project procurement
- Project human resources
- Project stakeholders

18 SE Leading indicators vs. 10 Knowledge areas

Model input

Improving Project Performance Measurement

Lagging indicators are dominant in the PPM, but leading indicators are not yet well developed.