

An International Comparative Analysis of Evaluation Criteria for Public Research Programs

November 4, 2004

Presented at

***American Evaluation Association 2004 Conference
Research, Technology, and Development Evaluation TIG***

**Hilton Atlanta Hotel at Downtown
Atlanta, GA**

**Yongsuk Jang, Ph.D.
Center for International Science and Technology Policy (CISTP)
The George Washington University**

Email: jang@gwu.edu / Tel: 202-994-1640



Evaluation Criteria/Indicators for Public R&D Programs

◆ Define What to Measure : Indicators

◆ Determine How to Measure : Methodologies

◆ Lead to RIGHT Evaluation : Balances

International Benchmarking on Indicators

◆ Analysis, Evaluation, and Pre-Budget Review, Korea

- All (over 200 in 20 agencies) R&D Programs

◆ Office of Science, DOE, US

- Five different Types of R&D Programs

◆ Framework Programme, EU

- Annual Continuous Monitoring
- Five-Year Assessment

Evaluation Criteria (Indicators)

Quality

Relevance

Leadership



NRC Rec.

Infrastructural Stewardship

Management & Operation Excellence

Evaluation Indicators for the Office of Science, DOE, US

	Research Support	Lab M&O	Scientific User Facilities	Construction	Infrastructure
Quality					
Relevance					
Leadership					
Infrastructural Stewardship					
M&O Excellence					

Evaluation Indicators for Framework Programme, EU

	Continuous Monitoring	Five-Year Assessment
Quality		
Relevance		
Leadership		
Infrastructural Stewardship		
M&O Excellence		

Comparative Analysis

- Many Overlaps**
 - **Quality**
 - **Relevance**
 - **M&O Excellence**

- Missing Categories/Indicators**
 - **Leadership**
 - **Infrastructural Stewardship**

- Different Dimensions**
 - **Program Types**
 - **Time spans**

Policy Implications

- ☐ Context-Complying Adoption**
 - Quality**
 - Relevance**
 - M&O Excellence**

- ☐ New Dimensions / Indicators**
 - Program Types**
 - Monitoring & Long-term Assessment**

- ☐ Continuous (international) Learning**
 - Leadership**
 - Infrastructural Stewardship**
 - International collaboration**

Table 15. Rearranged Evaluation Indicators for National R&D Programs in Korea

	Category	Indicator
Quality	Performance	Q1. Performance and its effect Q2. Quality of R&D enough to achieve program goal
	Goal Achievement	Q3. <i>Extent of goal achievement in terms of duration, cost, performance</i> Q4. Degree of achievement against the projected tangible outcome Q5. Degree of achievement against the projected technological goal Q6. Other tangible and intangible outcomes
Relevance	Marketability	R1. Commercialization of developed technologies and/or establishment of new firm R2. Market size, export effect, and/or Market forecast of commercialized technologies R3. Feasibility of developed technologies for other fields or for venture Market
	Adaptability to Environmental Change	R4. Adaptability of current program to expected changes in government role or function R5. Adaptability of current program to environmental changes R6. Program structure that can adapt to future environmental changes R7. Existence of clearly defined customer groups
	Future Technological Demand	R8. Technological validity of current program against technology forecast R9. Economic validity of current program against Market forecast R10. Necessity of program adjustment
	Socio-Economic Impact	R11. <i>Cost/Benefit Analysis of developed technologies</i> R12. <i>Techno-Economic effects when terminated or reduced</i> R13. <i>Provision of proper solutions to its technological, economic, and social problems</i> R14. <i>Technological or Economic effects of program reduction or suspension</i>
Leadership		L1. <i>Appropriateness of technological goals compared to those of competitors</i>
Infrastructure	Large User Facility	
	Infrastructural Facility	
M&O	Program Management	M1. Management which is rational enough to achieve the projected goals M2. Appropriateness of resource size and allocation M3. Appropriateness of program size, structure, and organization M4. Appropriateness of program management to its R&D environment M5. Account of plausible risks in the process of management
	Program Operations	M6. Feasibility of projected technological goal M7. Appropriateness of budget size M8. Appropriateness of program duration M9. Effectiveness of physical and human resources M10. Interim evaluation or frequency of evaluation M11. Program adjustment M12. Program structure and strategy
	Strategy	M13. Appropriateness of technology import rather than development M14. Appropriateness of program changes in terms of direction, subject, duration, or size

* This table is the rearrangement of Table 1 (Lee, 2000).

Table 16. Summary of Evaluation Indicators in Office of Science, DOE, US

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
Quality	Q1. technical/scientific merit Q2. technical soundness and feasibility Q3. appropriateness of method or approach Q4. performance competency of researcher Q5. cost reasonableness and realism	Q1. research quality Q2. research performance Q3. Environment, Safety and Health (ES&H)			
Relevance	R1. relevance to SC's missions R2. consistency with program funding priorities R3. educational benefits	R1. relevance to mission	R1. furthered the Department missions R2. manage facilities to meet their goals R3. effectiveness of user facility research programs R4. benefits of facilities R5. scientific and technological demand R6. user demand R7. scientific impact R8. impacts of the shutdown R9. trained students	R1. Lehman Reviews R2. Project conformance to mission needs	R1. stakeholder relations R2. availability of funding sources R3. allocations in support of landlord activities R4. overall effectiveness of the implementation of landlord responsibilities R5. whether unfunded risks are acceptable
Leadership	L1. national and international standing of the portfolio elements L2. program policy and priorities L3. breadth and depth of portfolio elements	L1. corporate involvement & oversight			

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
	L4. appropriate balance among the program areas L5. future directions and opportunities				
Infrastructure		I1. research facilities I2. human resources I3. training I4. diversity I5. personal property I6. communications and trust	I1. service to users I2. user satisfaction on facility operations I3. user satisfaction on schedule or service I4. user satisfaction on facility performance I5. user satisfaction on facility staff I6. user satisfaction of access to unique capabilities I7. user satisfaction of facilitated collaborative interactions I8. user satisfaction on training and safety procedures I9. user recommendation on facility operations I10. long-range planning for all the facilities I11. need for new facilities I12. vision of the future I13. expected future capability I14. visions accommodate potential changes I15. capabilities complement one another		I1. 'Landlord Lehman Review' I2. infrastructure management and planning I3. human Resources I4. high quality federal staffs I5. federal workforce in the field I6. educational human resource development I7. appropriateness of position descriptions I8. annual performance appraisals on all workforce I9. diverse workforce I10. Facility Condition Index (FCI) I11. evaluation of improvements

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
			I16. funding priorities I17. appropriate level of R&D funding for continuous improvement of current facility operations I18. level of investment on facilities		
M&O	M1. completeness M2. duplication/overlap	M1. effectiveness and efficiency of research program management M2. Environment, Safety and Health (ES&H)	M1. average operational downtime below 10% of schedule M2. construction and upgrades within 10% of schedule and budget	M1. technical work scope documentation M2. cost estimates: level of detail, basis, risks, contingency planning, funding/ obligations/cost plans, integration with schedules, overhead rates, material and labor quantities and rates/quotes, life cycle costs	M1. Environment, Safety & Health (ES&H) M2. energy efficiency
	M3. availability of sufficient funds	M3. environmental performance & awareness	M3. user demographics	M3. schedules: level of detail, activity and logic assumptions, risks, contingency planning, integration with cost estimates, activity logic alignment with technical-scope planning, resource planning	M3. waste management

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
	M4. reasonableness and appropriateness of budget	M4. waste minimization/pollution Prevention	M4. facility budget and operations data	M4. business management: management organization, staffing, work assignment process, project management control systems, risk management, baseline and technical work management, quality management, and ES&H/NEPA compliance.	M4. integrated safeguards and security
	M5. efficacy and quality of the processes	M5. safeguards & security	M5. laboratory management	M5. Recommendations and action items from previous reviews	M5. safeguards and security
	M6. how the process for these reviews might be improved	M6. integrated safety management	M6. ES&H	M6. Procurement Strategy	M6. incidents of safeguards and security concerns
	M7. how the award process has affected	M7. Injury Cost Index (ICI)	M7. cyber and other security activities	M7. ES&H	M7. site security plan
	M8. effects on science programs	M8. total recordable case/lost workday case rates	M8. quality of operations		M8. nuclear materials accounting system
	M9. methods for performance measurement	M9. financial management	M9. technical		M9. nuclear material control program
	M10. appropriateness and comprehensiveness of evaluation methods	M10. procurement	M10. cost		M10. protection of DOE property and security interests
	M11. integration of performance measures with the budget process	M11. scientific & technical Information	M11. schedule		M11. accurate vulnerability assessments
		M12. information management			M12. cyber security
		M13. technology transfer			M13. comprehensive cyber security program

	Research Support	Laboratory M&O	Scientific User Facilities	Construction	Infrastructure
					M14. training cyber-security personnel M15. Facilities Information Management System (FIMS) database M16. office space utilization M17. requirements for unclassified visits and assignments by foreign nationals

Table 17. Summary of Evaluation Indicators in Framework Programme, EU

	Annual Monitoring	Five-Year Assessment
Quality	<p>Q1. overall progress as regards the major objectives</p> <p>Q2. progress and output of projects against the original targets set</p>	<p>Q1. Framework achievements</p> <p>Q2. major achievements</p> <p>Q3. performance of FP3&4</p>
Relevance	<p>R1. extent to which selected projects or clusters of projects fulfill the wider policy objectives of the EU</p> <p>R2. consistency of the selection of projects with the initial objectives and the work programme</p> <p>R3. progress in ERA and the Lisbon Strategy</p> <p>R4. Lisbon Strategy and the International Context</p> <p>R5. contribution to enlargement</p> <p>R6. participation of SMEs</p> <p>R7. women and science</p> <p>R8. supporting the development of EU policies and instruments</p> <p>R9. use of specific measures and support activities and participation in the programme of firms and institutions from less favored regions</p> <p>R10. commercialization of research</p> <p>R11. Impact of Framework Programme Research</p> <p>R12. whether the objectives, priorities and financial resources are still appropriate in the overall context</p> <p>R13. whether these objectives, priorities and financial resources are still appropriate to changing circumstances</p> <p>R14. flexibility to respond to the needs of society in the light of changing circumstances</p> <p>R15. needed changes to the balance of the Programmes or to the strategy for implementation, in the light of experience and changes in the wider environment</p> <p>R16. appropriateness of Community research objectives and synergies between Specific Programmes</p>	<p>R1. relevance (whether the initial objectives are still valid against new S&T developments and socio-economic conditions)</p> <p>R2. effectiveness (whether the initial objectives have been achieved)</p> <p>R3. coherence between the Community and national S&T policies with a view to enhancing their mutual consistency</p> <p>R4. coordination with other international S&T policies or programmes</p> <p>R5. focus and appropriateness</p> <p>R6. harmonious and widespread development</p> <p>R7. international cooperation</p> <p>R8. additionality</p> <p>R9. complementary work at Community level</p> <p>R10. cohesion of the common market</p> <p>R11. ensuring coherence</p> <p>R12. strategy for enlargement</p> <p>R13. Community's economic and social cohesion</p> <p>R14. unification of European science and technology</p> <p>R15. expanding and creating good growth prospects</p> <p>R16. competitiveness of Community businesses</p> <p>R17. recommendations for future activities</p> <p>R18. Framework Tomorrow</p> <p>R19. maintaining momentum, scale and emphasis</p> <p>R20. emphasizing excellence and risk</p> <p>R21. retaining variety</p> <p>R22. nurturing human potential</p> <p>R23. keeping an emphasis on relevance</p> <p>R24. benefits</p> <p>R25. motives and goals</p> <p>R26. industrial achievements & expectations</p> <p>R27. nature of work</p> <p>R28. goal attainment</p> <p>R29. consumer satisfaction</p>

	Annual Monitoring	Five-Year Assessment
		R30. social exclusion R31. reduced crime R32. critical mass in human and financial terms R33. contribution to implementation of one or more Community policies R34. standardization at Community level R35. development of European Research Area R36. equality between European regions R37. improving the employment situation R38. promoting the quality of life and health R39. preserving the environment R40. dissemination and exploitation of results
Leadership		L1. Beyond Framework L2. responding to the challenge L3. strategy for europe L3. importance of STI L4. taking the lead in RTD L5. opening up prospects of significant scientific and technological progress L6. stimulating innovation
Infra	I1. Joint Research Centre	I1. people and education I2. exploiting the EU treaty
M&O	M1. cost effective implementation M2. external communication and information dissemination M3. project monitoring and evaluation methodology M4. project and programme impact methodology M5. efficiency and transparency of the programme management and the internal Commission coordination M6. recommendations for the future indicators to be used for monitoring as well as the monitoring process itself M7. follow-up of previous monitoring recommendations M8. strengths and weaknesses M9. cases that need further examinations because of their significant impact or poor performances M10. Specific Programme Monitoring Reports M11. linking research, education & training M12. conclusions & recommendations	M1. efficiency (whether the objectives have been pursued in a cost effective manner through programme implementation) M2. lessons learned from programme implementation M3. initial implementation of FP5 M4. transition from FP4 to FP5 M5. implementing new management structures M6. Programmes management and administration M7. separation of functions M8. advisory structures M9. monitoring and evaluation M10. access to services M11. safety M12. informed consumers M13. citizen participation M14. security and reliability of electronic interactions M15. preserving the best of the past M16. re-engineering for flexibility M17. greater flexibility

Table 18. Comparative Analysis of Evaluation Indicators

	Korea	Office of Science				Framework Programme		
		Research Support	Laboratory M&O	User Facility	Construction	Infrastructure	Annual Monitoring	Five-Year Assessment
Quality	Q1. Performance and its effect	Q1	Q2				R11	Q1, Q2, Q3
	Q2. Quality of R&D enough to achieve program goal	Q2	Q1					
	Q3. <i>Extent of goal achievement in terms of duration, cost, performance</i>	R1, R2	R1	R2		R2, R3	Q1	R2
	Q4. Degree of achievement against the projected tangible outcome							
	Q5. Degree of achievement against the projected technological goal							
	Q6. Other tangible and intangible outcomes			R3, R4	R2	R4	Q2	
		Q3, Q4, Q5	Q3					
Relevance	R1. Commercialization of developed technologies and/or establishment of new firm						R10	
	R2. Market size, export effect, and/or Market forecast of commercialized technologies							
	R3. Feasibility of developed technologies for other fields or for venture Market							
	R4. Adaptability of current program to expected changes in government role or function						R1	R17
	R5. Adaptability of current program to environmental changes						R12, R13	R18
	R6. Program structure that can adapt to future environmental changes						R14, R15	
	R7. Existence of clearly defined customer groups					R1		
	R8. Technological validity of current program against technology forecast			R5				
	R9. Economic validity of current program against Market forecast							
	R10. Necessity of program adjustment							

	Korea	Office of Science				Framework Programme	
		Research Support	Laboratory M&O	User Facility	Construction	Infrastructure	Annual Monitoring
	R11. <i>Cost/Benefit Analysis of developed technologies</i> R12. <i>Techno-Economic effects when terminated or reduced</i> R13. <i>Provision of proper solutions to its technological, economic, and social problems</i> R14. <i>Technological or Economic effects of program reduction or suspension</i>			R8 R8		R5	R24
		R3		R1, R6, R7, R9	R1		R2 - R9, R16 R1, R3, R4 - R15, R19 - R40
Leadership	L1. <i>Appropriateness of technological goals compared to those of competitors</i>						R16
		L1 - L5	L1				L1 - L6
Infra							
			I1 - I6	I1 - I18		I1, I2, I9, I10	I1 I1, I2
M&O	M1. Management which is rational enough to achieve the projected goals M2. Appropriateness of resource size and allocation M3. Appropriateness of program size, structure, and organization M4. Appropriateness of program management to its R&D environment M5. Account of plausible risks in the process of management	M4 M5	M1	M1, M2, M5 M4			M1 M1

Korea	Office of Science					Framework Programme	
	Research Support	Laboratory M&O	User Facility	Construction	Infrastructure	Annual Monitoring	Five-Year Assessment
M6. Feasibility of projected technological goal							
M7. Appropriateness of budget size		M9	M10				
M8. Appropriateness of program duration			M11				
M9. Effectiveness of physical and human resources					I3 - I8	M3	
M10. Interim evaluation or frequency of evaluation						M5	
M11. Program adjustment	M6						
M12. Program structure and strategy	M8		M8		I11		M5, M6
M13. Appropriateness of technology import rather than development		M13					
M14. Appropriateness of program changes in terms of direction, subject, duration, or size							
	M1 - M3, M7, M9, M10, M11	M2 - M8, M10 - M12	M3, M6, M7, M9	M1 - M7	M1 - M17	M2, M4, M6 - M12	M2 - M4, M7 - M17