

Program Theory and Logic Modeling and Its Uses

DOE/EERE Program Evaluation Training
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Gretchen B Jordan



360 Innovation LLC

Course Objectives

By end of course you will be able to

- Describe a logic model and its uses
- Know how to construct (or judge) a logic model
- Know how to apply logic modeling

Outline

- What is logic modeling? Why do it?
- How to develop a logic model
 - Describe problem that the program is trying to solve and logical pathways to achieve goals
 - Check assumptions and context
 - Draw a diagram
 - Verify
- How to use one to define performance metrics and evaluation questions

Definitions

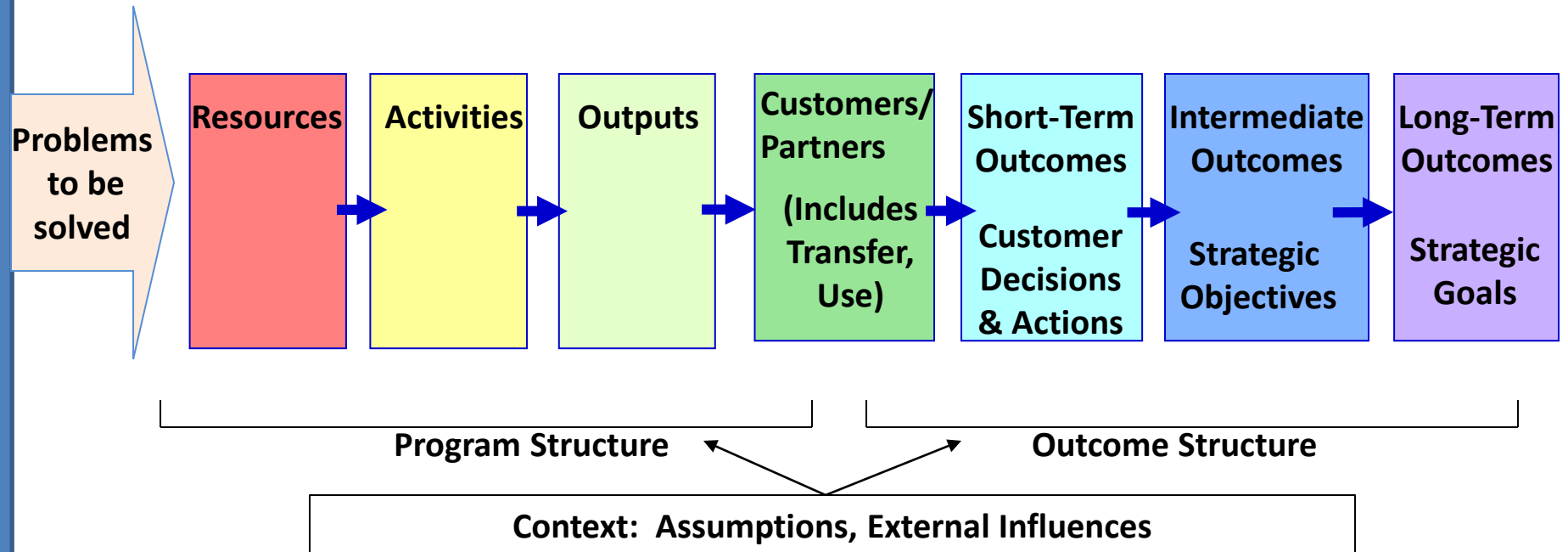
- **Performance Assessment.** Includes both performance measurement and program evaluation.
- **Performance measurement.** the ongoing monitoring and reporting of program accomplishments, particularly progress toward pre-established goals.
- **Program evaluation.** individual systematic studies conducted periodically or on an ad hoc basis to assess how well a program is working. A program evaluation typically examines achievement of program objectives in the context of other aspects of program performance or in the context in which it occurs.

Source: GAO 2011

What is logic modeling?

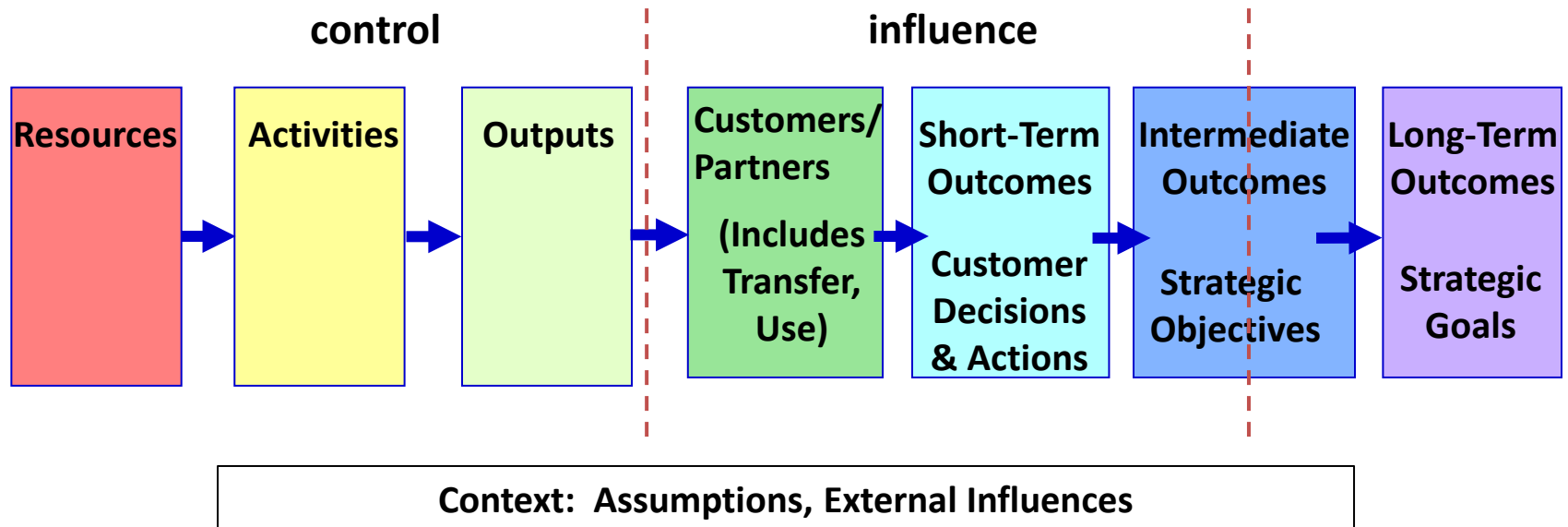
- Logic modeling is ***a process***, which results in a diagram (logic model) and text that describe the key logical (causal) relationships among program elements and the problem to be solved.

Basic elements include Program and Outcome Structures and Context



A logic model reflects implementation of a program plan

- Planning starts with environmental scan and defining strategic goals. ←
- Performance assessment starts with “did we get planned resources?” →
- Circles of influence* applies.



Logic models ideally show program theory

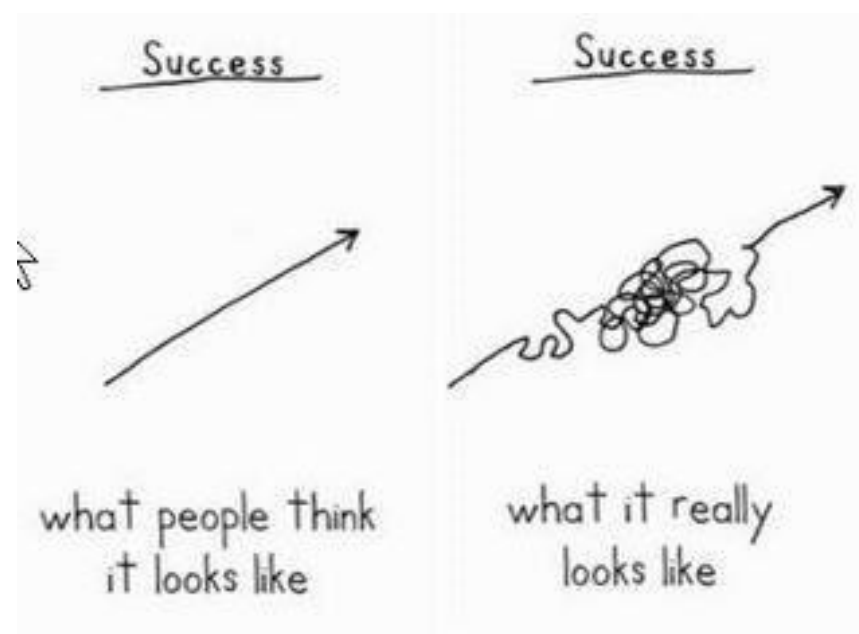
- *Program theory*: An explicit theory or model of how an intervention contributes to (or causes) a set of specific outcomes through a series of intermediate results.
- The theory can have two components:
 - a *theory of change* about the central mechanisms by which change (outcomes) comes about for individuals, groups, and communities and
 - a *theory of action* about how the program is constructed to activate the theory of change

Funnell and Rogers 2011

Why do logic modeling?

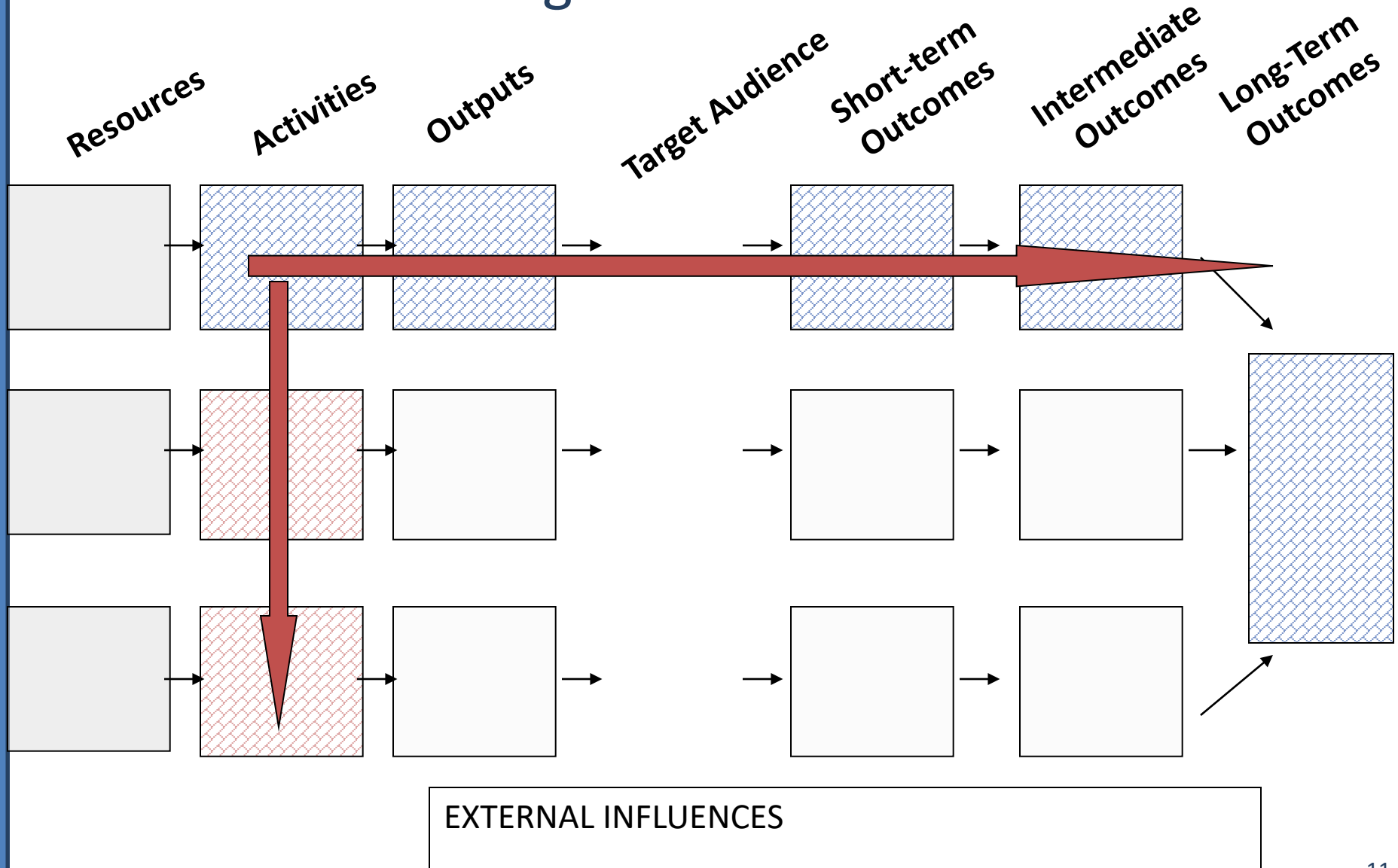
- Communicate the performance story - Builds a common understanding among staff and with stakeholders
 - What is the program trying to achieve, with what resources, through what customers?
 - What is the program niche? Why are the program's proposed results the correct results within the given context?
- Helps “manage for results” and informs program design
 - How will its effectiveness be monitored (what metrics) and evaluated (key questions to answer)?
 - How will you know what works and why in what contexts?

How to do logic modeling (it Isn't as simple as it looks)



One format for a logic model

Note: logic in two directions



Logic Model Terms - I

- *Resources*: human and financial resources as well as other inputs required to support the program, such as partnerships, information on the type and level of the problem addressed by the program.
- *Activities*: the essential action steps necessary to produce program outputs.
- *Outputs*: the products, goods, and services provided to the program's direct customers or program participants.
- *For whom/ with whom*: our partners and the target audience we are trying to influence.

Logic Model Terms - II

- *Outcomes*: changes or benefits to people, organizations, or other program targets that are expected to result from their being exposed to activities and outputs.
 - short-term outcomes, the changes most closely associated with, or “caused” by, the program’s outputs; often these are changes in knowledge, attitudes or behavior.
 - intermediate outcomes, which are expected to result from the short-term outcomes.
 - long-term outcomes or program impacts, which are expected to follow from the benefits accrued through the intermediate outcomes
- *Key contextual factors*: Factors external to the program and not under its control that may influence its success either positively or negatively.

Steps in the logic modeling process

- Step 1. Gather and absorb relevant program information from documents and people.
- Step 2. Describe the situation and needs (the problem space) and program's role in achieving desired ultimate outcomes in the problem space.
- Step 3. Describe the target audiences and for each describe the sequence of outcomes leading to ultimate outcomes.
- Step 4. Define specific success metrics for outcomes, and for each determine program outputs, activities and resources and check assumptions about context.
- Step 5. Summarize in an organized table or a diagram with supporting text.
- Step 6. Check logical relationships (iterate) with stakeholders.

General Tips – the Big Picture

- For development of a logic model, involve a full range of program managers and stakeholders who will use the model and its results.
- To best use a group's time, concentrate on the sequence of outcomes. Activities and outputs are more obvious and easy to identify.
- Think through how success would be measured and why things could go wrong to illuminate assumptions, risks.
- Don't shortcut the process, but don't spend lots of time developing a perfect model; rather leave time and resources to define metrics and develop an evaluation plan.
- Make it a dynamic, iterative process, updating as program and program context change.

Step 1. Collect relevant information

- Where a program already exists, collect and analyze program documents (strategic plans, annual performance plans, current metrics, previous program evaluations, pertinent legislation and regulations)
- For existing and new programs, conducting a literature review will gain insights on what others have done to solve similar problems, and on key contextual factors to consider in designing and implementing the program.
- Make it a team effort in most cases, starting with persons most familiar with the program. Things look different depending on where you sit.
- For complex programs or where communication and consensus is lacking, start to analyze documents with a small group, perhaps assisted by an independent facilitator.
- Interviews by a facilitator who then leads a discussion of a preliminary draft logic diagram is often helpful.

Step 2. Defining the problem

- Look for what drives the need for the program. Some put “client/customer needs” as the first point in the logic and repeat these again as outcomes.
- Define what factors “cause” the problem.
- Decide which of these factors the program addresses, and where the program fits among others addressing the problem.
- Legislative language may have to be restated to be clear, perhaps by adding an additional layer of outcomes.
- Try to get agreement on a single or primary program goal, assign priorities to conflicting objectives, or discuss optimizing a set of objectives (see section on choosing metrics).

Defining the Problem

Example: Public programs for clean energy

Problem statement:

There are economic and environmental *challenges* related to the production, distribution, and end use of energy. US *taxpayers face problems such as* dependence on foreign oil, air pollution, and threat of global warming from burning of fossil fuels. *Factors that might be addressed to increase* the efficiency of end use of energy include the limited knowledge, risk aversion, budget constraints of consumers, the lack of competitively priced clean and efficient energy technologies, the externalities associated with public goods, and restructuring of US electricity markets.

To solve the problem of economic and environmental challenges related to the use of energy, ***the program chooses to focus on factors*** related to ...

Exercise – Outcome Space

Here is the problem the program sees (based on Better Buildings Neighborhood Program (BBNP)):

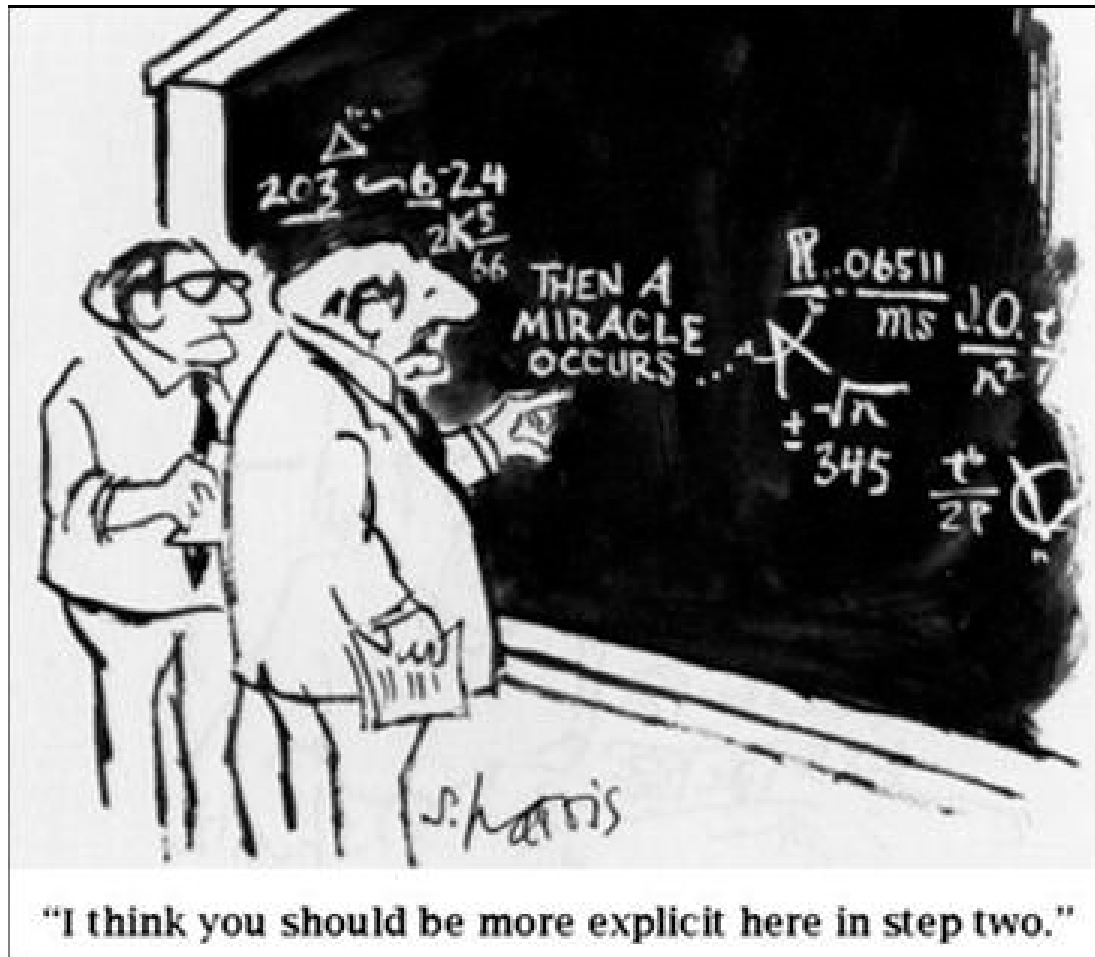
- The world needs to reduce the economic and environmental costs related to the production, distribution, and end use of energy.
- Increased energy efficiency in buildings through renovation and remodeling would lead to energy savings and reduced greenhouse gas emissions.
- The reasons for missing efficiency opportunities that the program chooses to address (there may be more) are:
 - Financing options are not available;
 - Incentives and assistance from utility programs for contractors and consumers to identify efficiency opportunities are not sufficient for them to get training or buy upgrades;
 - Contractors are not trained in efficiency assessments, home performance, and up-selling;
 - New consumers are not asking about all of the energy efficiency opportunities when considering a home renovation/remodel.

Exercise: Restate these as program goals (desired outcomes). Identify which are longer term/ultimate outcomes, which are short or intermediate outcomes.

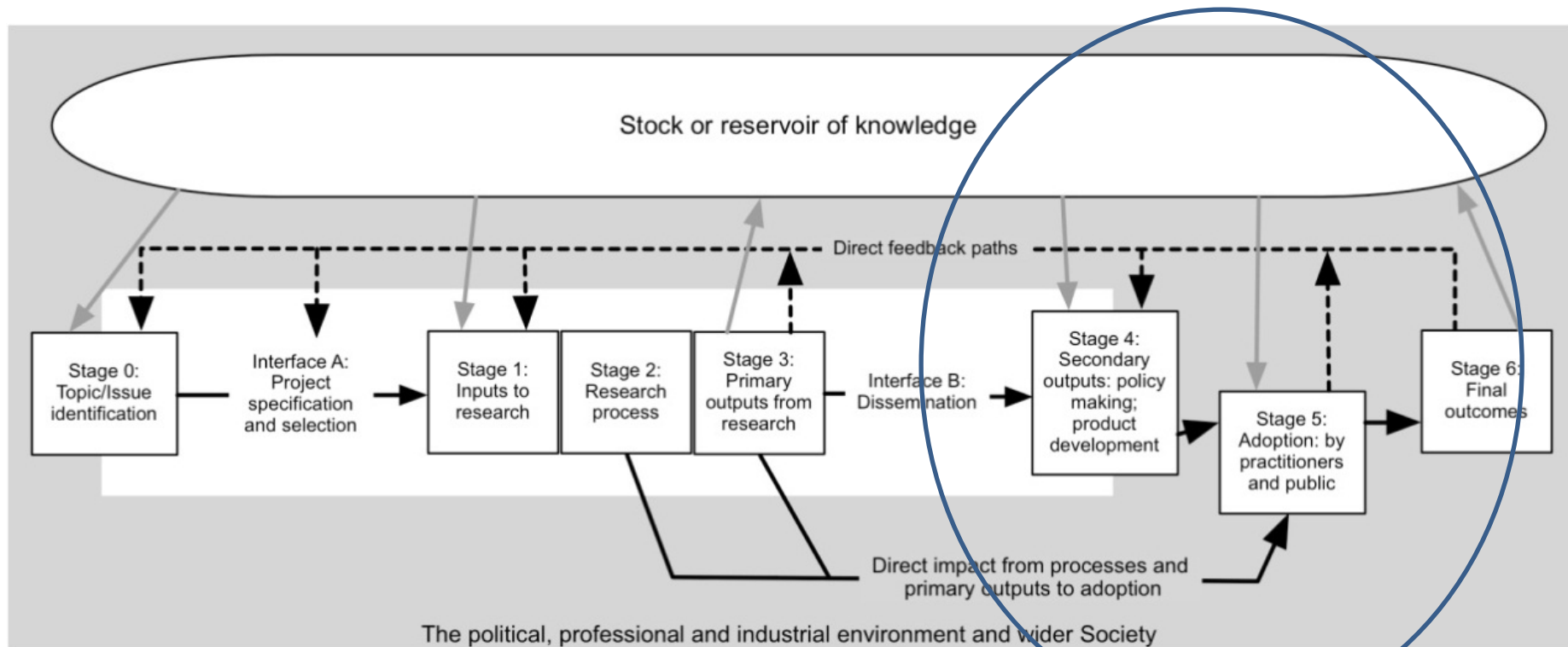
Step 3. Describe the target audiences and for each a sequence of outcomes leading to ultimate outcomes

- Outcomes happen because users of program outputs (the target audience) react to outputs and change attitudes or behaviors, which then brings about other changes.
- Often this theory of change has not been explicated, especially for new programs or existing programs being implemented in a different context.
- This part of the logic is often referred to as the “magic in the middle”.

Now for the harder part –the pathways from outputs to outcomes –magic in the middle



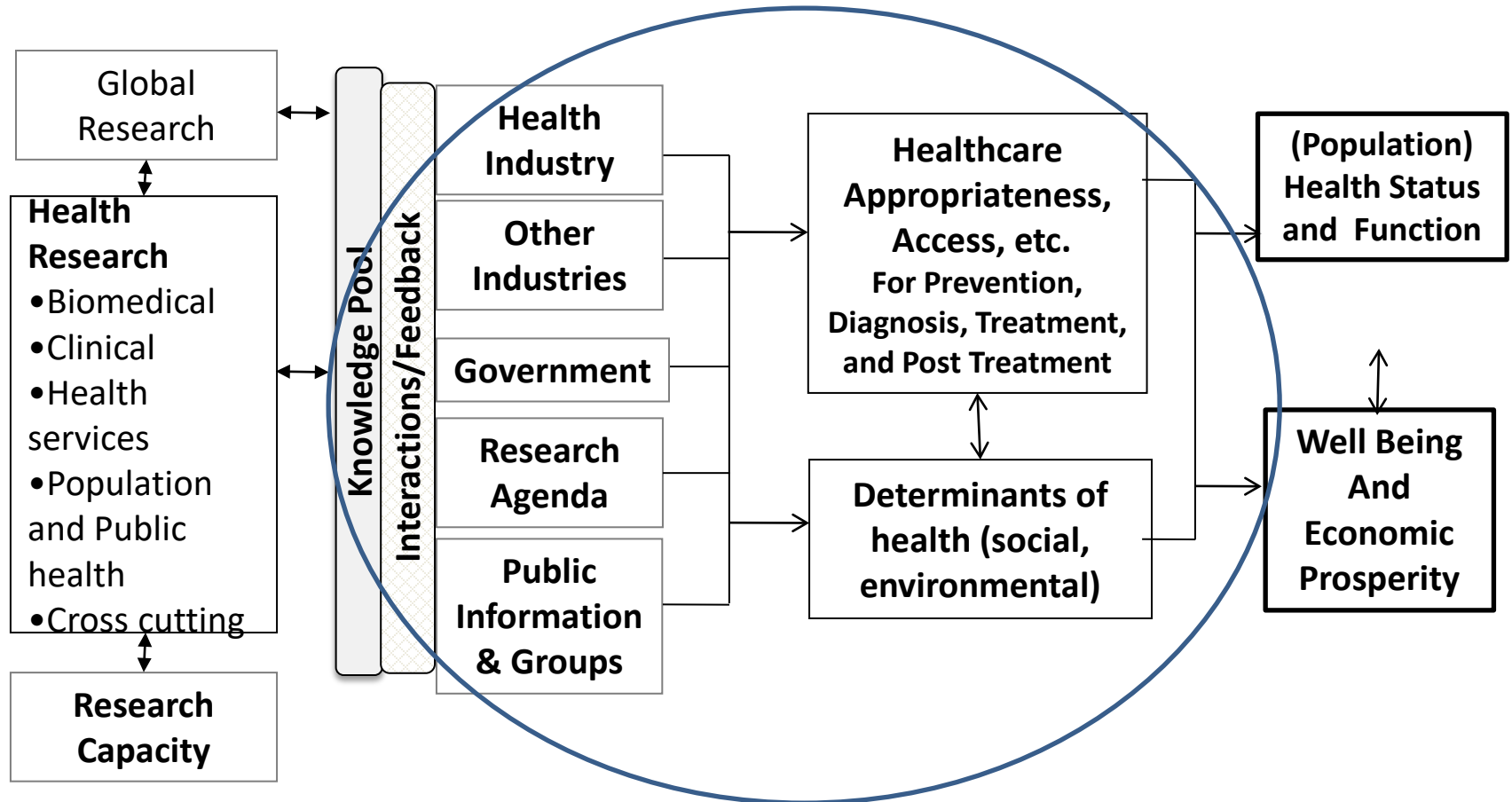
Example of a logic model that leaves the middle vague



Donovan, Claire, and Stephen Hanney. "The 'Payback Framework' explained." *Research Evaluation* 20.3 (2011): 181-183.

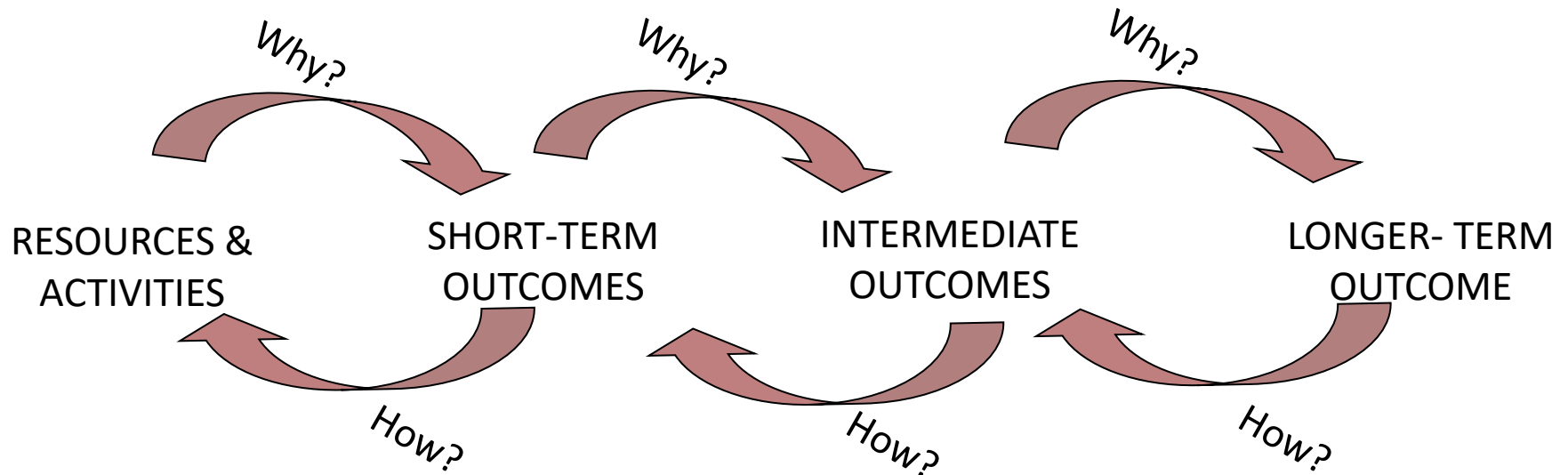
Describing Pathways – the magic in the middle

The Canadian Academy of Health Sciences Logical Framework for Understanding the Impacts of Health Research



Modified from CAHS Report on ROI for Health research available at www.cahs-acss.ca/making-an-impact-a-preferred-framework-and-ind...

TOOL: Do Forward Mapping (Why? or If-Then) and Backwards Mapping (How?)



If Evidence is found then Guidelines are changed

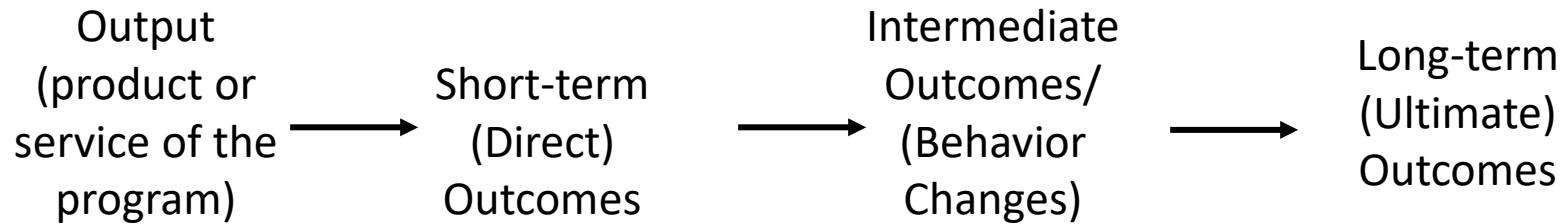
If Doctors use new guidelines then Patients get additional tests

If \longrightarrow

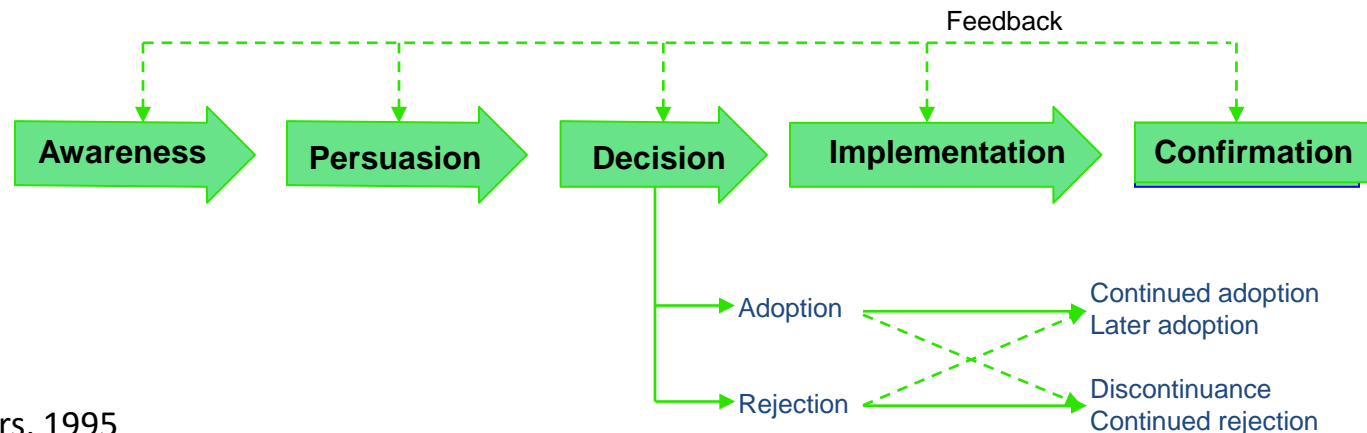
Exercise: Make a series of If-Then statements out of these BBNP logic elements

- Increased energy efficiency in building renovation and remodeling leads to energy savings and reduced greenhouse gas emissions.
- Contractors are trained in efficiency assessments, home performance, and up-selling.
- Consumers buy energy upgrades when doing home renovation/remodel.
- Contractors offer efficiency assessments and up-sell efficiency upgrades.
- Incentives and assistance from utility programs are available for contractors to get training to identify profitable efficiency opportunities.

TOOL: Identify the sequence of program outcomes. Use theories/logics in the literature



A commonly used sequence of Direct and Intermediate Outcomes:



E. Rogers, 1995

TOOL: Identify the target audiences and the program effects/outcomes expected for each

	Target Audiences		
Attribute of Change (Example sequence)	A	B	C
Aware			
Have Knowledge/Skill			
Decide			
Implement			
Confirm Value			

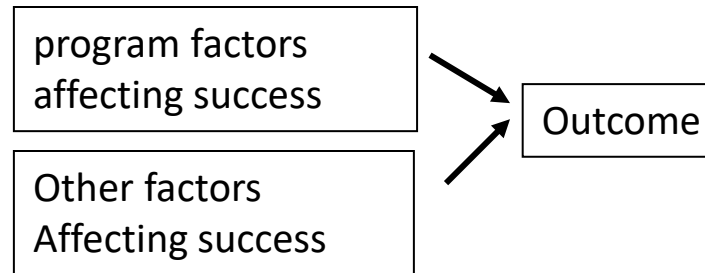
Exercise: Identify the program effects/outcomes expected for each BBNP target audience

Attribute of Change	Remodel Contractors	Remodel Consumers
Aware of		
Have knowledge, skill; persuaded		
Decide		
Implement		
Confirm Value		

Step 4. Define success metrics for outcomes and check assumptions you have about how those will happen

- Getting specific about how success will be measured is critical.
- Contextual external factors are not under control of the program but could influence its success, such as legislative funding and reaction to terrorist attacks.
- Analysis of context such as barriers and risks can be done for the sequence of outcomes and every point along the logic model.
- Explaining what these factors are and how they influence program implementation helps clarify the program niche.
- The exercise may stimulate changes in program design to take advantage of, or mitigate, other contextual factors.
- Factors not addressed become part of the context.

TOOL: define assumed risk and success factors for each outcome



These can be described in a program logic matrix.

Intended Outcome	Success Criteria	Program Factors Affecting Success	Non program Factors Affecting Success	Activities & Resources of program	Performance Information
1. Changes in attitudes of target businesses toward being willing to change practices	Agreement to meet to discuss action; Action plans; Specific examples of increased willingness	Availability of confidential advisory assistance, etc.	Business beliefs, past experiences, etc.	Promotes advisors and makes commitments about confidentiality, etc.	% business that request assistance, compared with targets; % that do actions plans; etc.

Exercise: For BBNP example, define success and think through what that assumes. What else has to be true?

a program logic matrix

Intended Outcome	Success Criteria	Program Factors Affecting Success	Non program Factors Affecting Success	Activities & Resources of program	Performance Information
Changes in Behavior of contractors (to sell more efficiency upgrades)	Participation of contractors in related incentive programs Specific instances of up-selling	Availability, credibility of training; Partnerships with related incentive programs	Business beliefs, past experiences, etc. What else?	Training on profitability, where to buy, how to best sell	% contractors that request assistance, compared with targets; % that do up-selling; etc.
Changes in Behavior of consumers (to buy more efficiency upgrades)					

Step 5. Summarize in an organized table or a diagram with supporting text

- Drawing a picture, or using arrows and numbering sequential outcomes in the table, helps make the causal chain clear and explicit.
- There are many different forms of logic model diagrams. They don't have to be complex "wiring" diagrams.
- You may want to have more than one model
 - different levels of detail for different groups of activities or different levels at which performance is measured
 - different stakeholder views, different theories.
- Logic models, once done, are deceptively simple. It takes many drafts and knowledge of the detail to describe the essence of a program on one page.

Defining the elements in a table

- HOW -			WHO	WHAT and WHY		
Resources	Activities	Outputs	Customers Reached	Outcomes		
				Short Term	Intermediate Term	Long Term
					Program outcomes related to factor(s)	Program impact on the problem

External Influences:

Example. Logic Model Table: Energy Efficient Technology Development

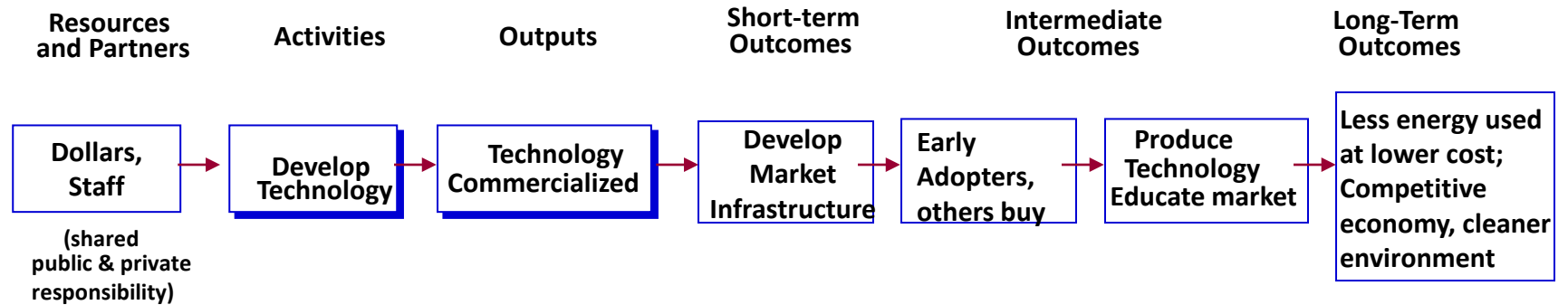
Resources	Activities	Outputs for Customers	Short term Outcomes	Intermediate term Outcomes	Long term Outcomes
Federal, state & local government funding Private funding, Personnel, Facilities, Past R&D results	Develop technology - investigation -prototypes -scale up -test, validate -commercial launch	Research plans Technical reports Publications Performance and cost data	Technical progress -lower investment risk -increasing private investment	Commercial scale products	Less energy used, lower energy cost, a more competitive economy and cleaner environment
	Develop emerging market structures -Manufacture R&D -State program	Manufacturing capacity Codes and standards Audit tools, State programs	Government purchases, Information disseminated, Early seeding of technologies	Favorable policies, capable delivery channels for efficient technologies	
	Produce technology & Educate the market -volume manufacturing-websites -decision support tools	Products for sale Accessible, trusted information	Customers, business infrastructure, aware, persuaded, decide to buy,	Widespread adoption of products; confirm value tell others repeat purchase	
External Context: Availability of technical workforce, Market structure/hurdles, Price of oil and electricity, general economic conditions					

Developing a diagram of logical relationships

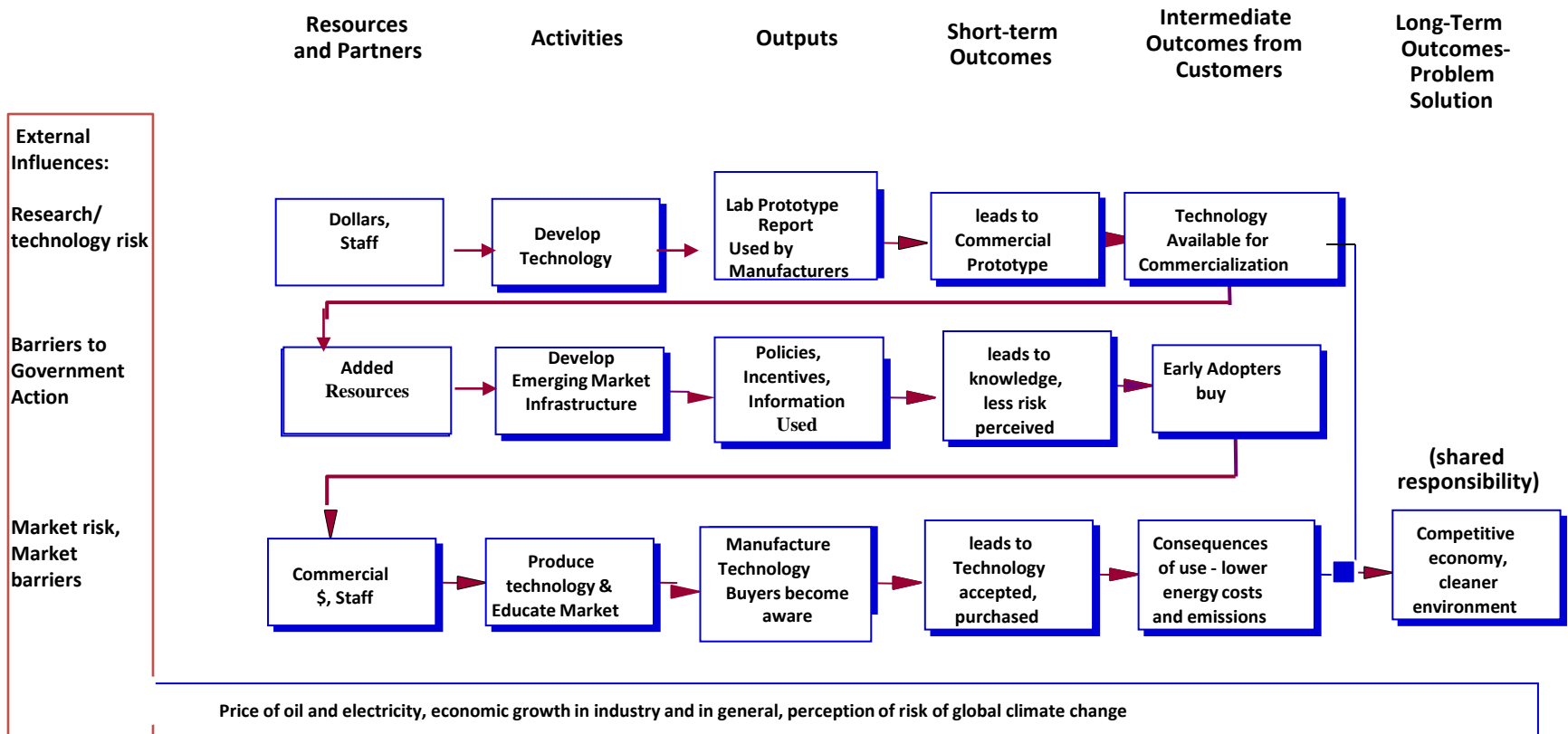
- Get started. Then use the tools and iterate.
- Group activities into 5-7 groups.
- Limit the words in the diagram, but attach more detail in separate charts or a written profile.
- Limit the number of arrows. Show only the most critical relationships among logic elements.
- Include outputs to external customers only, collapsing internal outputs (e.g., management plans) to one activity group or a separate profile.
- Leave organizational charts separate, but link by using the same activity descriptions in both.

May have a simple summary diagram to communicate basics to people who are unfamiliar

High Level of "Z" Logic
(over a 15-20 year time frame)



and a detailed one to guide evaluation.
 A “Z” logic model shows a sequence of logics with “hand offs” and shared responsibility



Source: McLaughlin and Jordan, 1999

Step 6. Check logical relationships

- Involve key people who are involved with delivering the program or assessing its performance.
- Does the diagram explain succinctly what the program intends to accomplish and how?
- Do proposed performance metrics (if present) align with the logic, or suggest gaps in the logic?
- Is there a sequence of plausible steps in progress toward outcomes, with no leaps of logic?
- Are the target audiences clearly identified?
- Are external influences identified?
- Why might this logic not work? At what points in the logic is there high risk of a stated outcome not working?
- Modify as needed.

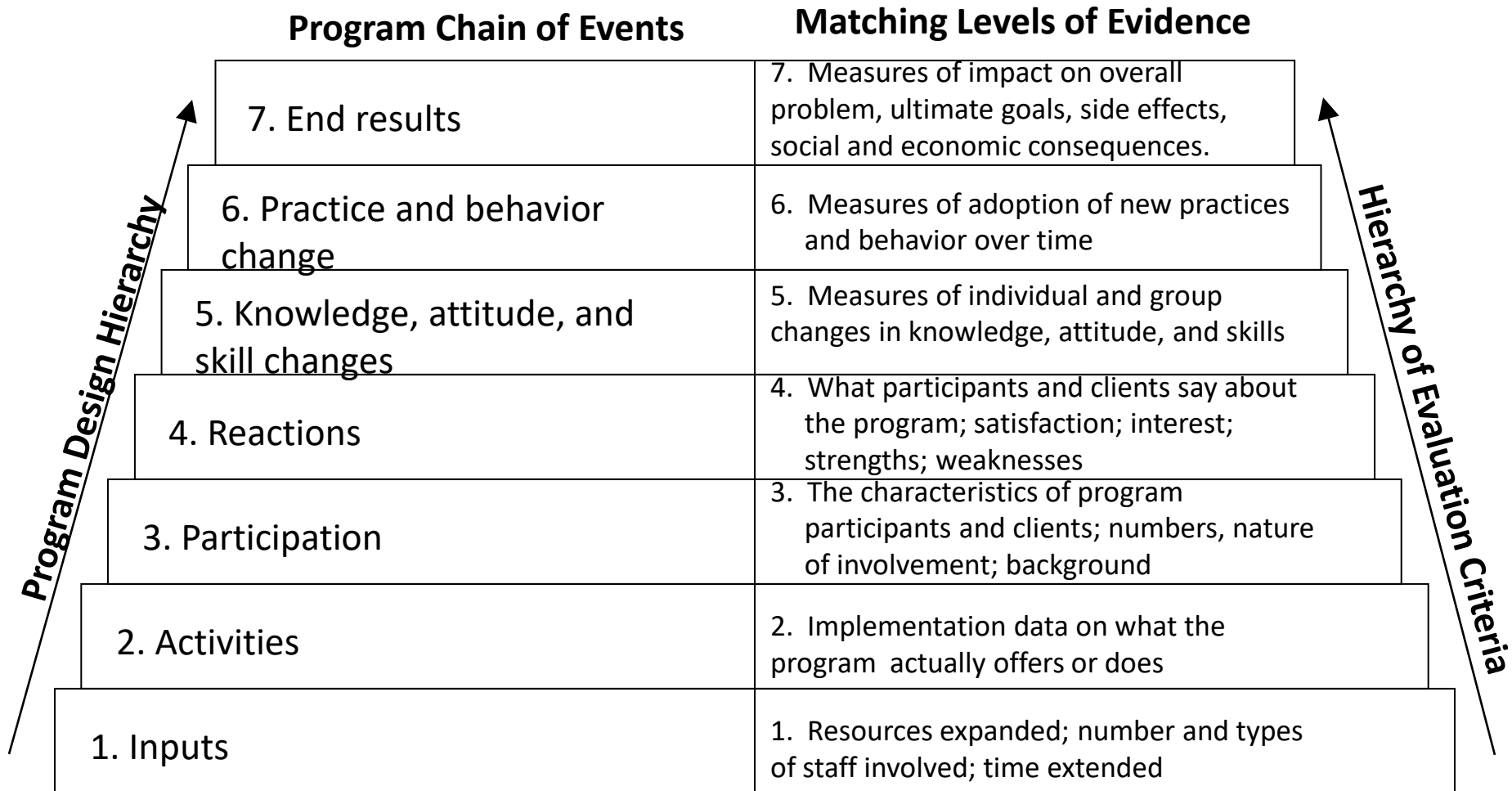
Exercise – Distinguish between program outputs and outcomes

Which of these are outputs and which are outcomes?

- Contractors are trained in efficiency assessments, home performance, and up-selling.
- Consumers find and hire contractors to complete the energy upgrades.
- Marketing materials are sent to consumers.
- Efficiency assessments are funded, completed.
- Consumers find and use financing for energy upgrades.
- New consumers are aware of the program and seek to participate.
- Financing options are developed.
- Contractors know profitability margins for energy upgrades and sell those that are profitable.

Using The Logic Model to Define Key Evaluation Questions and Performance metrics

Match evaluation questions and metrics with program events or “logic”



Source: Montague from Patton, 1997 (Adapted from Bennett 1979)

Choose a small set of key metrics

Various levels of the organization each need a small set. Each metric in the set will

- **Link to desired outcomes.** And at least one metric should link to goals in the organizational/reporting hierarchy.
- **Communicate well.** Set must be simple to report and understand; help the public understand how the program is doing.
- **Benefits greater than costs (feasibility).** Be sure benefits of measuring it are greater than the costs of getting the data.
- **Drive performance the right way,** or perverse effects are offset by another metric in the set.

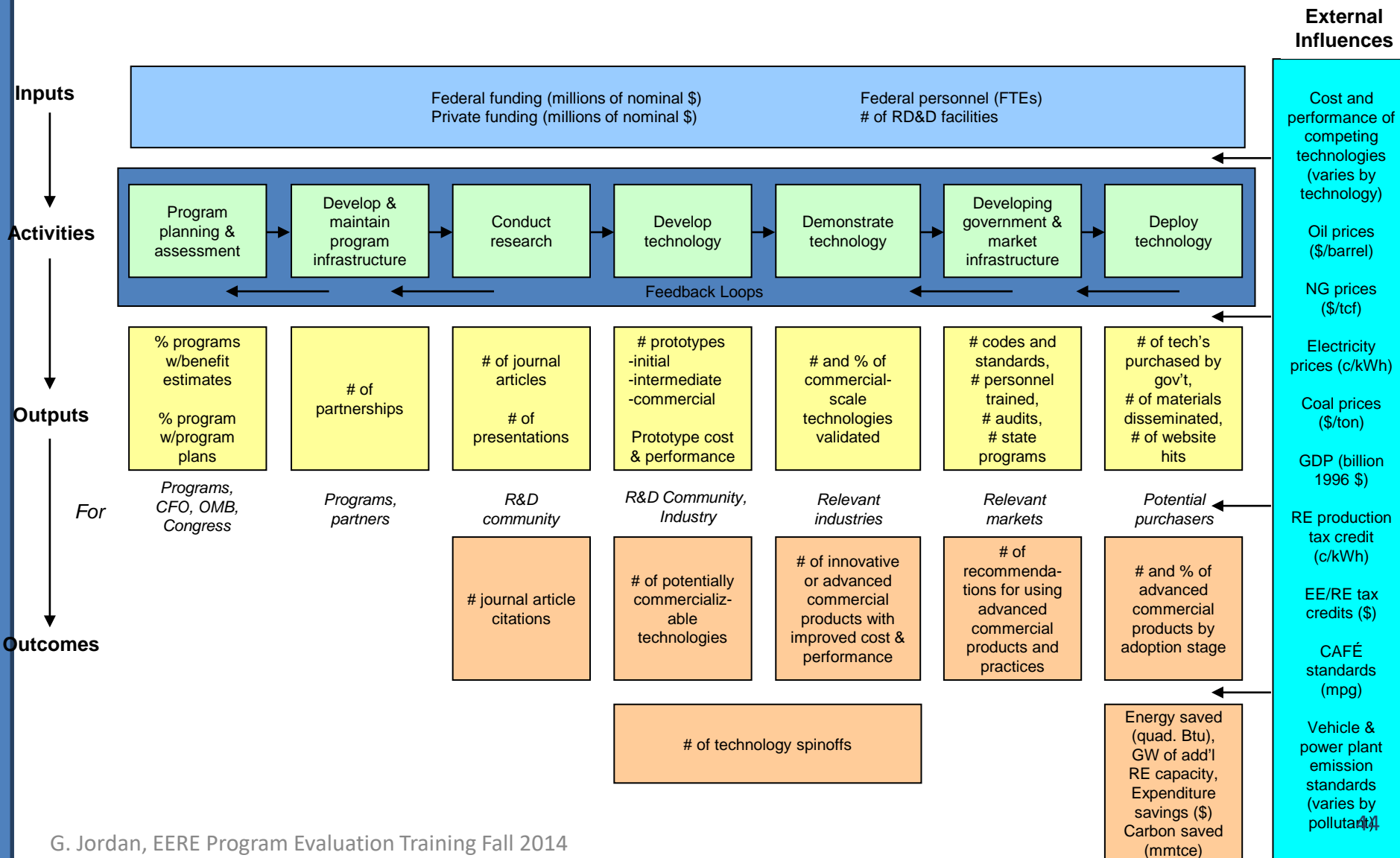
A Balanced Set/Scorecard tells a brief, convincing performance story and drives performance the right way by measuring the strategies and by covering all aspects of the program logic and of stakeholder information needs.

(2004)

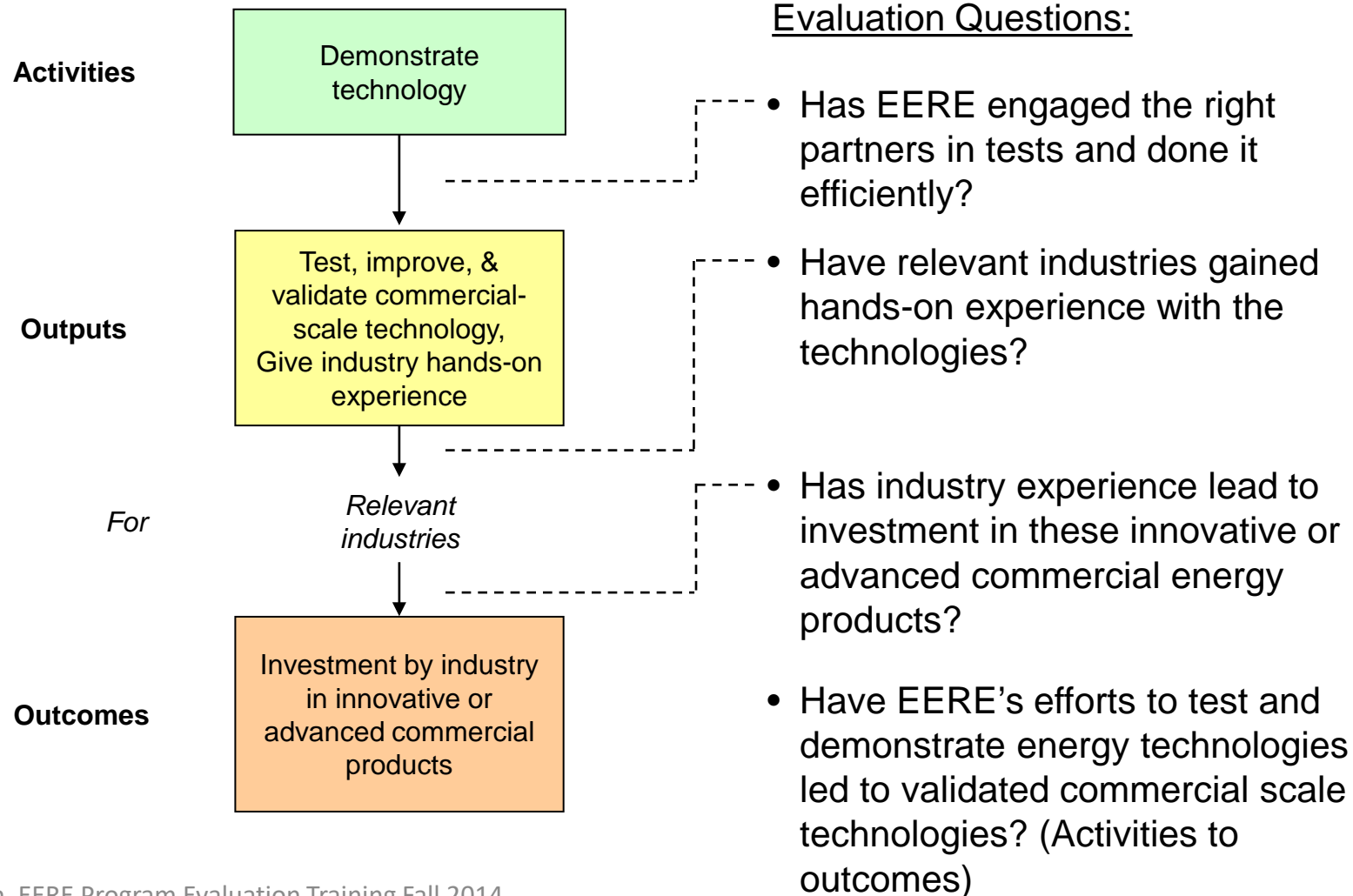
An example: EERE's draft logic model links strategies/activities to goals



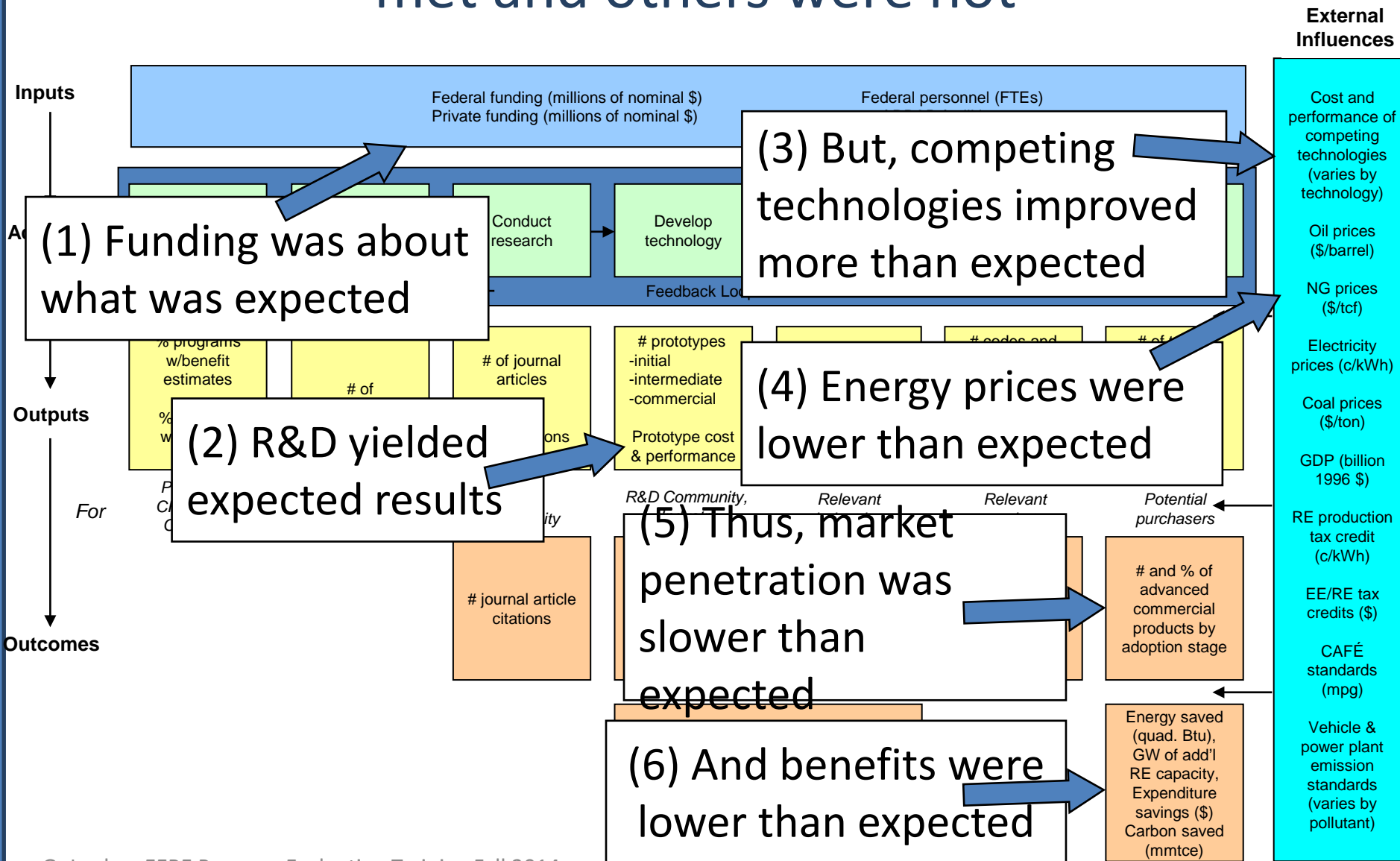
Each box in the logic model is a potential measurement area



Arrows between the boxes help identify evaluation questions



Evaluations can explain why some goals were met and others were not



Bad practice and why you don't go there

Bad practice:

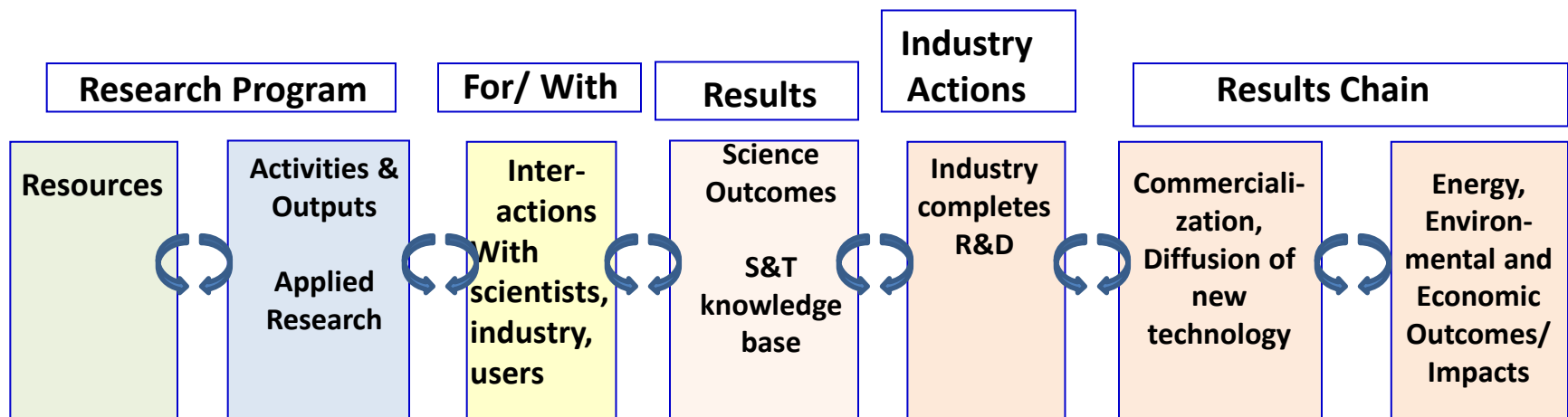
- Measure something because you can, or already are.
- Not measuring something because it “isn't measureable” or you don't have the data, or the measure isn't perfect.
- Measure too many things, or things that are not important to accomplishing goals.

What happens with bad practice:

- Goal displacement when metrics are too simple.
- Rigid use of metrics means can't respond to changes.
- Use of too narrow a set of metrics means inferior projects/contractors may be chosen.
- Focusing on wrong metrics may lead to findings that may affect the perceived success (or lack of success) of a program (i.e., wrong findings)

Exercise: Define a small set of key metrics and evaluation questions for this high level program logic

U.S. DOE Wind R&D Linkages with Commercial Wind Generation



Hint: Use earlier EERE example for ideas

Exercise: Define performance metrics, evaluation questions for U.S. DOE Wind R&D Linkages with Commercial Wind Generation

Research Program

Resources

Activities & Outputs
Applied Research

For/ With

Interactions
With scientists, industry, users

Results

Science Outcomes
S&T knowledge base

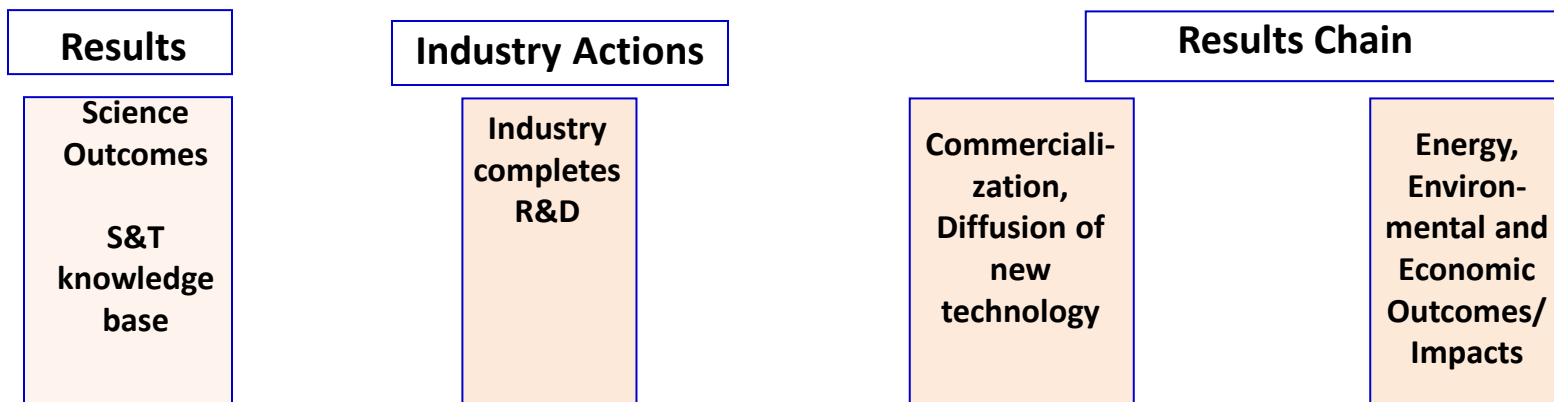
metrics

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Evaluation Questions

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Exercise: Define performance metrics, evaluation questions for U.S. DOE Wind R&D Linkages with Commercial Wind Generation



metrics

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Evaluation Questions

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Logic Model Resources

On Line Training:

- Centers for Disease Control and Prevention. *Logic Model*. [http://www.cdc.gov/nccdphp/dnpao/hwi/programdesign/logic_model.htm], 2010, last accessed 1 July 2014.
- Taylor-Powell, E., and Henert, E. *Developing a Logic Model: Teaching and Training Guide*. [http://www.uwex.edu/ces/pdande/evaluation/pdf/lmguidecomplete.pdf]. 2008, last accessed 1 July 2014.
- W. K. Kellogg Foundation. *Logic Model Development Guide*. <http://www.wkkf.org/resource-directory/resource/2006/02/wk-kellogg-foundation-logic-model-development-guide>, 2005, last accessed 1 July 2014.
- U.S. Environmental Protection Agency, [Online Logic Model Training](http://www.epa.gov/evaluate/lm-training/index.htm), <http://www.epa.gov/evaluate/lm-training/index.htm>, last accessed August 2014.

Wrap Up

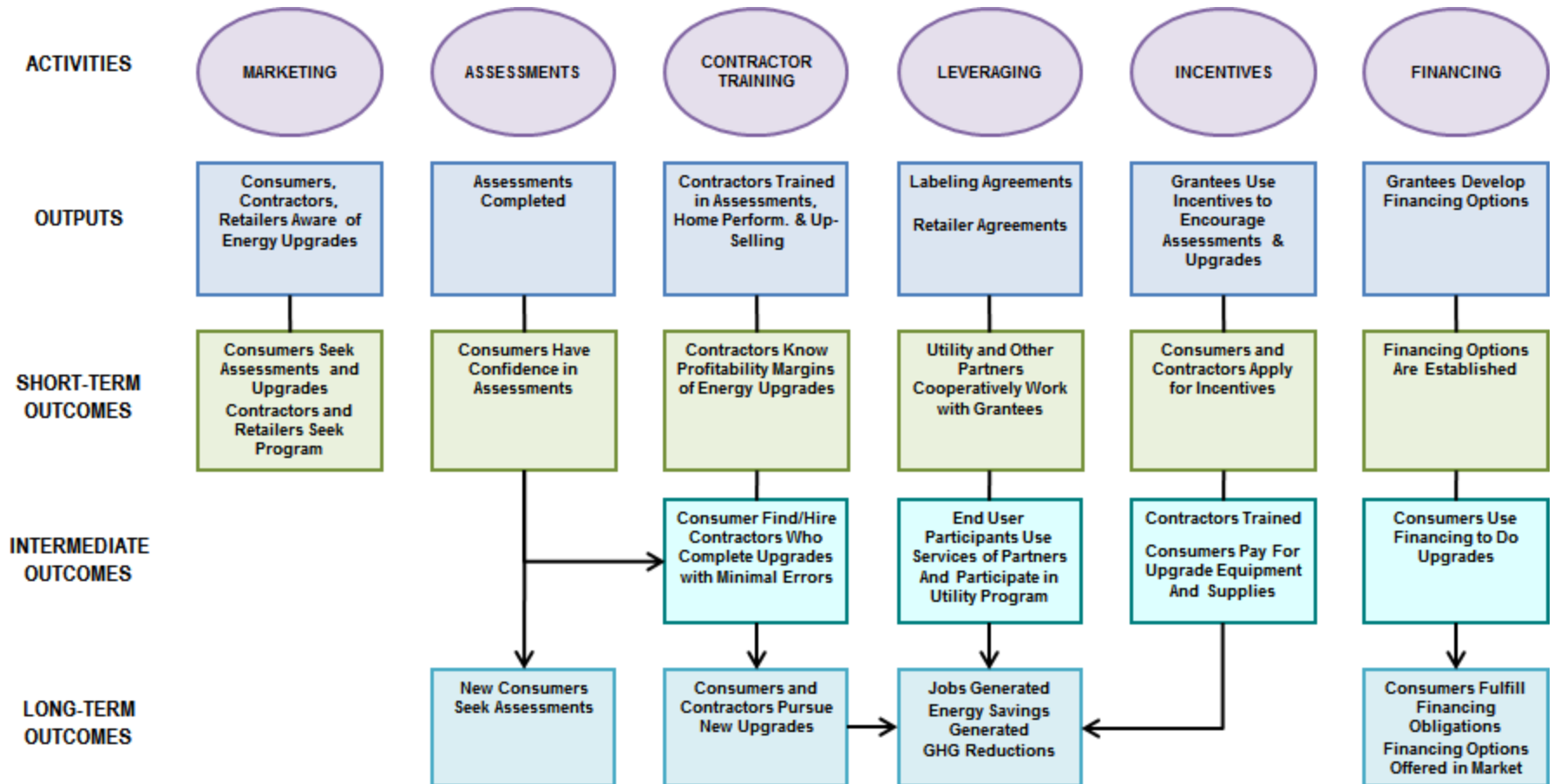
We hope our objectives have been met and you are now able to

- Describe a logic model and its uses;
- Know how to construct (or judge) a logic model;
- Know how to apply logic modeling.

See annex for additional resources and examples.

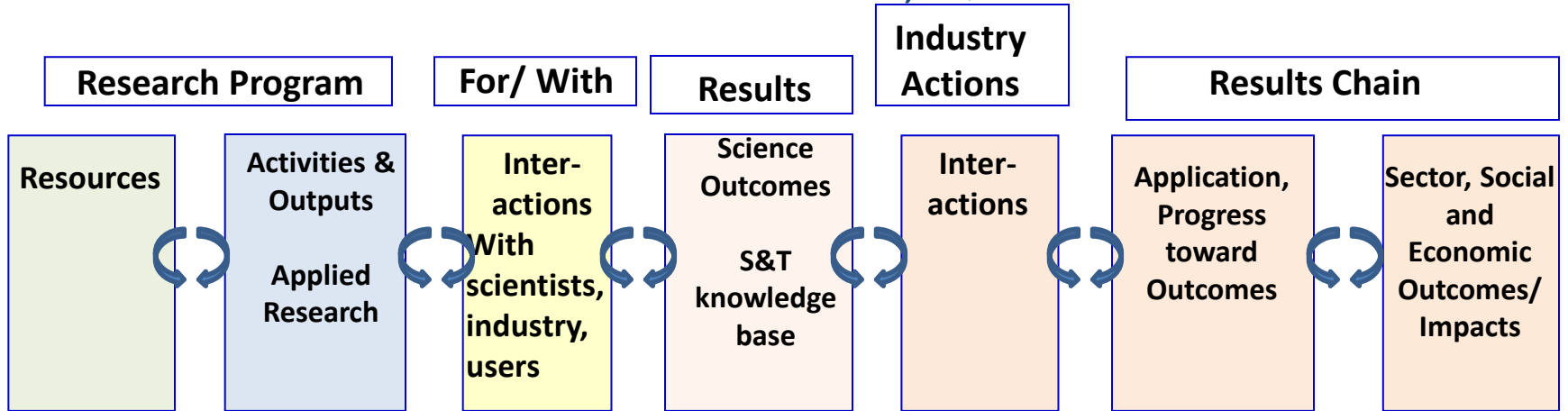
*For more discussion or questions, contact me,
gretchen.jordan@comcast.net*

From their Evaluation Plan: Better Buildings Neighborhood – Grantee Perspective



Final Report : Preliminary Process and Market Evaluation:
Better Buildings Neighborhood Program December 2012

Exercise: Partial Answers for Metrics, Questions



			metrics			
\$ spent by year Topics funded	Publications, reports, patents. Prototypes of turbines, blades, control systems	Partnerships with universities, research labs, technology & engineering firms, utilities, user groups	Co-authorship and citation of publications. Patent tracing & citation of DOE research. Testimonials.	Commercialization of DOE prototype turbines. System Integration. Other new innovations.	Cost per MW reduced. Improved system reliability, durability. Market growth. Spillovers.	Change in wind power capacity (MW). Fossil fuel, pollution avoided.

Evaluation Questions

- What key events happened in the technology development since the program began (DOE, other)?
- What partnerships have formed? How have networks changed in this time period?
- What DOE R&D is embedded in commercially available wind technology?
- What would have happened without the program?