The Role of Economic Analysis at NIST

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NIST's Role in Innovation

NIST Mission

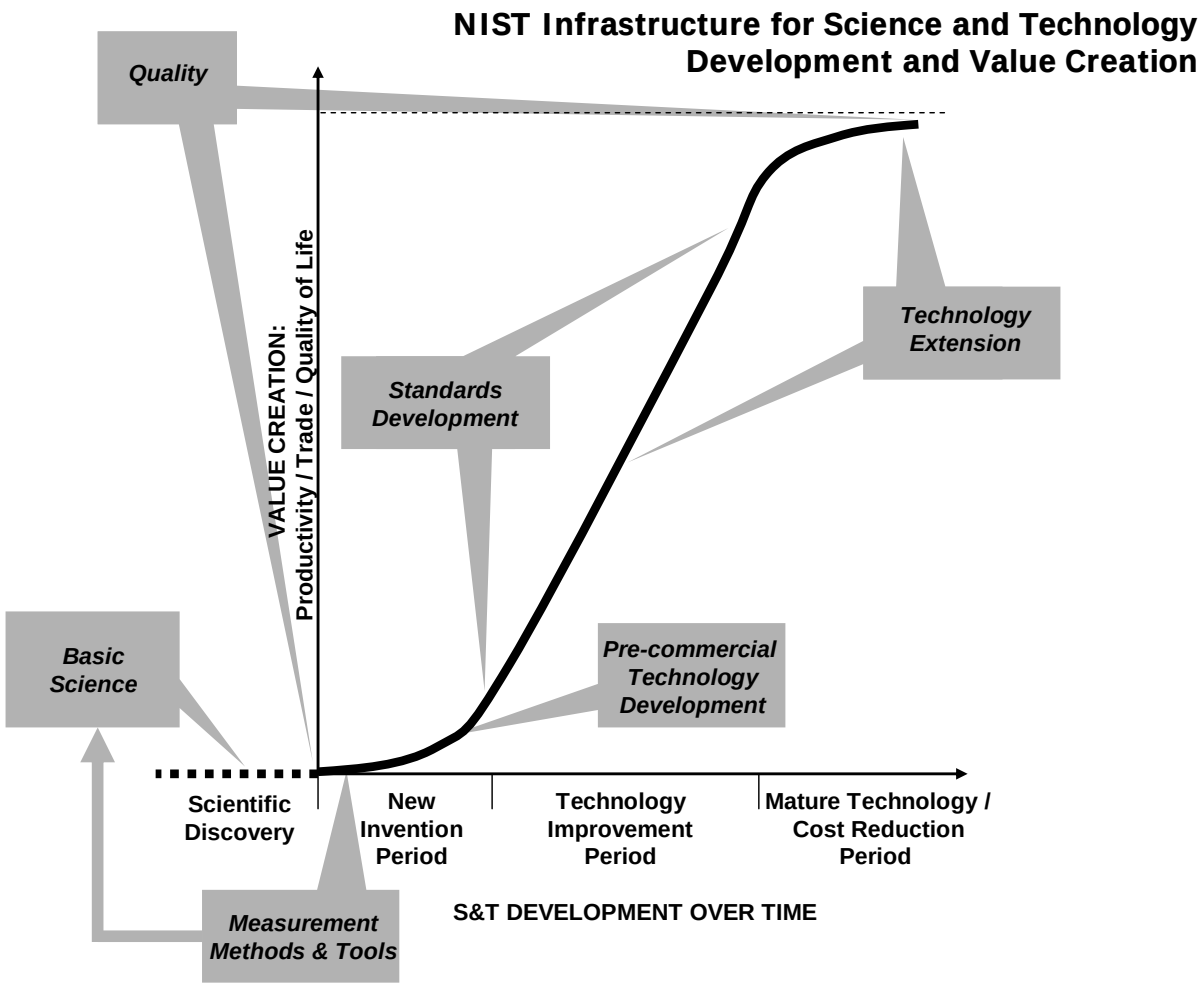
To promote U.S. innovation and industrial competitiveness by advancing

measurement science, **standards**, and **technology**

in ways that enhance economic security and improve the quality of life for all Americans.

NIST's Role in Innovation

Infratechnology impacts every stage of innovation



Economics & Strategic Planning

The Cost of Not Having Critical Infratechnologies

Focus of Study	Infrastructure Studied	Industries Covered	Estimated Annual Costs of Inadequate Infrastructure
Interoperability costs (1999)	• Product design data exchange	• Automotive supply chain	$1 billion
Deregulation (2000)	• Metering • Systems monitoring/control	• Electric utilities	$3.1–$6.5 billion
Software testing (2002)	• All stages of the testing cycle	• Transportation equipment • Financial services • Extrapolation to entire U.S.	$1.8 billion $3.3 billion $60 billion
Interoperability costs (2004)	• Business data exchange: production scheduling, inventory management, procurement, and distribution/marketing	• Automotive supply chain • Electronics supply chain	$5 billon $3.9 billion
Interoperability costs (2004)	• Business data exchange: design & engineering, construction, and operations & maintenance	• Construction/building systems management	$15.8 billion
Medical testing (2004)	• Quality of measurement assurance	• Laboratories (calcium)	$0.06–$0.199 billion

Demonstrating NIST Impact

Economic Studies Performed

- Average benefit-cost ratio of 44:1 in 19 studies since 1996
- Estimates of direct impacts only; no multiplier effect estimated
- Caveat – selection of projects based on perceived existence of industry impact; not randomly selected
- Topics cover wide range of technologies and industries and can be collectively viewed as a legitimate indicator of NIST industry impact

Demonstrating NIST Impact

Sample of Retrospective Economic Impact Studies: Outputs and Outcomes of NIST Laboratory Research			
Industry/Project	**Output**	**Outcomes**	**Measure**
Chemicals: Standards for sulfur in fossil fuels (2000)	• Measurement methods • Reference materials	• Increase R&D Efficiency • Increase productivity • Reduce transaction costs	IRR: 1,056% BCR: 113 NPV: $409M
Semiconductors: Josephson volt standard (2001)	• Measurement methods • Reference materials	• Increase R&D efficiency • Enable new markets	IRR: 877% BCR: 5 NPV: $42M
Communications: Data encryption standard (2001)	• Standard (DES) • Conformance test methods	• Accelerate new markets • Increase R&D efficiency	IRR: 270% BCR: 58–145 NPV: $345M–$1.2B
Communications: Role-based access control (2001)	• Generic technology • Reference models	• Enable new markets • Increase R&D efficiency	IRR: 29–44% BCR: 43–99 NPV: $59–138M
Energy: Gas mixture standard for regulatory compliance (2002)	• Standard (NTRM)	• Increase productivity • Reduce transaction costs	IRR: 221–228% BCR: 21–27 NPV: $49–63M
Manufacturing: Product design data standard (2002)	• Standard (STEP) • Conformance test methods/facilities	• Increase R&D efficiency • Reduce transaction costs	IRR: 32% BCR: 8 NPV: $180M

IRR=Internal (Social) Rate of Return, BCR=Benefit-Cost Ratio and NPV=Net Present Value.

Studies available at http://www.nist.gov/public_affairs/budget.htm

Recent and Ongoing Analysis

Programmatic Studies

- **Economic Impact of Measurement in the Semiconductor Industry**
  - Calculated the investments and benefits of measurement science investments as well as other measurement-related activities
  - 1996–2006 semiconductor supply chain invested $12.3 billion measurement expenditure (in 2006 dollars).
  - Estimates of economic benefits accruing between 1997 and 2011, which stemmed from investments made between 1996 and 2006 are Net present value: $17 billion Benefit-cost ratio: 3.3 Internal rate of return: 67%

More microeconomic project studies

- **Prospective Planning studies: Technology Infrastructure Needs of the U.S. Biopharmaceutical Industry**
  - Industry currently spends: $21 billion per year on R&D;1.2 billion per year on technology infrastructure
  - Probability of FDA approval for a drug candidate could be increased from 30 to 40 percent
  - Expenditures for a new FDA-approved drug could be reduced from between 25 and 48 percent (to between $289 million and $421 million, compared to a current baseline cost estimate of $560 million)
  - Time to move from discovery through clinical trials could be reduced from 11 years to as little as 8 year
- **Retrospective Impact studies**
  - Several On-Going

Other retrospective analysis

- Econometric studies based on linked firm and establishment level data
- Bibliometric analysis

Moving Forward

Increased Importance of Effective Budget Allocation

NIST Laboratory Budget Relative to Industry-Funded R&D