Australian Government
Department of Defence
Defence Science and Technology Group

Can We Improve Project Risk Management ?

Projects Governance & Controls Symposium 2016

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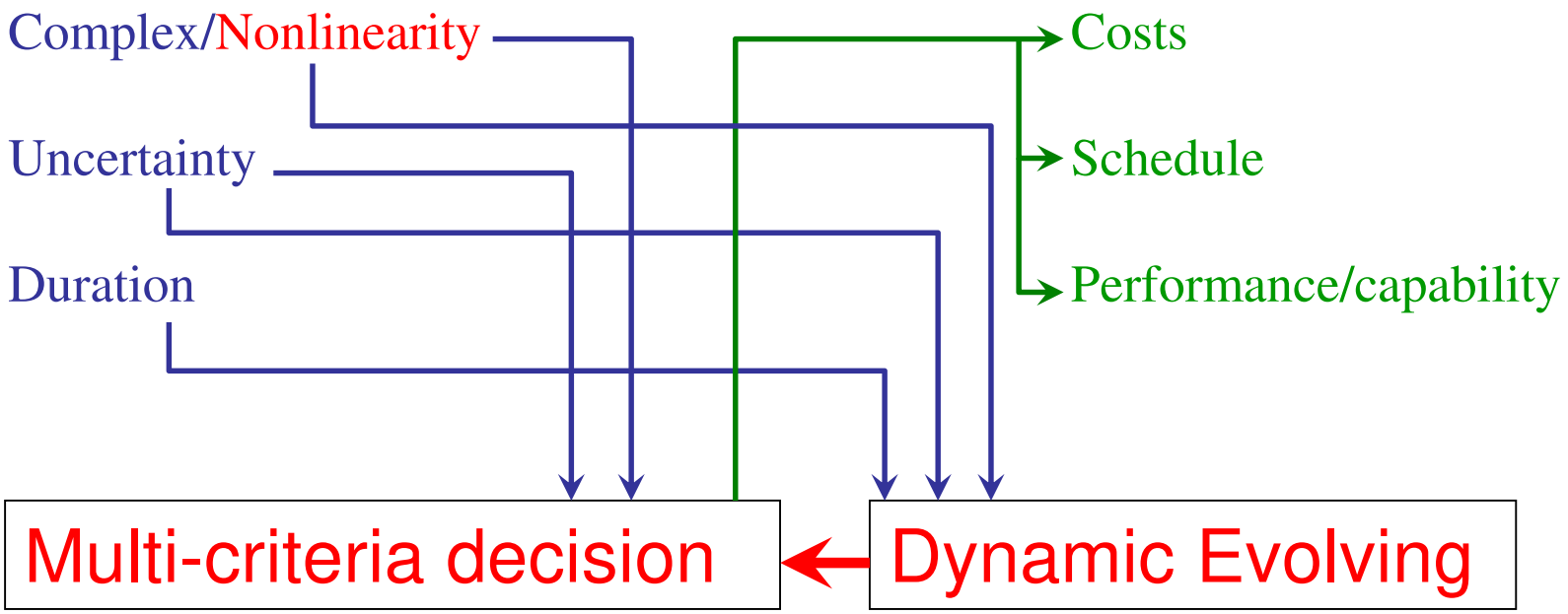
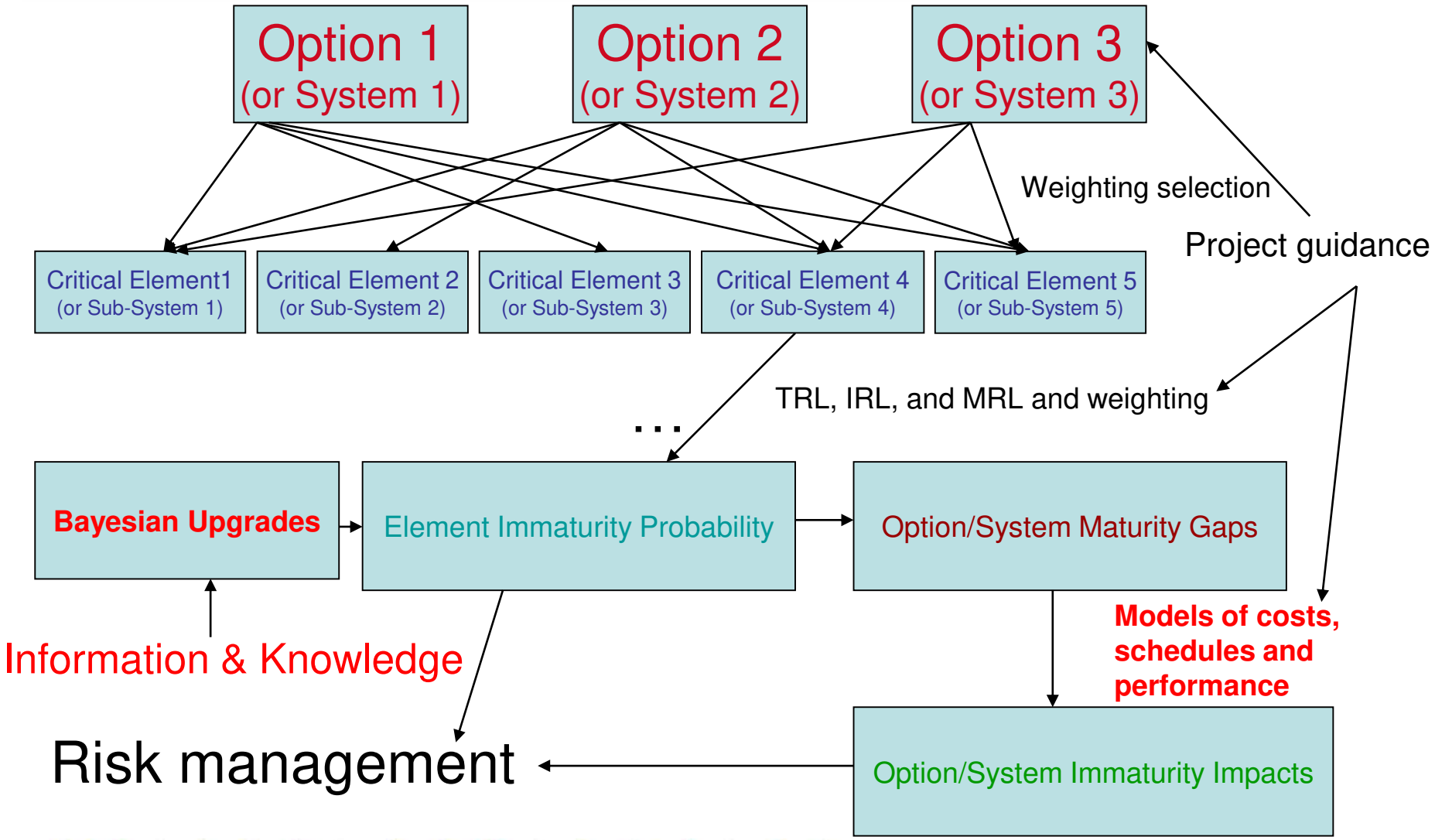
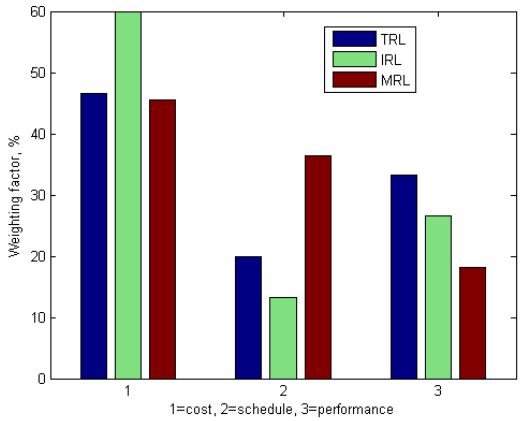
Project Control Problem Space

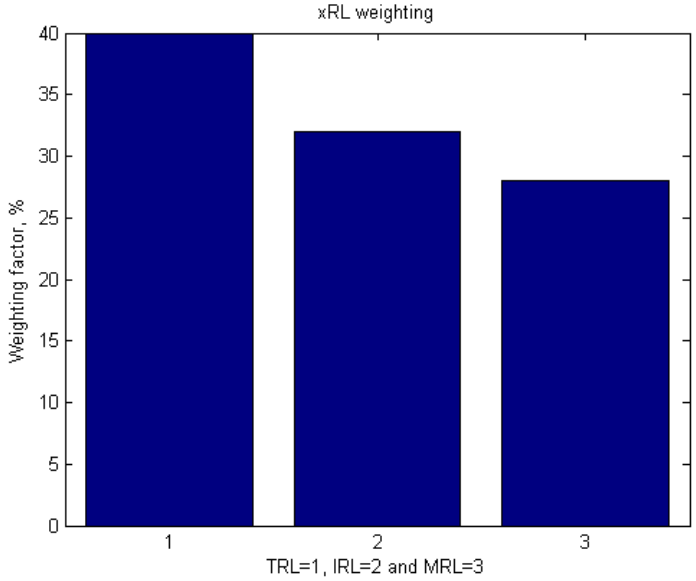


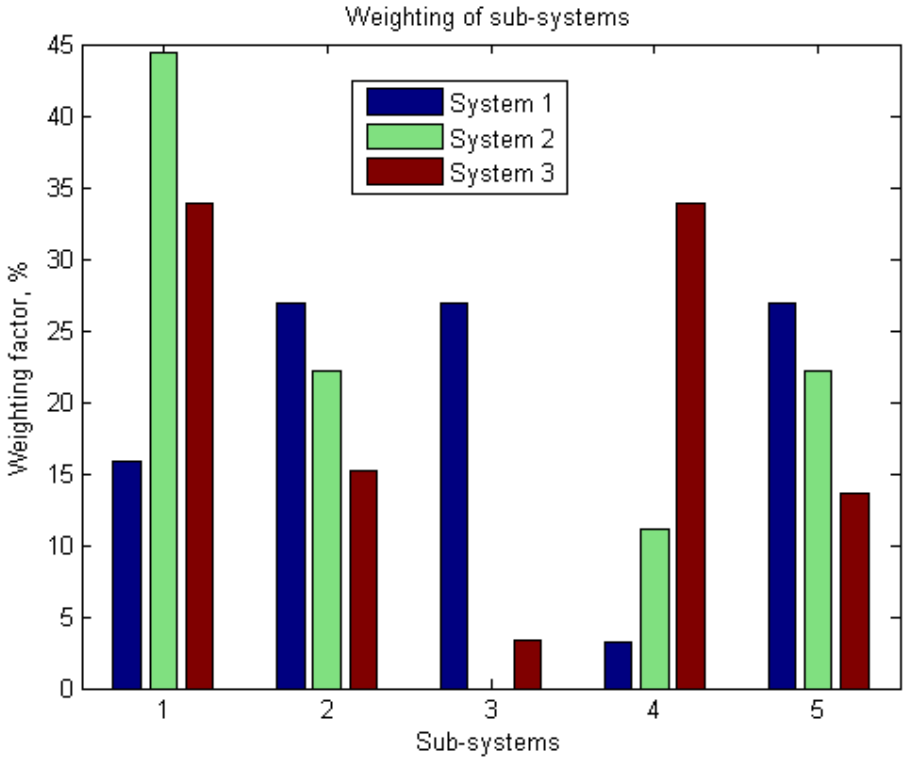
A Bayesian Evolved Multi-Criteria Analysis



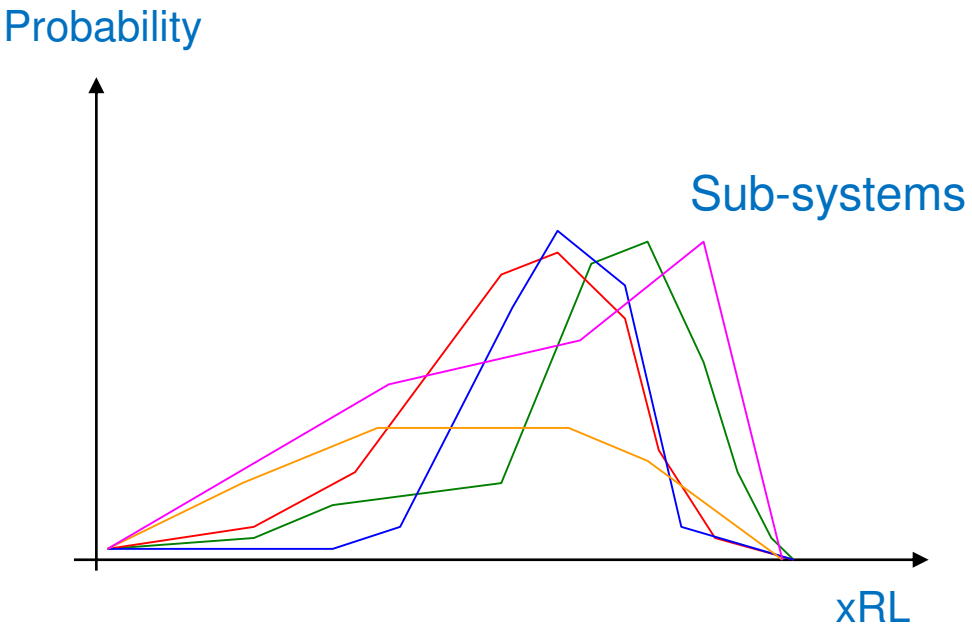
Letting People Able to See Their Influence







Measures of Readiness Levels



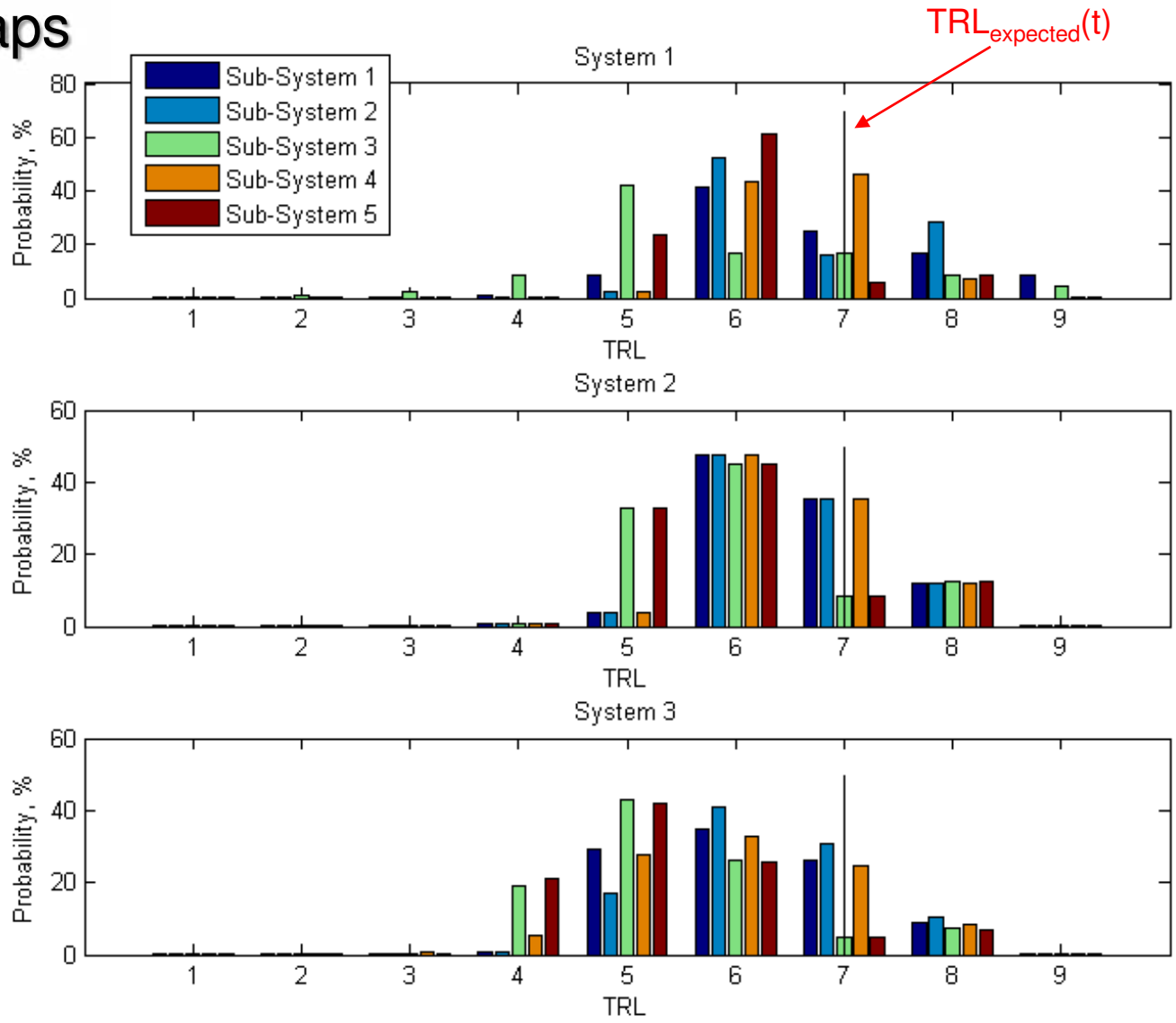
Are There Any Domain Experts?

Estimated Probability	Score if happens	Score if does not happen
0	-inf	0
0.01s	-150	-2
0.10s	-90	-7
0.20s	-64	-13
0.30s	-48	-20
0.40s	-37	-28
0.50s	-28	-37
0.60s	-20	-48
0.70s	-13	-64
0.80s	-7	-90
0.90s	-2	-150
1.00	0	-inf

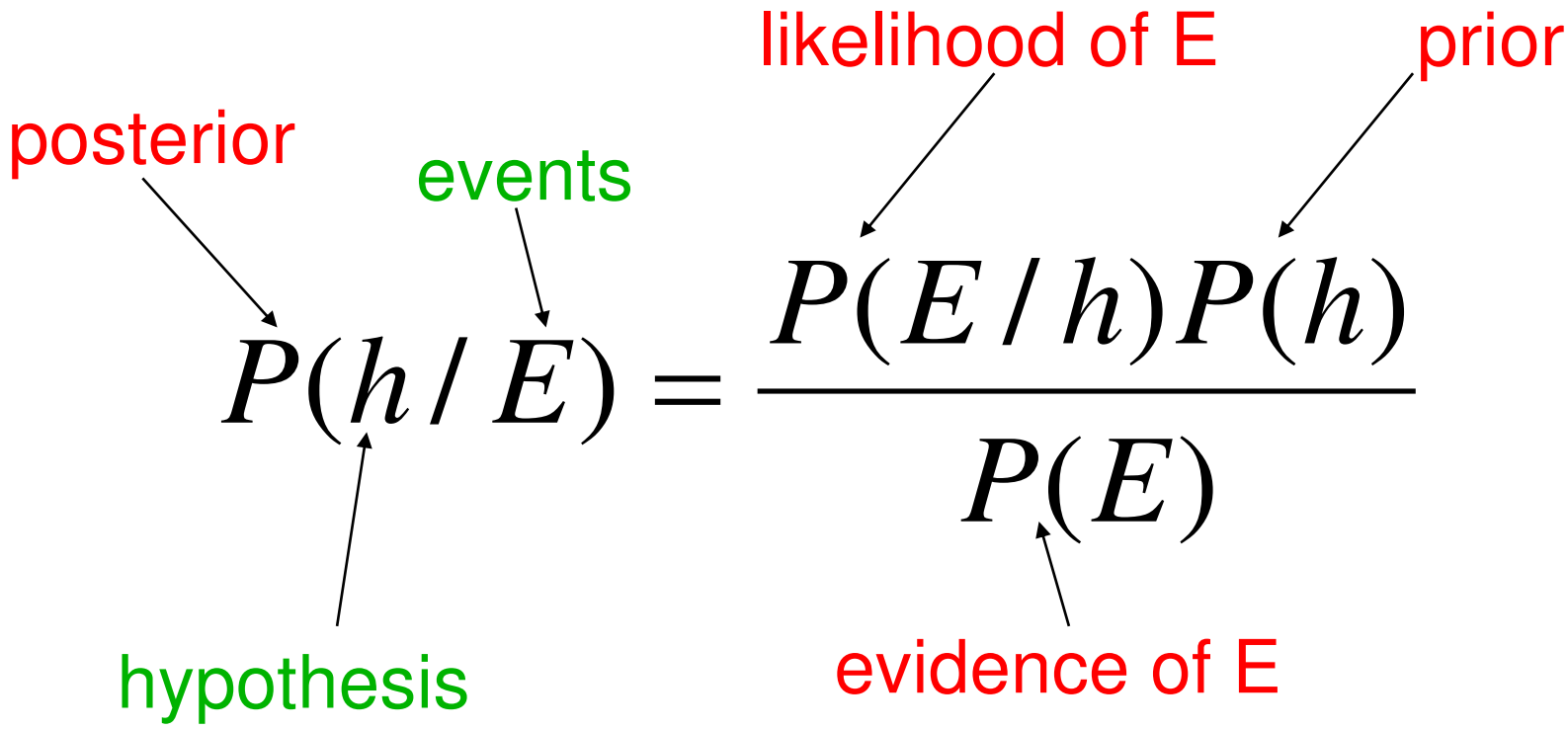
Example for expert's estimating probability

$\min(S_s * P_e + S_f * (1-P_e))$

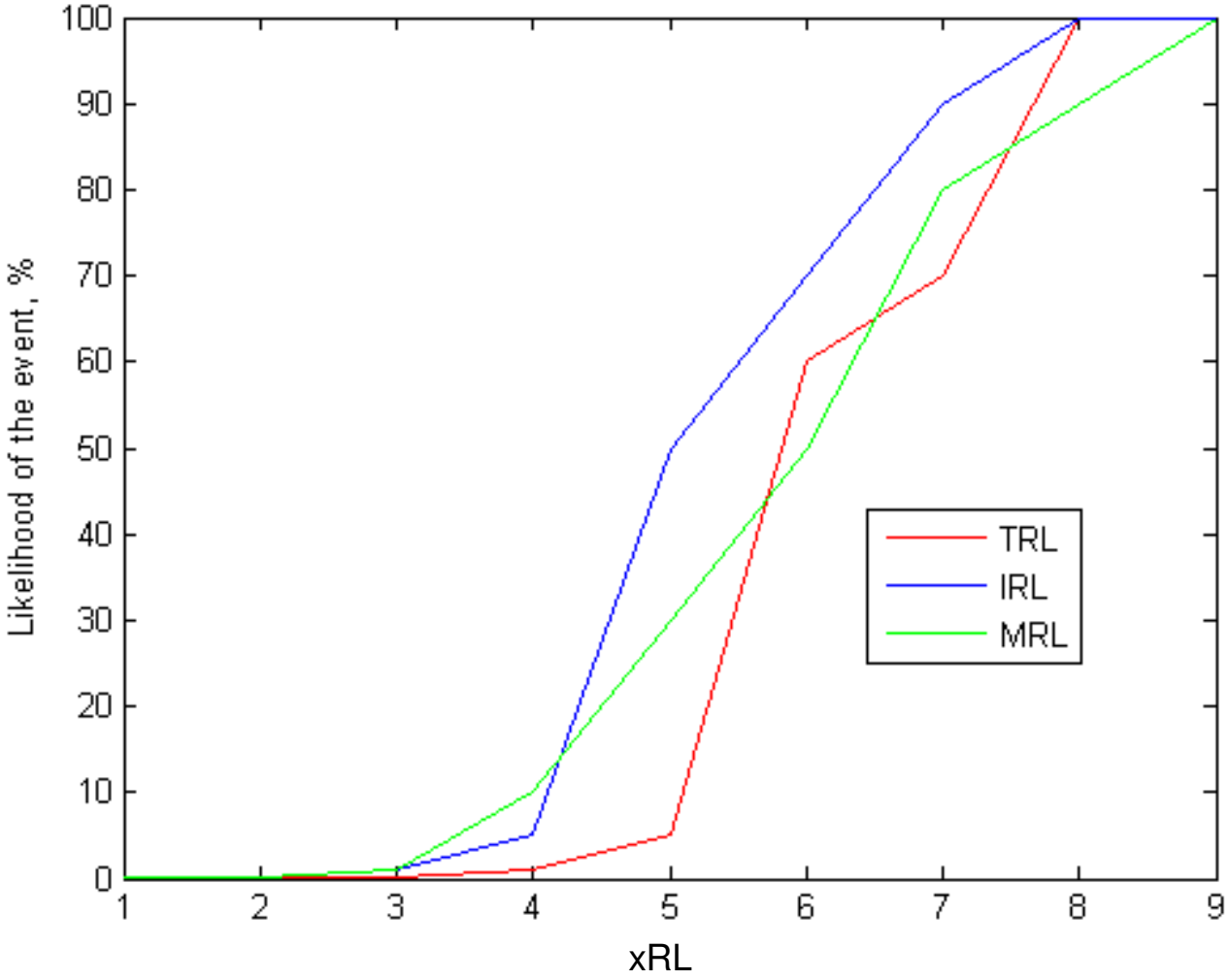
Find Gaps


TRL expected(t)
System 1
Sub-System 1
Sub-System 2
Sub-System 3
Sub-System 4
Sub-System 5
Probability, %
TRL
System 2
Probability, %
TRL
System 3
Probability, %
TRL

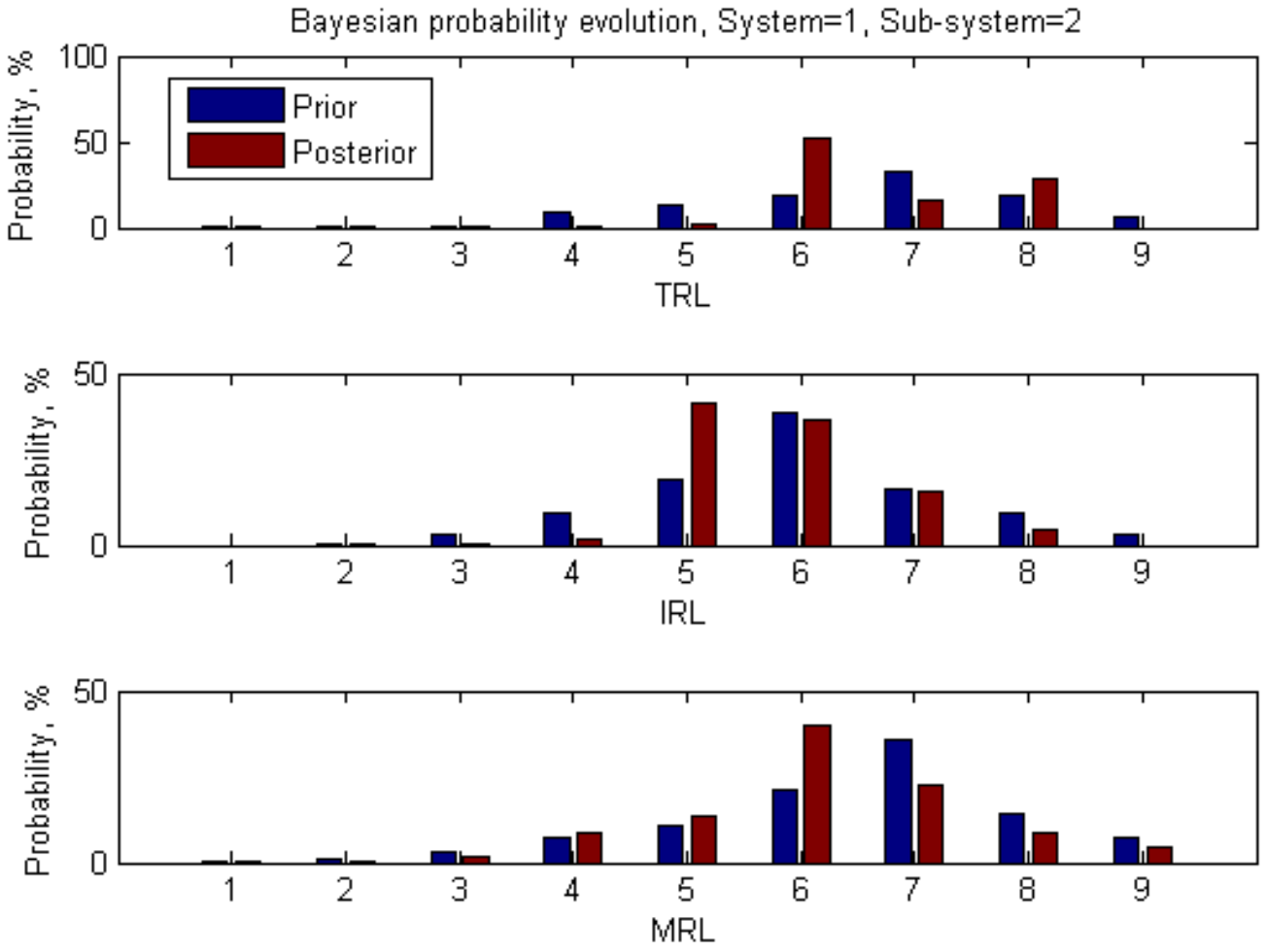
Bayesian Inference



Analysis of an Event Occurring During the Project



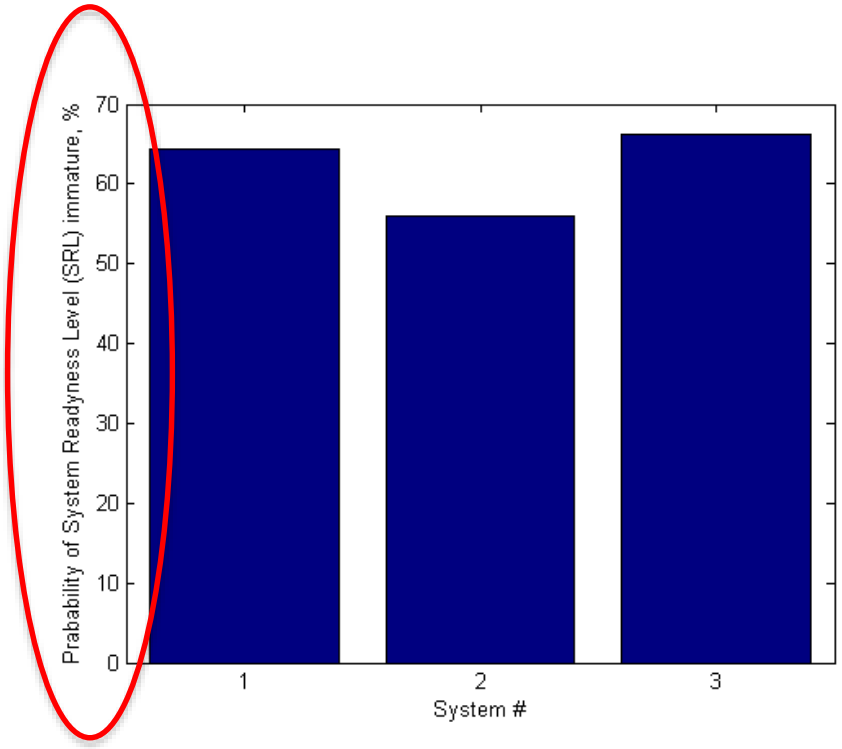
Dynamic Evolving Readiness Levels

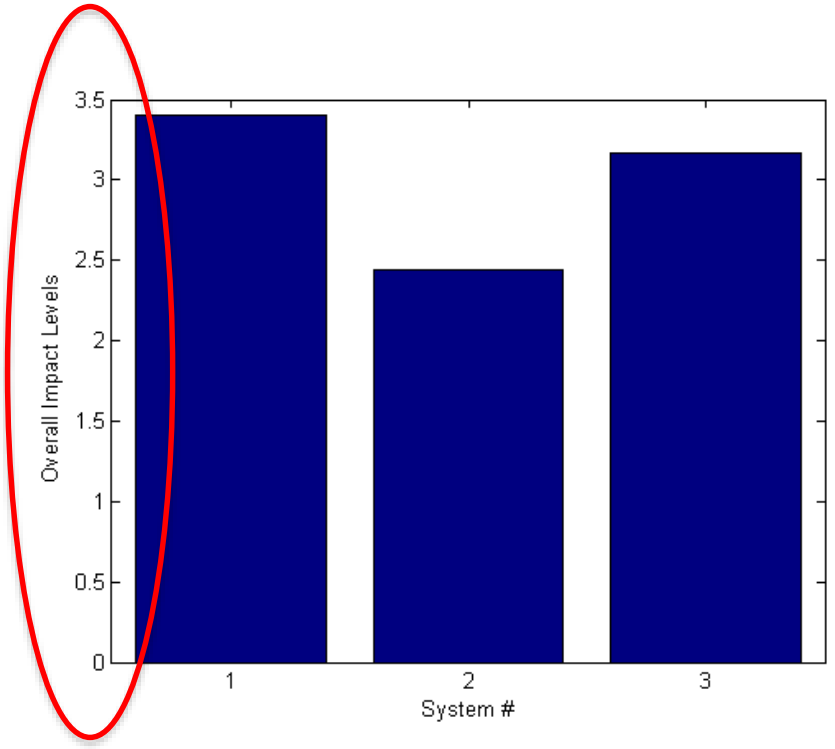


An Example of Immaturity-to-Impact Mapping

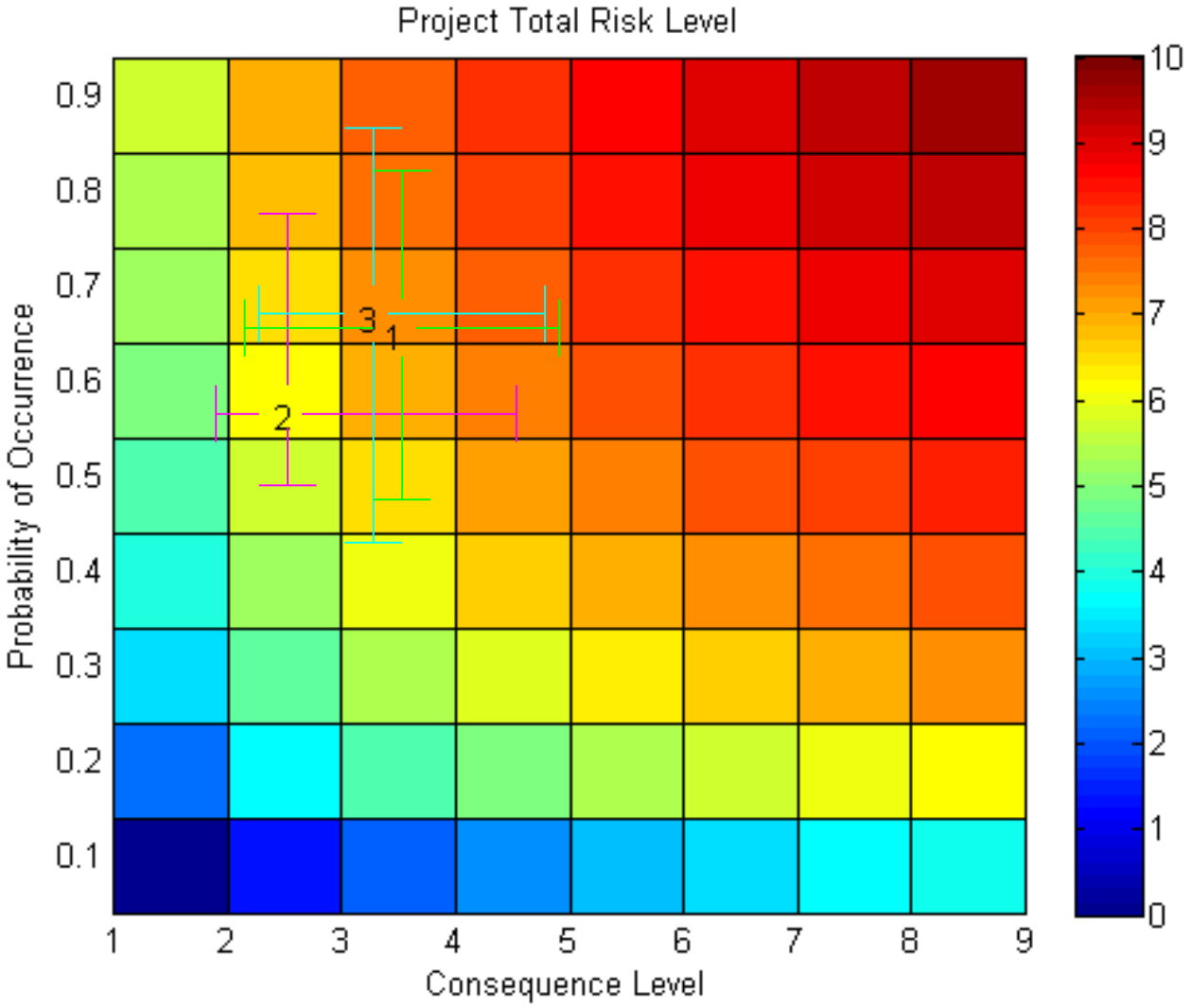
Rating	Cost %	Schedule %	Performance
8	30+	30+	Significant failure involving major rework or major setback that directly affect the project's objectives
6	10-30	10-30	Failure that involves significant rework, modification or reassessment
3	2-10	2-10	Failure or setback that causes additional work and reassessment but containable
1.5	0.1-2	0.1-2	Impact has some effect causing rework or reassessment but easily handled
1	<0.1	<0.1	Little impact, minor inconvenience, effects easily remediated

What We Finally Get?





Risk Assessment Matrix



Selection of Number of Levels in Discrete Probabilities and Grades

Knowledge and expert level ⟸ Number of grades/levels

Uncertainties ⟸ Distribution/prior selection

⇓

- Inclusion of variance for analysis credibility
- Parametric/sensitivity analysis

You Can Start from Nothing

Noninformative priors ← No information/knowledge

(e.g. principle of indifference)

Improper priors ← Information is not enough

Benefits of New Approach

- Consistency
- Management efficiency and active risk measurement
- Records of all events and decision logics, traceable analysis and credibility
- Constant learning, and up-to-date decision support
- Multi-criteria and multi-levels
- Support apple-orange comparison
- Support parametric analysis
- Easy for understanding and operation
- Welcome political players
- Support optimisation
- …

Conclusion

A multi-criteria dynamic risk analysis to project management is recommended by (i) introducing Bayesian upgrade of technical, integration, and manufacture readiness levels (TRL, IRL and MRL) for the options/systems and critical elements/sub-systems, and (ii) allowing more flexible models for estimation of impacts of the project immaturity.

The method developed here can dynamically monitor the evolution of the project, trace and control the risks, and maintain credible records.