The Social Implications of Public Science Policy: “Public Value Mapping”

Presentation to Workshop on “Assessing the Benefits of ARS R&D Within an Economic Framework”

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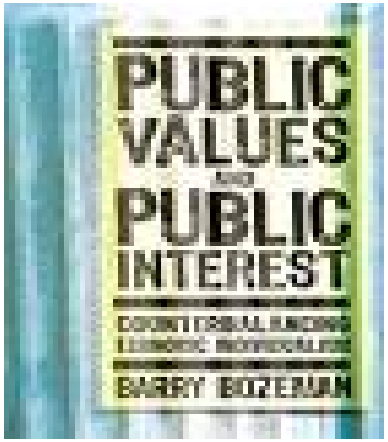
Objectives

- Provide theoretical and philosophical rationale for develop social and public value models and indicators of science effectiveness
- Describe early work on “Public Value Mapping in Science” project
- Describe recently funded NSF “Science of Science Policy and Innovation” grant activity

A general rationale for a “public value” focus on evaluation

- Need alternative to market failure models: sometimes public AND market failures
- Neo-classical economic models have difficulty with goods that are public, non-substitutable and oriented to future generations
- Neo-classical approaches (e.g. benefit cost analysis) have utilitarian and “consequentialist” assumptions



"Public" Term	Definition
Public Interest	**An ideal, public interest refers to those outcomes best serving the long-run survival and well being of a social collective construed as a "public."**
Public Values	**Fundamental secular values which provide the normative consensus about the rights and prerogatives to which citizens should be entitled and about the principles on which governments and policies should be based.**
Economic Value	**The exchange value of goods and services, usually based on socially sanctioned indices, especially monetary units.**
Market Failure	**Market failure occurs when "prices lie- that is, when the prices of goods and services give false signals about their real value, confounding the communication between consumers and producers." Donahue (1991: 18),**
Public Value Failure	**"Public failure" occurs when neither the market nor public sector provides goods and services required to achieve public values.**
Public Goods	**Public goods as those goods that are, "in varying degrees, *nonrivalrous* in consumption, *nonexcludable* in use, or *both*" (Weimer and Vinings, 2005, p. 72).**

Public Values

A society's public values are those providing normative consensus about (1) the rights, benefits, and prerogatives to which citizens should (and should not) be entitled; (2) the obligations of citizens to society, the state and one another; (3) and the principles on which governments and policies should be based.

Public Value Mapping Model: "Public Failure Criteria"

Public Value	Definition
Mechanisms for values articulation and aggregation	Political processes and social cohesion should be sufficient to ensure effective communication and processing of public values
Legitimate monopolies	When goods and services are deemed suitable for government monopoly, private provision of goods and service is a violation of legitimate monopoly.
Imperfect Public Information	Similar to the market failure criteria, public values may be thwarted when transparency is insufficient to permit citizens to make informed judgments.
Distribution of benefits	Public commodities and services should, ceteris paribus, be freely and equitably distributed. When "equity goods" have been captured by individuals or groups, 'benefit hoarding' occurs in violation of public value.
Provider availability	When there is a legitimated recognition about the necessity of providing scarce goods and services, providers need be available.
Time horizon	Public values are long-run values and require an appropriate time horizon.
Substitutability vs. conservation of resources	Actions pertaining to a distinctive, highly valued common resource should recognize the distinctive nature of the resource rather than treat the resource as substitutable or submit it to risk based on unsuitable indemnification.
Ensure subsistence and human dignity	In accord with the widely legitimated Belmont Code, human beings, especially the vulnerable, should be treated with dignity and, in particular, there subsistence should not be threatened.

TABLE 1 | PUBLIC FAILURE CRITERIA

CRITERIA	DEFINITION	SCIENCE POLICY ILLUSTRATION
Inadequate mechanisms for values articulation and aggregation	Political processes and social cohesion insufficient to ensure effective communication and processing of public values	Peer review, the favored means of making decisions of individual-level projects, is appropriated for decisions about huge scientific programs, resulting in the displacement of social goals for more easily resolved technical goals
Imperfect monopolies	Private provision of goods and services permitted even though Government monopoly deemed in the public interest	When public authorities abrogate their responsibility for overseeing public safety in clinical trials for medical research, there is potential for violation of public trust and public value
Scarcity of providers	Despite the recognition of a public value and agreement on the public provision of goods and services, they are not provided because of unavailable providers	The premature privatization of the Landsat program shows that a scarcity of providers can create a public failure potentially remediable by Government action
Short time horizon	A short-term time horizon is employed when a longer-term view shows that a set of actions is counter to public value	Policy for energy R&D, by considering the short-term, fails to fully capture the costs of global climate change on future generations
Substitutability vs conservation of resources	Policies focus substitutability (or indemnification) even in cases when there is no satisfactory substitute	'No-net-loss' policies fail to take into account the non-substitutability of many natural organisms ranging from wetlands protection to prohibiting the sale of human organs on the open market
Benefit hoarding	Public commodities and services have been captured by individuals or groups, limiting distribution to the population	A prime technical success of genetic engineering, the 'terminator gene', proves an excellent means of enhancing the efficiency of agricultural markets, to the detriment of millions of subsistence farmers throughout the world

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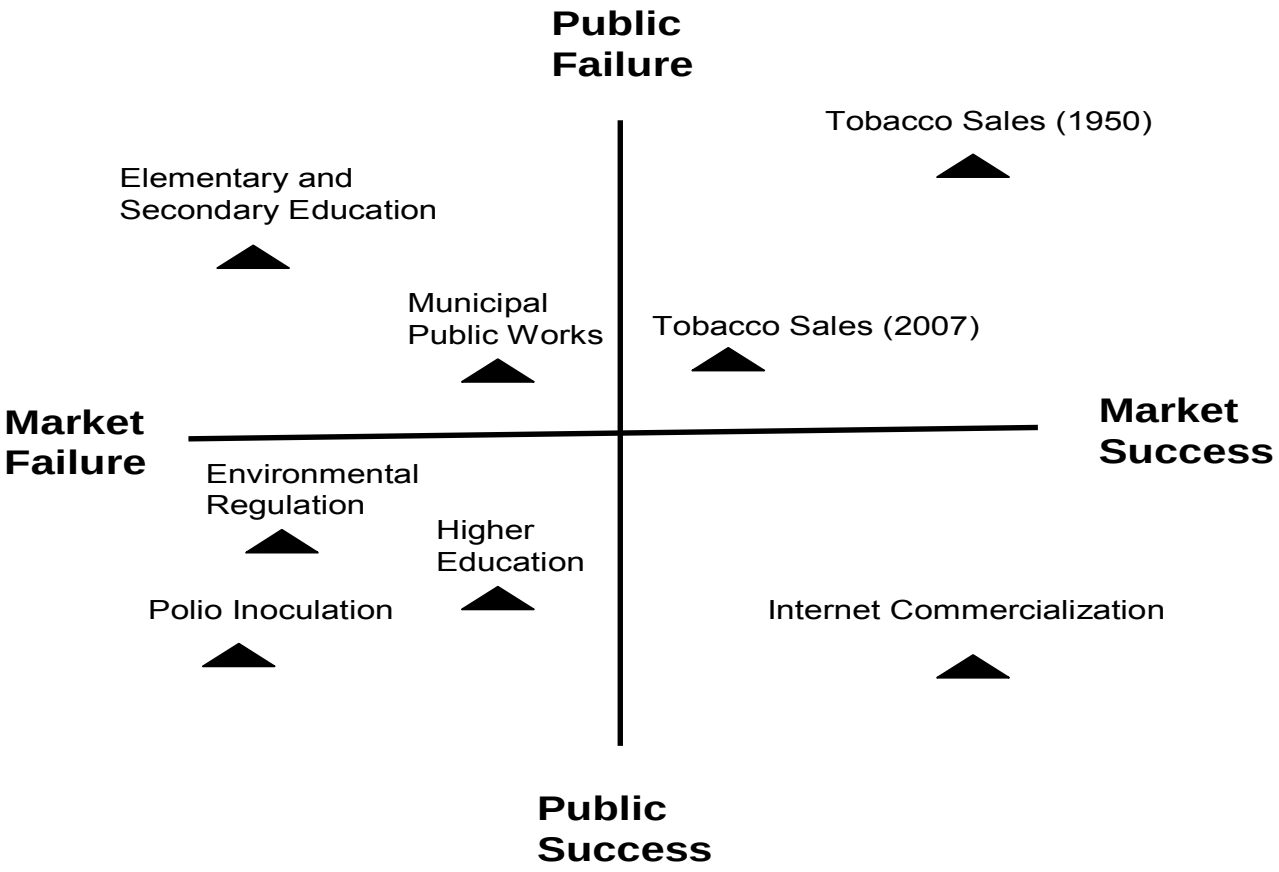
Public Value Mapping Grid



3. Developing value analysis chains: Among the many reasons why public value analysis of SIP has made little headway is that values analysis itself is remarkably underdeveloped. One of the difficulties of values analysis (Gaus, 1990) is that analysts sometimes fail to consider interrelationships among values, including such features as values hierarchies, conditional relations among values, logical structures of multiple and related values, and ends-means relations (Braybrooke and Lindblom, 1963). One of the key objectives of the proposed research is thus to develop the ability to clarify relationships among values. Philosophers clarify values through logical analysis and

1. Analytical Lenses for Case Studies

The analytical lenses for the cases can be thought of as essentially master hypotheses about possible determinants of the public value outcomes for the cases. We identify four important contextual factors that affect the social impacts of SIPs.

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[5] We do not discuss these cases further, but see Budget Explanation for further information on cost-

a. *Characteristics of the knowledge that the SIP produces.* In some instances knowledge creation processes, innovation, and, ultimately, social impacts are very much governed by inherent characteristics of the science or technology (e.g., "technology push").
b. *Institutional arrangements and management affecting knowledge production and use.* "Institutional arrangements" pertain to the configuration of producers and users of STEM knowledge, the ways in which they interact, their internal and network management. In this context, "management" refers to the self-conscious means used by producers of STEM knowledge to control, coordinate and convert resource inputs into STEM knowledge outputs and applications.
c. *Policy and political domains of knowledge production and use.* This analytical lens examines the political, legal, public policy and normative factors that determine STEM knowledge development and its associated outcomes, such as patent policies and the structure of the federal R&D budget.
d. *Market settings for knowledge production and use.* Public value may be achieved (or thwarted) by markets, quasi-markets, or government entities. In some instances, much can be understood about public values by considering such market features as the relative scarcity of resources, market actors controlling resources, market segmentation, extent and nature of competition.

Value / Lens	Competitiveness	Equity	Safety/ Security	Infrastructure	Environment
S&T Products		water quality	[nano energy]		
Institutions			disaster preparedness		[climate change]
Policy/Politics	tech transfer				[green chem]
Markets				open source	

Selection Framework

Public Value Mapping (PVM) Goal

- Public Value Mapping of Science Outcomes seeks to develop alternative means of thinking about *public values* in science, ones focusing on social outcome criteria rather than traditional market-based and economic criteria.
- Previous application: Breast Cancer Research (Bozeman, Gaughan and Taylor, 2003)

PVM Objectives

- **To provide a social theory (i.e. public value theory) basis for research evaluation**
- **To connect assessments of research outputs and first order impacts (e.g. RVM) with broad social impacts, both anticipated and unanticipated (PVM)**
- **To develop and implement a methodology that is valid, sensitive to institutional and policy context and widely applicable.**

PVM Operations

- **Step 1: Provisionally, identify research and social outcomes domain**
- **Step 2: Identify measurable public values**
- **Step 3: Sort values and their relationships (means-ends, hierarchies)**
- **Step 4: Establish metrics for public value (e.g. mission statements, statutory guidelines)**
- **Step 5. Identify research domain and researchers, map the "research ecology"**
- **Step 6. Identify target problems of researchers and research programs, ultimately linking to social indicators.**
- **Step 7. Develop causal logic models relating public value statements and research and program activities**

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PVM Operations, continued

- **Step 7. Develop causal logic models relating public value statements and research and program activities.**
- **Step 8. Identify research techniques appropriate for testing causal paths from research to public value at various outcome levels, to social indicators.**
- **Step 9. Using causal logic models, develop hypotheses about causal paths from research to public value.**
- **Step 10. Use research techniques to test the hypotheses and, when necessary, identify alternative outcome models.**
- **Step 11. Write PVM summary including findings about models relating research programs and activities to public value.**
- **Step 12. Develop prescriptive model and recommendations for enhancing contribution of research to public value.**

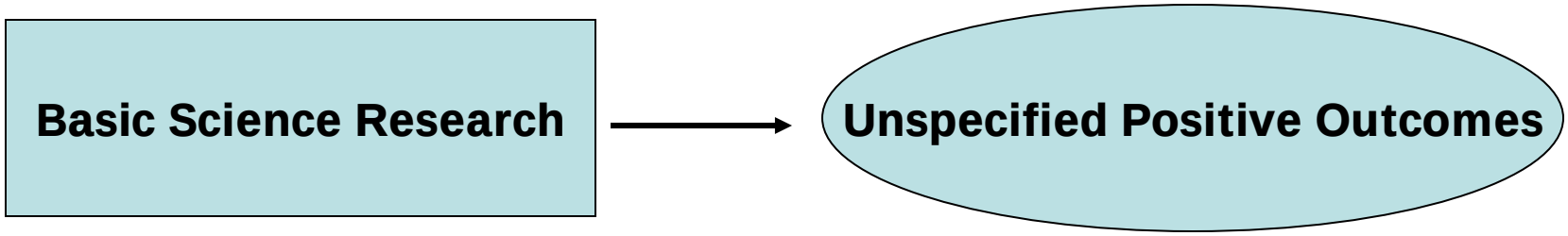
An Early Application

"Public Value Mapping and Cancer Research"

(Gaughan and Bozeman, 2002)

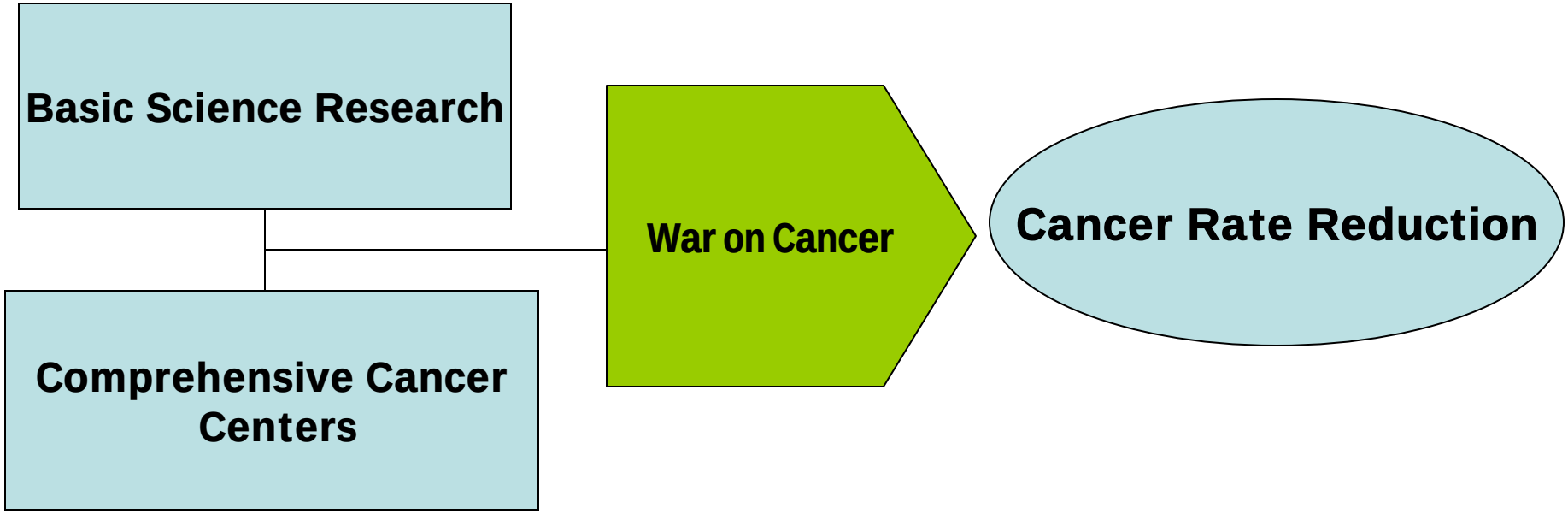
Causal Logic of Cancer Research Programs

Post War Model: 1948-1971

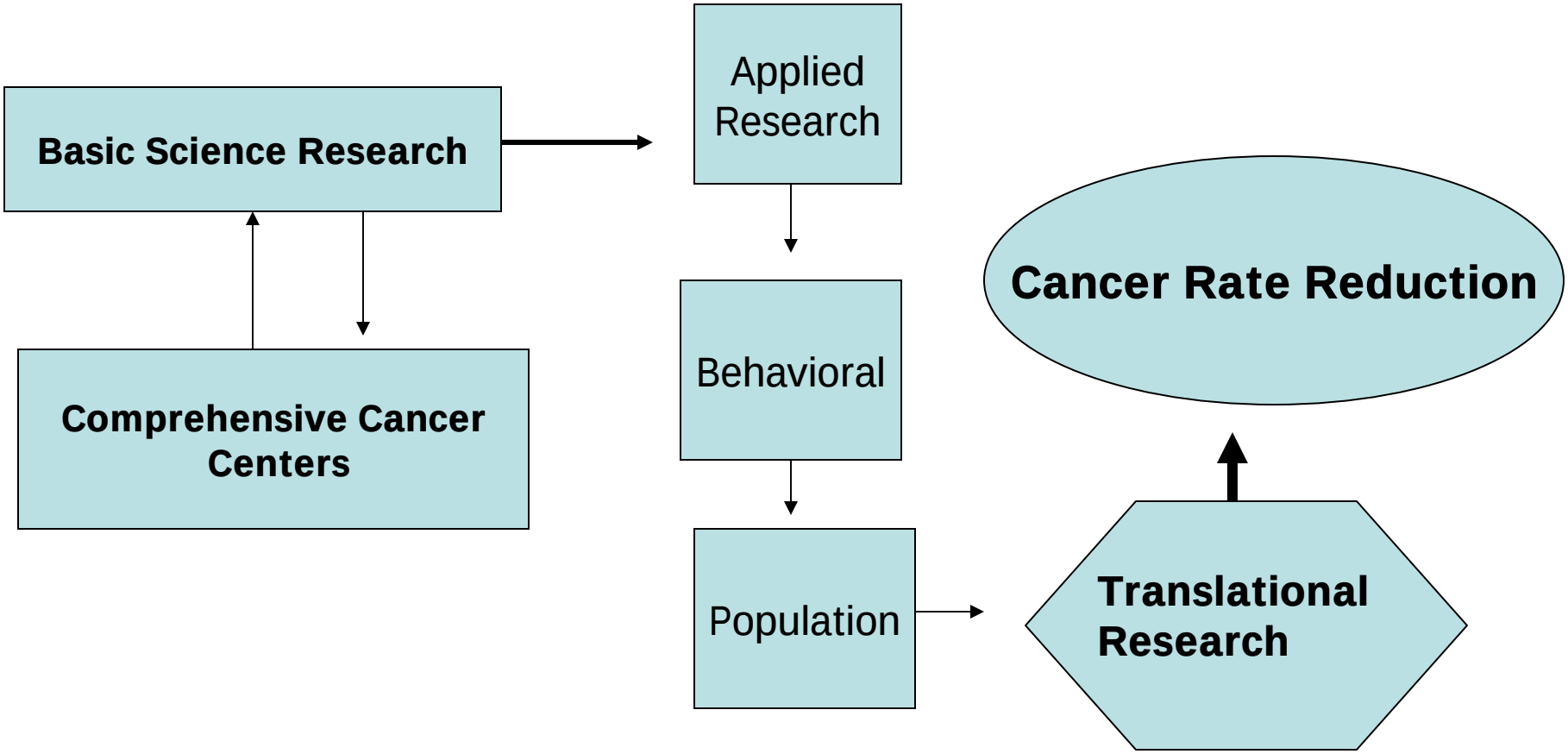


Application: Bozeman, B. and M. Gaughan (2003). Public Value Mapping of Science Outcomes: Theory and Method. In D. Sarewitz, et al., *Knowledge Flows & Knowledge Collectives: Understanding the Role of Science & Technology Policies in Development*, 2.

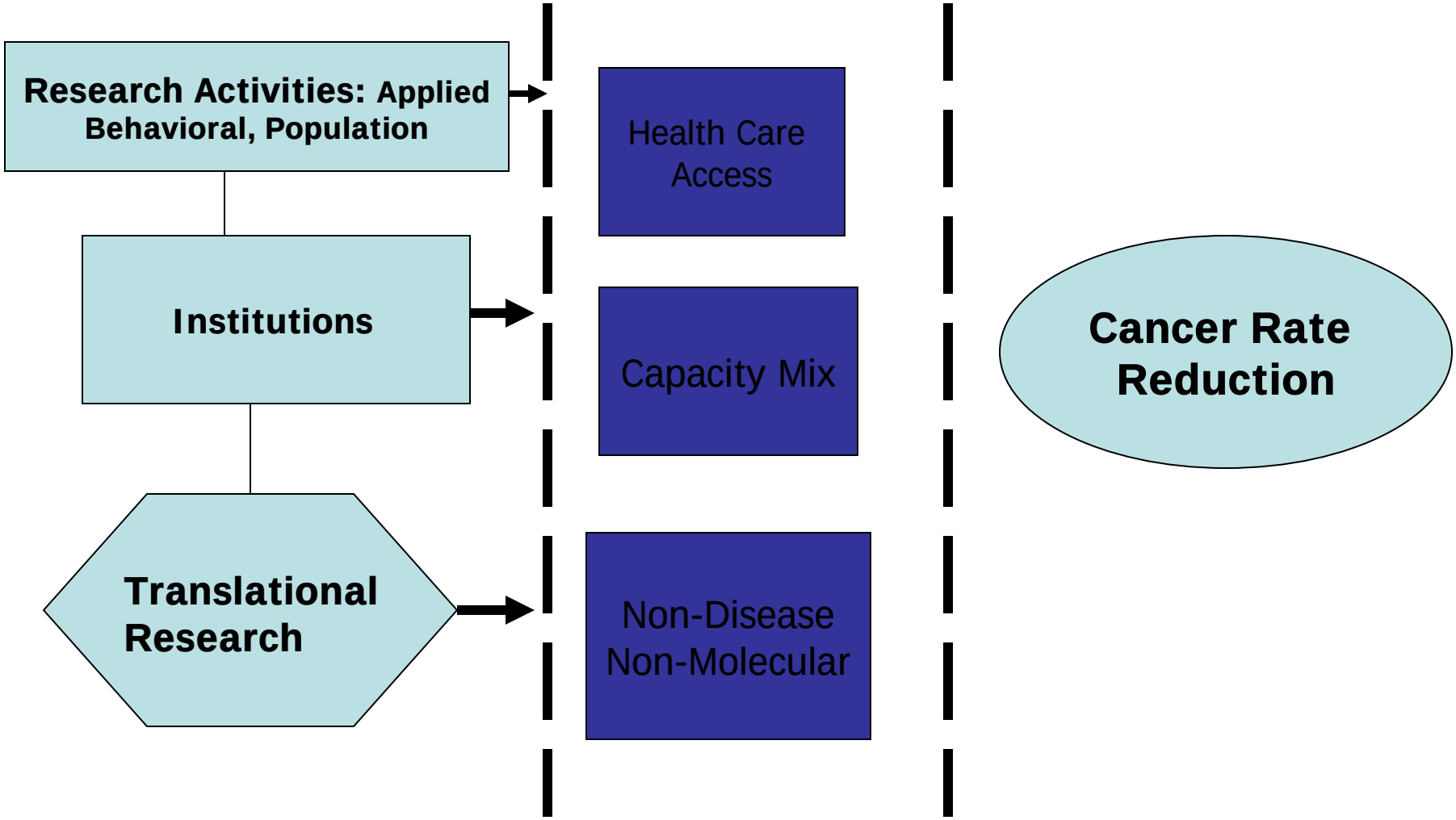
“Corporate” Logic Model



Contemporary Logic Model



Gaps in Current Logic Model



Lessons Learned for PVM

- Choose domains with understandable and operational public values, ones with unified goals
- Will have to “invent” program logic, not there already
- Developing adequate social indicators not as troublesome as expected
- Need a team effort, but with coordination and frequent interaction; not easy in distributed mode
- Existing “logic model” methods not high power
- Need strong mix of methodological, quantitative, and policy domain skills, working together
- PVM not yet a stable methodological construct, needs more fundamental work on values.

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