

Linking Projects to Program Outcomes in Metrics for Technology Development Programs

Presentation at
American Evaluation Association Conference
Baltimore, MD
November 10, 2007

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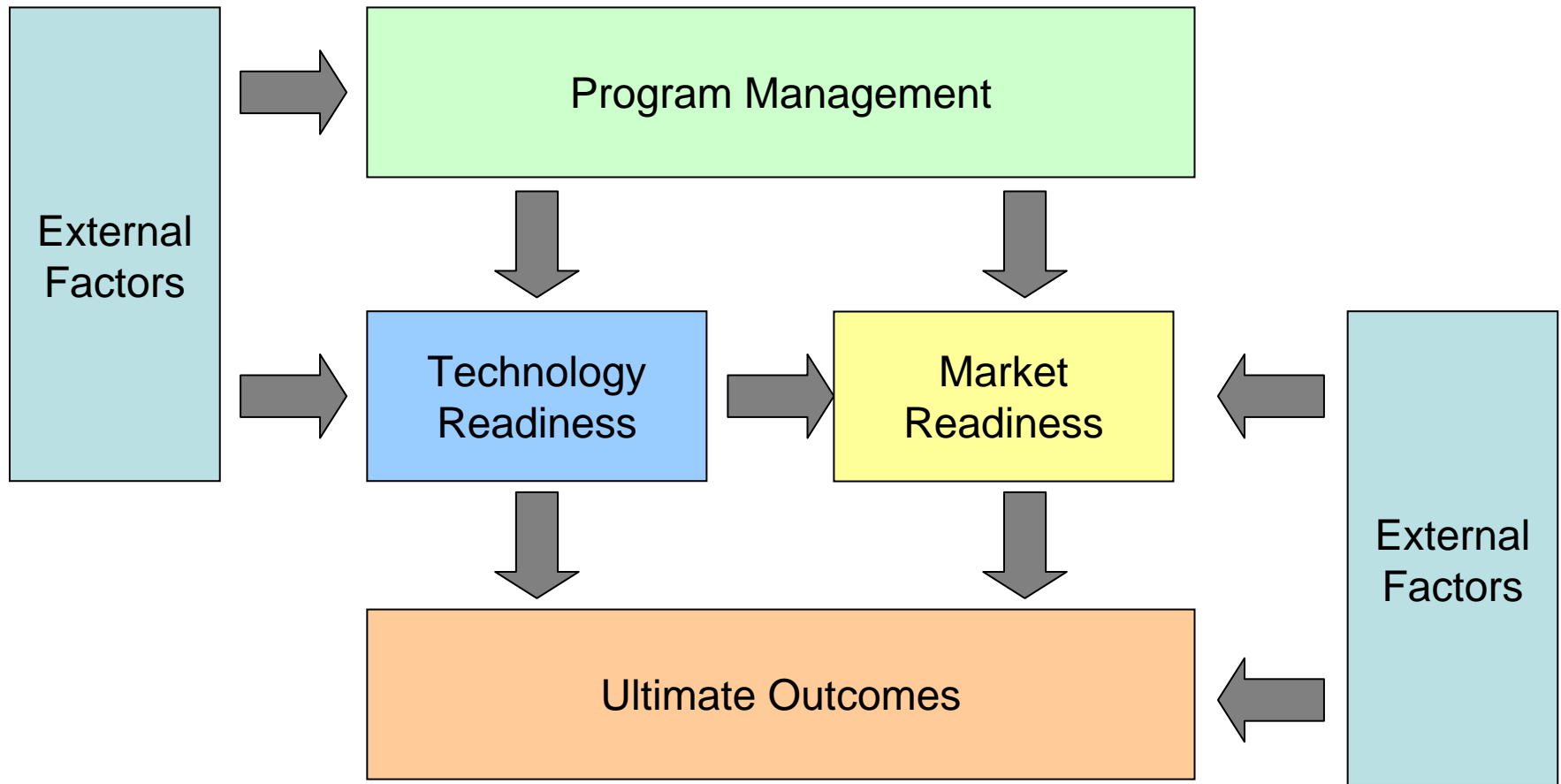
Work presented here was completed by Energetics Incorporated and Sandia National Laboratory for the U.S. DOE Office of Energy Efficiency and Renewable Energy.

The performance measure challenge

Improve current performance measures by defining a relatively small set of meaningful measures that

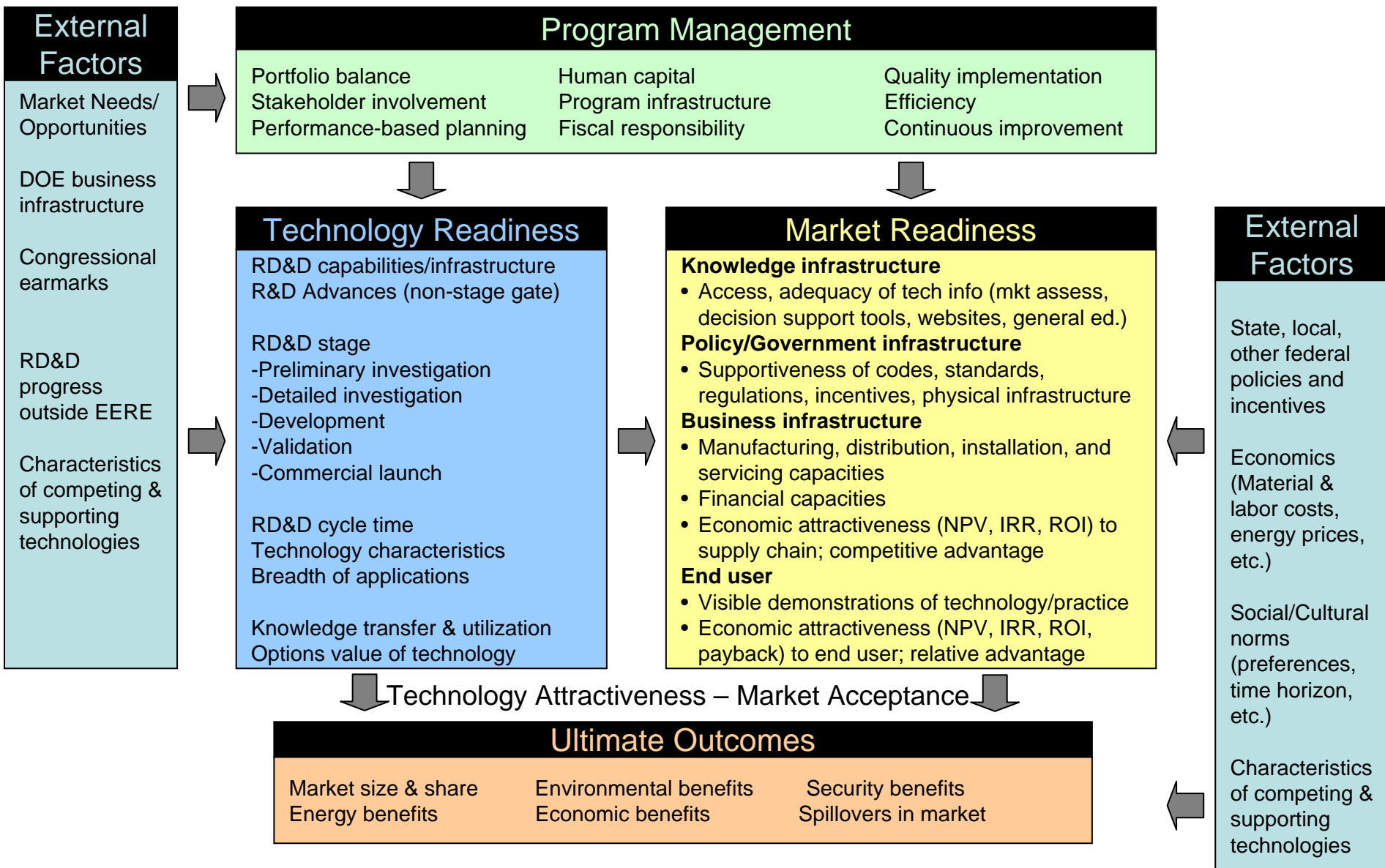
- Respond to multiple stakeholder perspectives
- Link performance in multiple levels of the organization
- Capture more performance
- Reduce proliferation of measures
- Increase consistency across diverse portfolio
- Link activities to outcomes (the magic in the middle)

Build upon the 5-box measurement framework



(Feedback loops not shown)

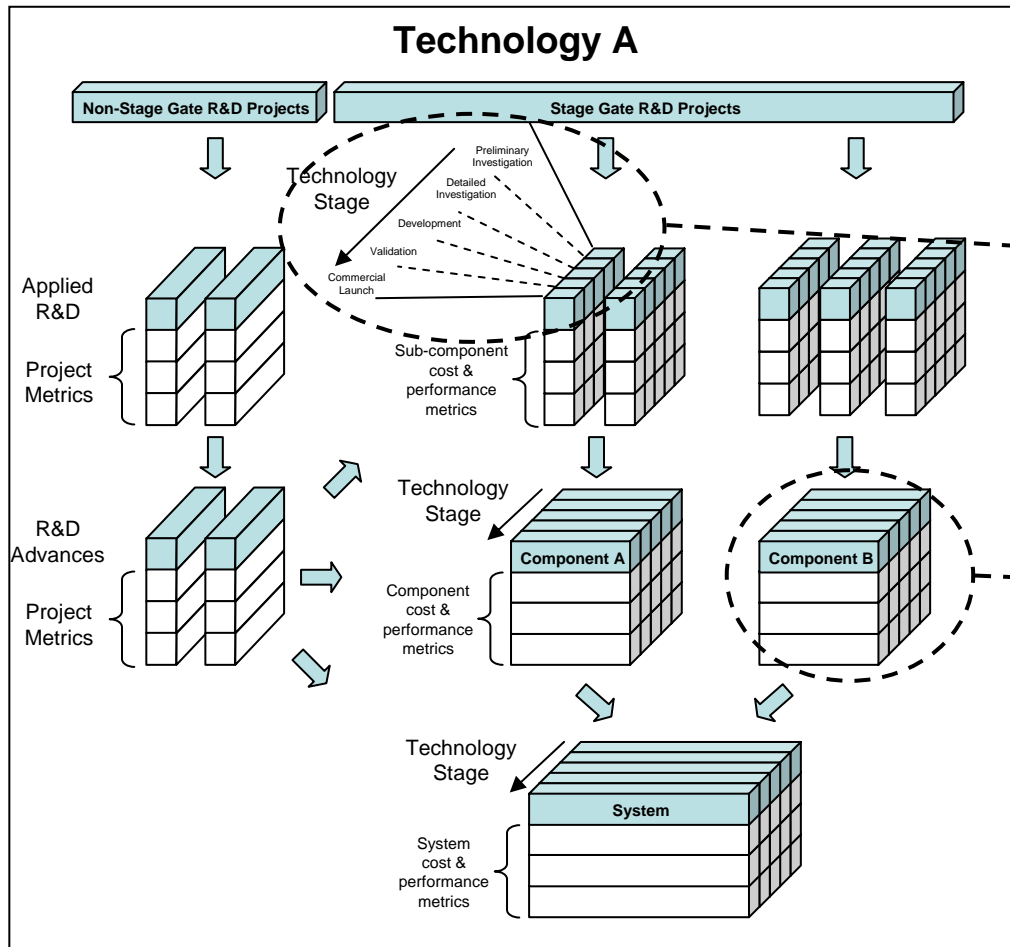
Generic measures were proposed for each measurement area



Generic technology readiness metrics

Generic Logic

Generic Metrics



- R&D Advances
- Technology stage
- RD&D cycle time
- Partner cost share by technology stage

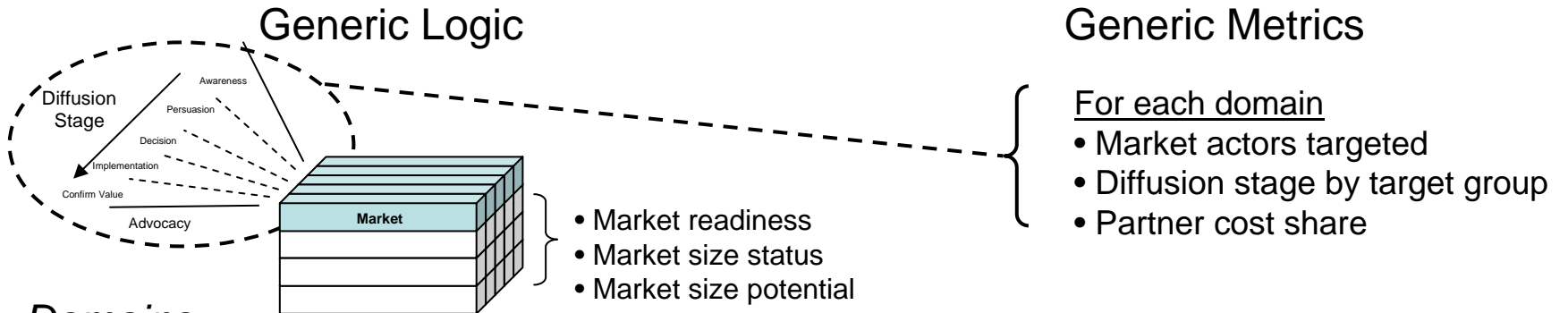
By Technology Stage:

- Technology performance
- Technology capital cost
- Technology O&M cost
- Other technology characteristics

External Influences

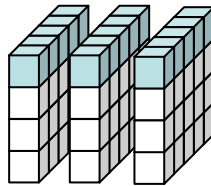
- Cost of inputs
- Related R&D advances elsewhere
- Characteristics of competing technologies
- Level of current demand (e.g. government purchases)

Generic market readiness metrics



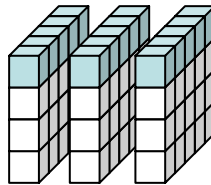
Domains

Business Environment



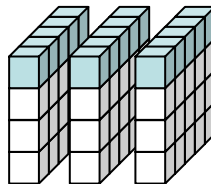
- Manufacturing volume, cost
- Total cost (installation, O&M)
- Financing availability, cost
- ROI

Knowledge Environment



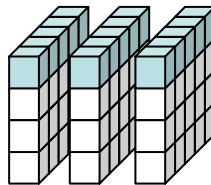
- Knowledge of technology, market
- Amount of use of decision support tools
- Influence on decisions

Policy, Government Environment



- Influence on policy, codes, gov't entities
- Amount of incentives offered
- Take up of incentives

Technology End Users

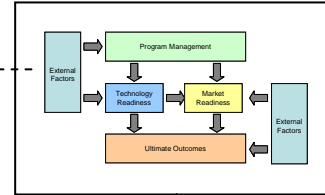


- Adopter group status (innovator, early adopter, etc.)
- Payback period
- Market characteristics (who is served)

3 EERE programs were examined and 4 types of gaps were found

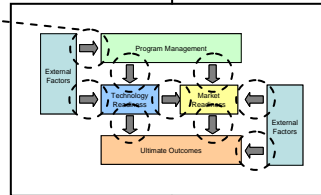
EERE

- ① **Missing Key Measures**
5 measurements areas are not adequately represented (at all org levels)



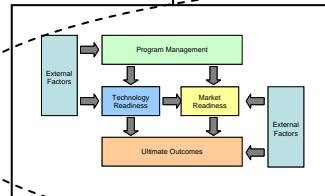
Program

- ② **Weak Links**
Linkages among the 5 areas are not adequately represented



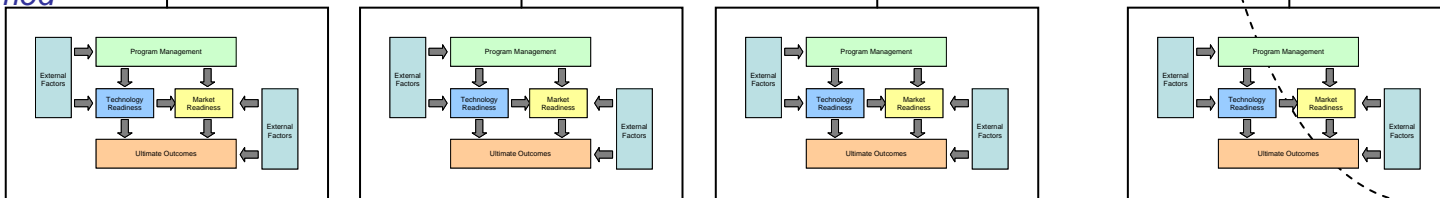
Subprogram or Technology

- ③ **Coverage**
Full suite of program activities are not adequately represented

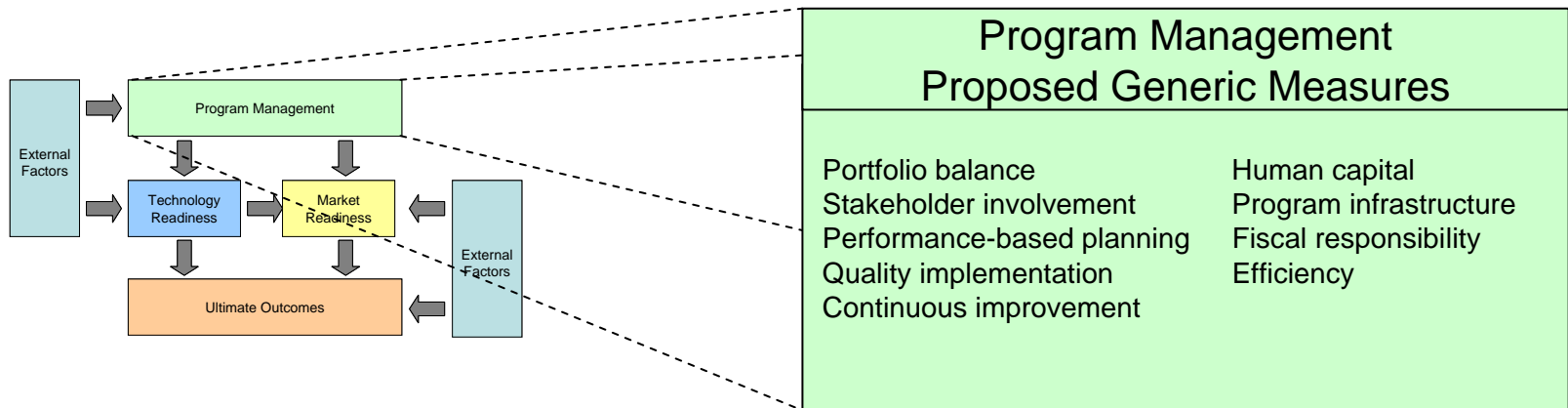


Project

- ④ **Cascade and Aggregation**
Aggregations across levels are not performed

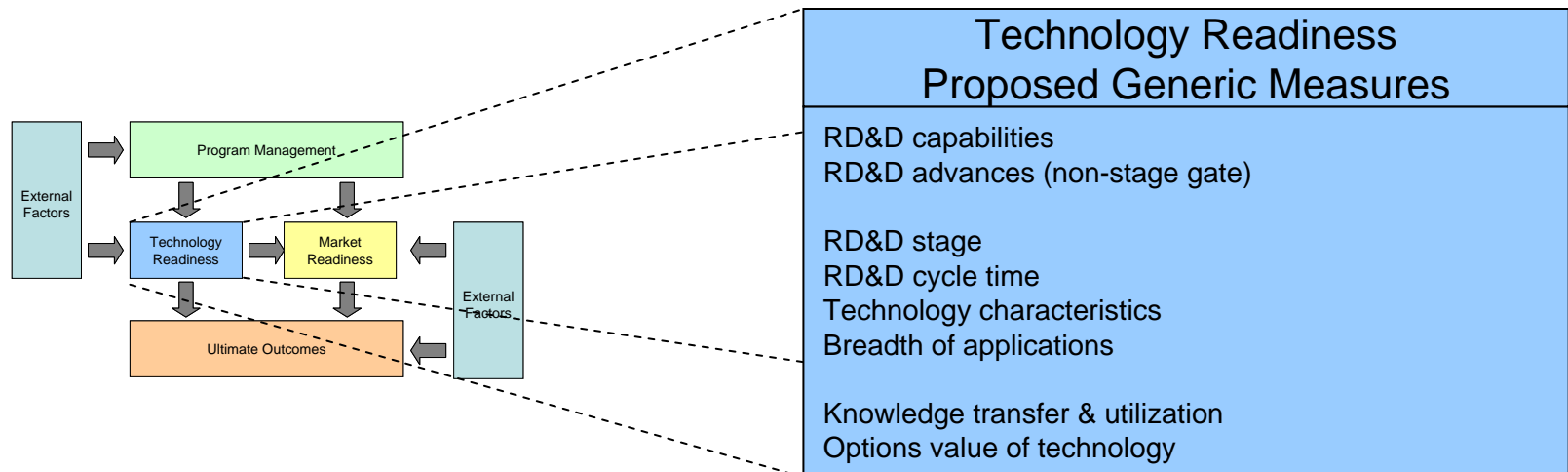


① Gaps in measuring program management



Metric Gap	Issue	Resolution
Portfolio balance	Information other than estimates benefits and funding is needed.	Measure RD&D stage, risk, timing
Performance-based planning	Need comprehensive targets, informed by past performance	Improved scheme for measures and their use
Quality implementation	Need more evidence than competitive selection	Add peer review scores
Efficiency	Low PART scores due to poor efficiency measure	Define metric with OMB, CFO that doesn't harm R&D
Continuous improvement	Can't demonstrate that performance informs decisions	Track response to review findings

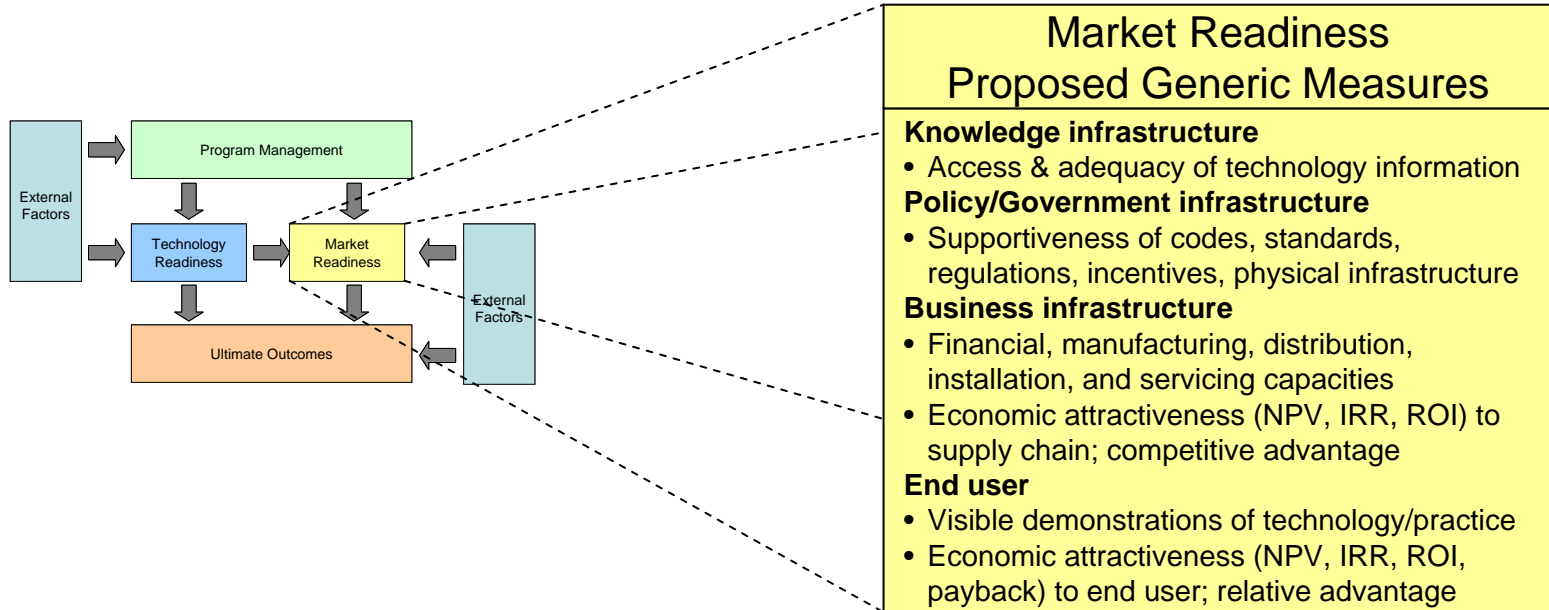
① Gaps in measuring technology readiness readiness



Metric Gap	Issue	Resolution
RD&D capabilities	Need to capture a major EERE role to build R&D infrastructure/community	Track investment in RD&D facilities, personnel skills, networks
RD&D stage	Need a common way to describe status and what progress has been made	Where it applies, track technologies using stage-gate terms
Knowledge transfer and utilization	Need to capture impact of knowledge – knowledge benefits	Track publications and citations, patents
Options value	Capture important outcomes (potential benefits of fully developed technologies waiting for market/policy changes)	Model options value.
RD&D cycle time	Demonstrate the claim that EERE accelerates development	Establish baselines and track, or use control groups

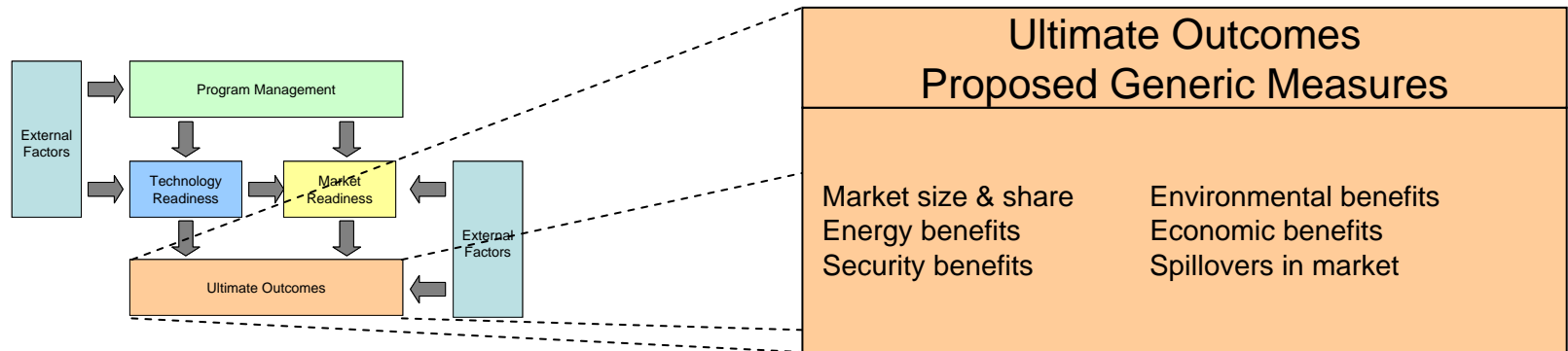
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Gaps in measuring market readiness



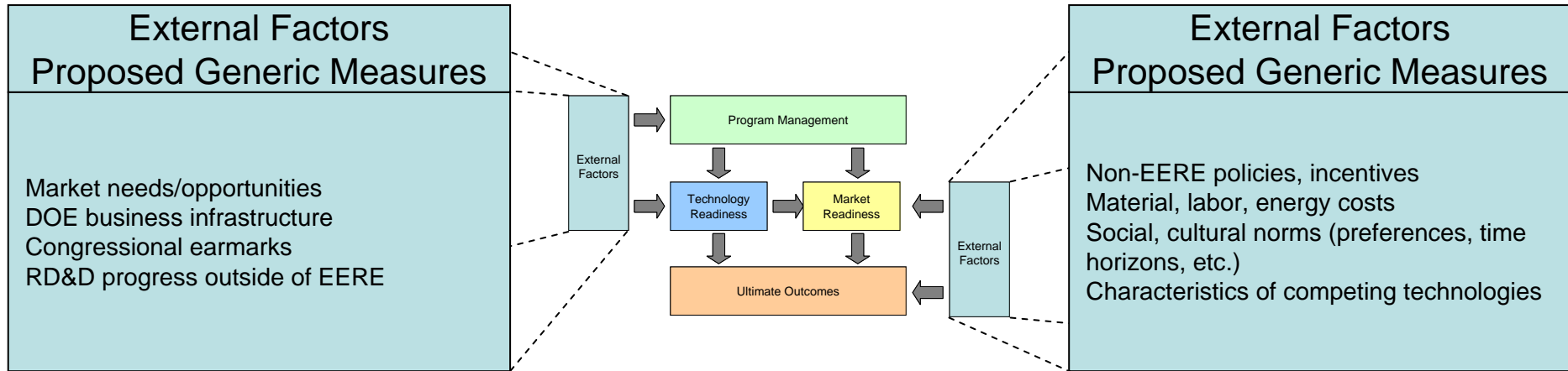
Metric Gap	Issue	Resolution
Knowledge infrastructure	Need way to aggregate metrics for software, performance data, etc.	Track quality and quantity of information made available.
Policy/government infrastructure	Need summary measure for how supportive gov't policies are.	Track influence on policies and their impacts on market.
Business infrastructure	Need way to measure status, progress of technology manufacturing, distribution, service	Track supply chain capacity. Track economic attractiveness to supply chain.
End user	Is technology attractive to end user?	Track technology payback, etc.

① Gaps in measuring ultimate outcomes



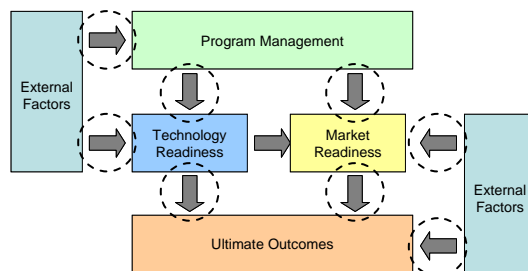
Metric Gap	Issue	Resolution
Actual outcomes are seldom tracked for R&D	Outcomes are projected for GPRA benefits but actual market penetration and associated benefits are not tracked.	Conduct more retrospective evaluations that track market penetration and associated outcomes.
Outcomes for deployment programs	Different programs measure and take credit differently.	Standardize, Quality assurance, templates.
Spillovers	Substantial benefits of technology applications in other markets may not be measured (projected, actual).	Examine other market impacts in evaluation studies.
Security benefits	No defined way to account for them	Task force, study

① Gaps in measuring external factors



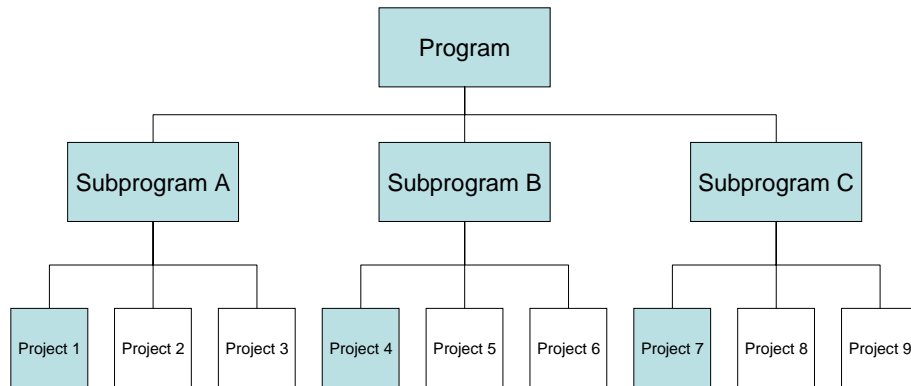
Metric Gap	Issue	Resolution
RD&D progress outside of EERE	Outside RD&D progress may impact EERE RD&D, need for attribution	Document annually
Non-EERE policies and incentives	Know policies outside of EERE that impact technology/ market success	Track external policies; model impact on technologies.
Material, energy, labor costs	Know what costs can impact attractiveness of EERE technologies	Identify and track key costs impacting technology.
Characteristics of competing technologies	Know improvements in competing technologies to explain progress, to inform planning	Track improvements in competing technologies.

② Gaps in linking 5 measurement areas



Metric Gap	Issue	Resolution
Program Management	What is impact of improvements in program management on technology and market readiness?	Track routine data that can then be used in in-depth evaluations to determine this.
Technology Readiness	Which technologies reached which markets and then what?	Track routine data that can then be used in in-depth evaluations to determine this.
Market Readiness	What are market preferences, obstacles? Are technology strategies correct/optimal?	Track routine data that can then be used in in-depth evaluations to determine this. Analysis.
Ultimate Outcomes	What is impact of EERE activities on outcomes (attribution)?	In depth evaluations.
External Factors	How do external factors impact the other four measurement areas?	In depth evaluations. Analysis.

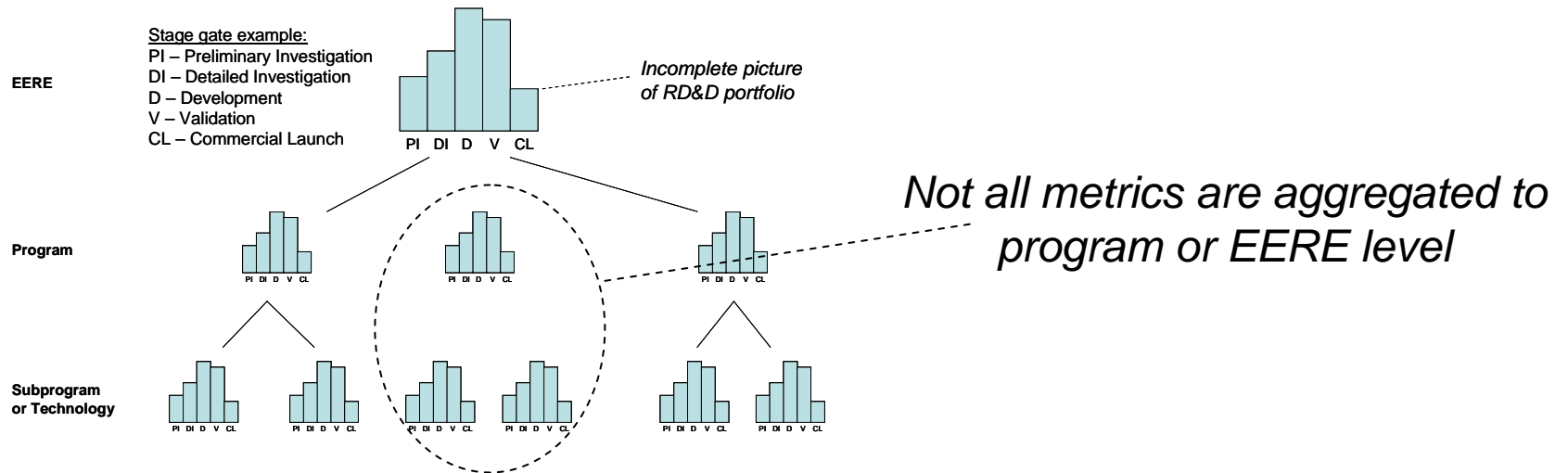
③ Gaps in measuring full suite of program activities



Only selected activities are used to represent the entire program

Metric Gap	Issue	Resolution
Subset of program activities are measured	Metrics do not represent full suite of program activities	<p>Request that major goals be measured, with defined more detailed contributors (a roadmap with markers).</p> <p>Examine whether metrics can be developed that cover multiple activities, e.g. technology performance and cost and contribution to that.</p>

④ Gaps in aggregating performance across organizational levels



Metric Gap	Issue	Resolution
Data not aggregated across organizational levels	Cannot get a complete picture of the organization's performance; cannot identify problem areas in the organization.	Collect key generic measures. Develop common definitions and ensure they are applied consistently. Develop tracking system.
Measures do not always cascade from Program to sub program to project	Cannot explain to lay person why specific research or accomplishment is important. Hard to briefly explain what is done and why.	Request that major goals be measured, with defined more detailed contributors (a roadmap with markers).

Next steps

- We are working with EERE and key stakeholders to develop metrics that address the gaps identified above

Summary and conclusions

- Generic metrics were identified for 5 areas
 - Management, technology readiness, market readiness, ultimate outcomes, and external factors
- 4 measurement gaps were identified
 - 5 measurement areas not covered
 - Performance not linked across 5 areas
 - Metrics not used in all program areas
 - Metrics do not cascade down and aggregate up
- Potential resolution to gaps were identified
- Working with EERE programs to develop metrics and address gaps