



Impact Indicators and Research Strategy: A Pilot Effort

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OST, Paris, May 2012

 **Technology Policy and
Assessment Center**



**Georgia Institute
of Technology**

An applications-oriented presentation

- **Small project done for client on our campus**
- **Our client put two questions to us:**
 - What indicators of impact can we use to make investment choices for the university?
 - What indicators of impact can we use to compare our performance with other universities?
- **The structure of the problem**
- **Promising ideas from recent reviews**
- **What we found on campus**
- **Possible next steps**

What do we mean by impact?

- Based in traditional evaluation model



- Should happen off-campus, in “the outside world”
- Should involve a “user” of an output
 - For students, an employer
 - For research, can be other researchers or even broader
 - For engagement, a “real world” user
 - Private sector, public sector, or non-governmental organizations

Decision units at a university

- **Hiring**
 - Faculty positions
 - Individual faculty members
 - Junior: teaching experience, publications
 - Senior: research standing, scientific impact in an area, possibly broader impacts depending on area
- **Internal resources/ seed funding**
- **Center or institute formation**
 - Cross-cutting
 - Relatively temporary
- **Major reorganization of schools and colleges**



Recent reviews of impact measurement

- **SOSP colloquium, December 2010**
 - Science of Science Policy (interagency working group)
 - Open call for short reviews
 - All materials posted at <http://www.nsf.gov/sbe/sosp/>
- **National Academies Workshop, April 2011**
 - *Measuring the Impacts of Federal Investments in Research*, Steve Olson and Steve Merrill
 - Report available at www.nas.edu
- ***Research Evaluation*, special issue on state of the art in impact assessment, September 2011**
 - Edited by Claire Donovan

(Almost) linear models

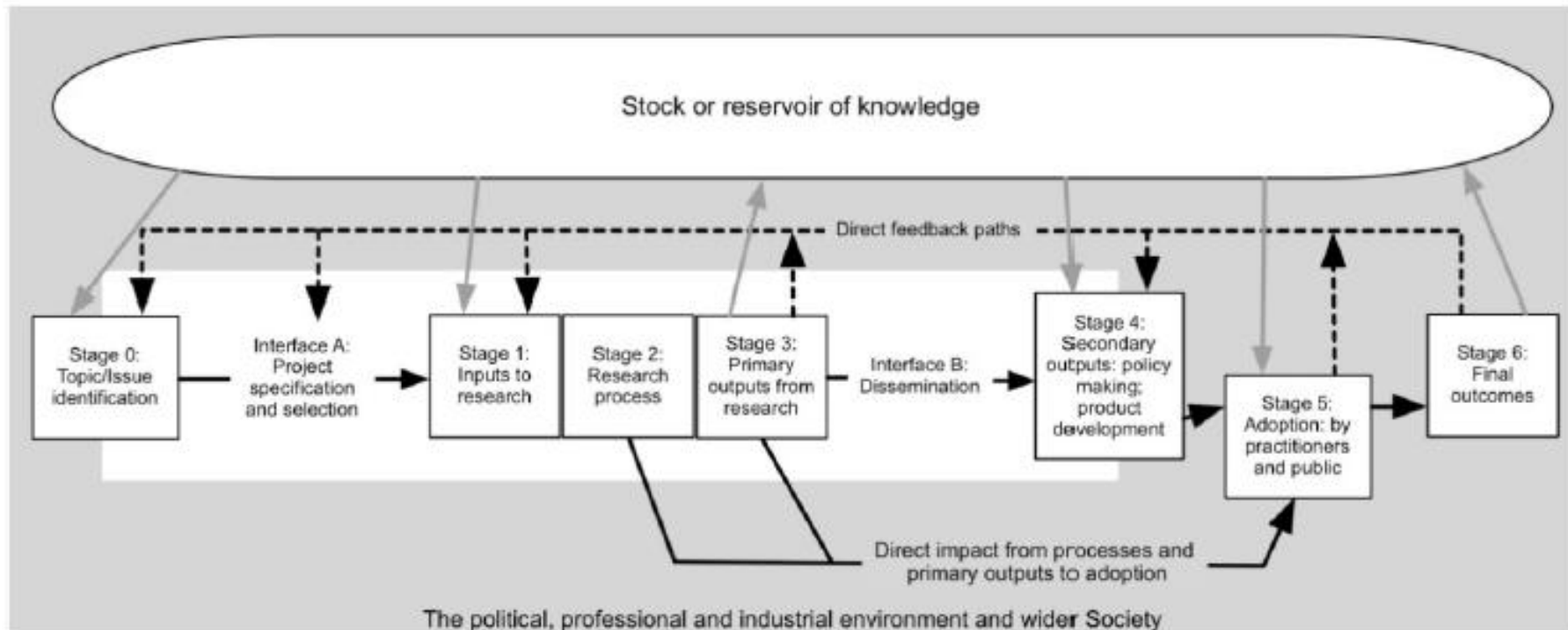
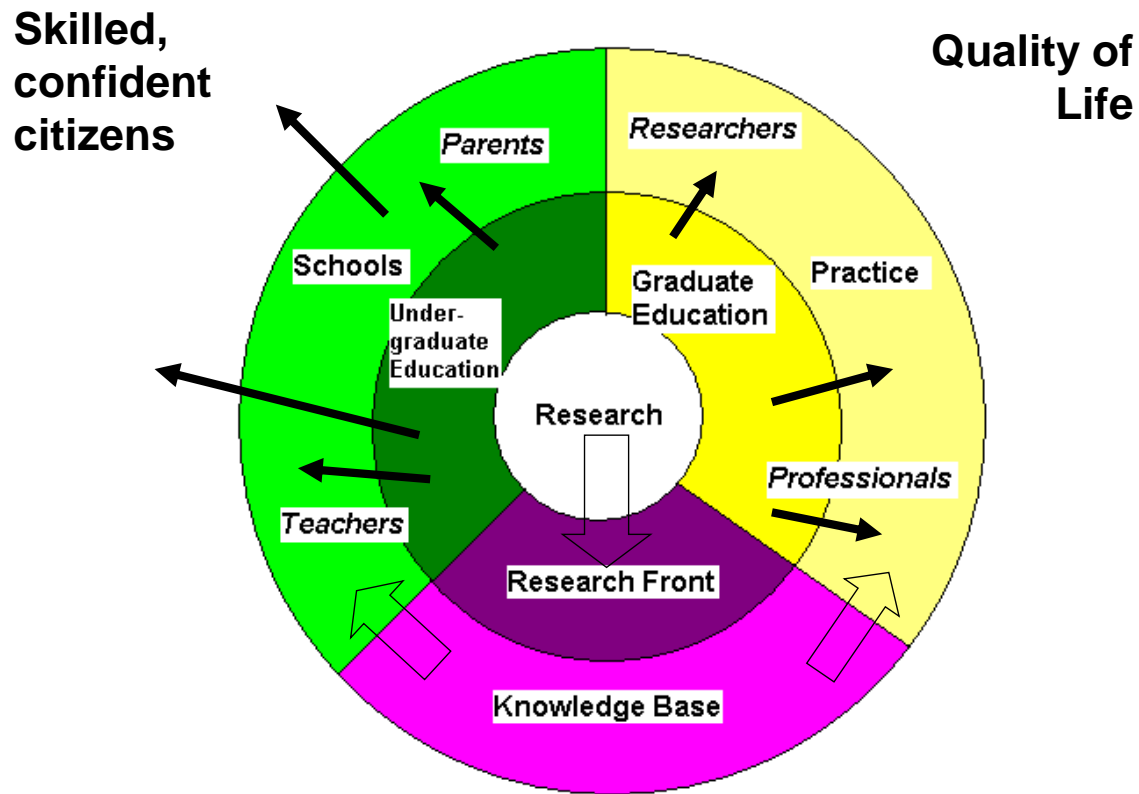


Figure 1. The logic model of the Payback Framework

Source: Hanney *et al* (2004)

From Donovan and Hanney 2011

Circular (linear) models



The Keystone Model

From Cozzens 1994

Interaction models

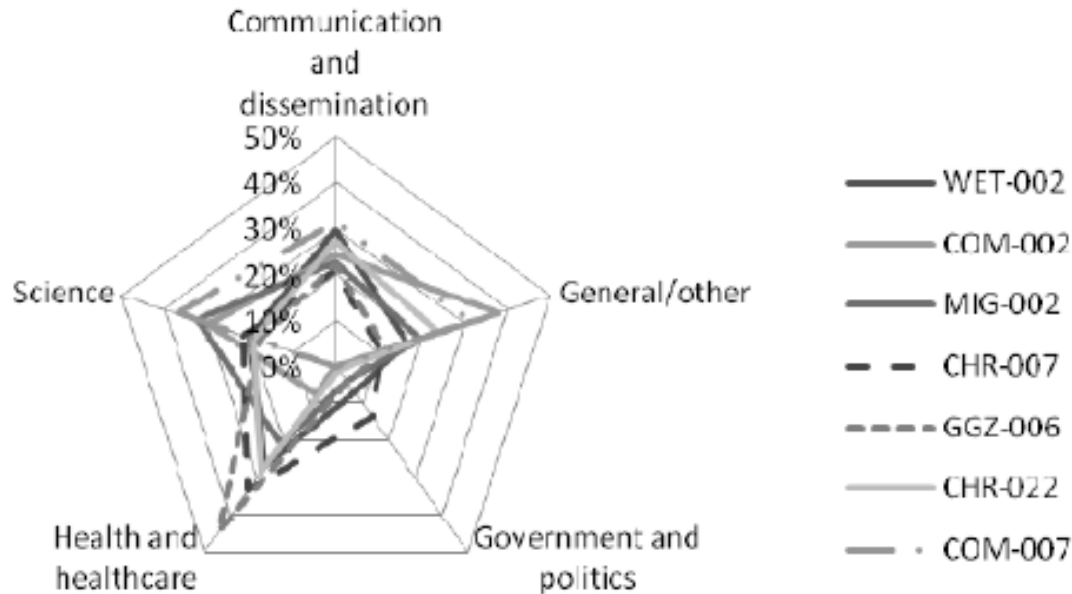


Figure 1. Contextual interest in NIVEL

Note: The column on the right refers to seven large research projects of NIVEL. Percentages refer to the share of total output of research projects (publications, press releases, other online material) as viewed via the internet by audiences in a particular social domain. Google and Yahoo search engines were used to track down the output

From Spaapen and Drooge

Our four impact areas

- **Economic impacts**
 - Through companies, IP/commercialization
 - Education/training
 - Growth and jobs
- **Societal impacts**
 - Environment
 - Health
 - Grand Challenges
- **Workforce impacts**
 - Jobs and careers, especially in research
- **Research impacts: citation measures**
- **Rejected: impacts through schools**

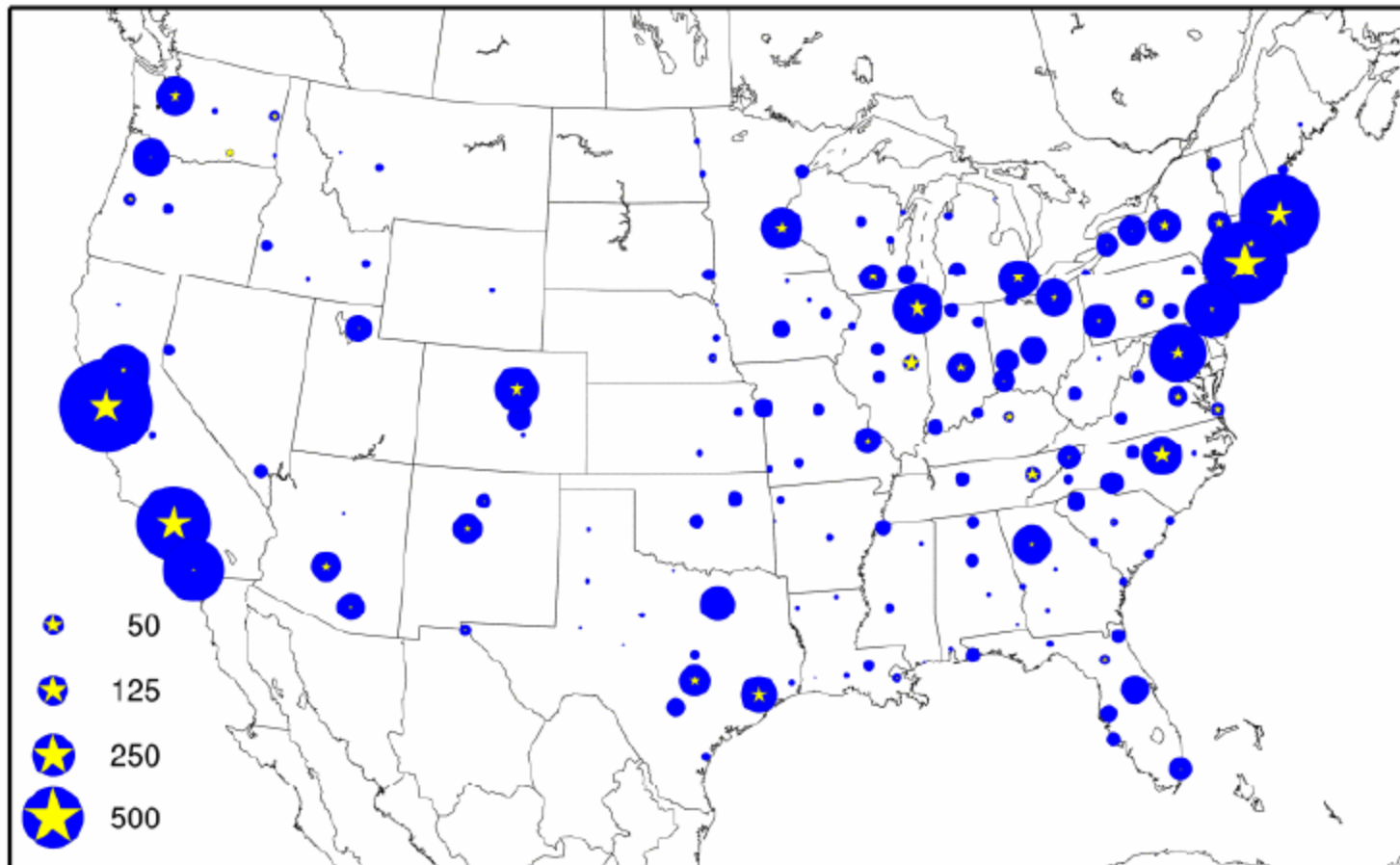
Economic impacts

- **How does the university think about this now?**
 - Broad-scale research and training efforts to support research-based industries
 - Logistics (e.g., United Parcel Service [UPS])
 - New media/ entertainment/ games (e.g., Turner)
 - Microelectronics/ nanotechnology (e.g., Intel)
 - Advanced manufacturing/ materials
 - Signs of success
 - Industry funding
 - Memberships in collaborative centers
 - Faculty consulting
 - Changing industry practice

What did the literature say?

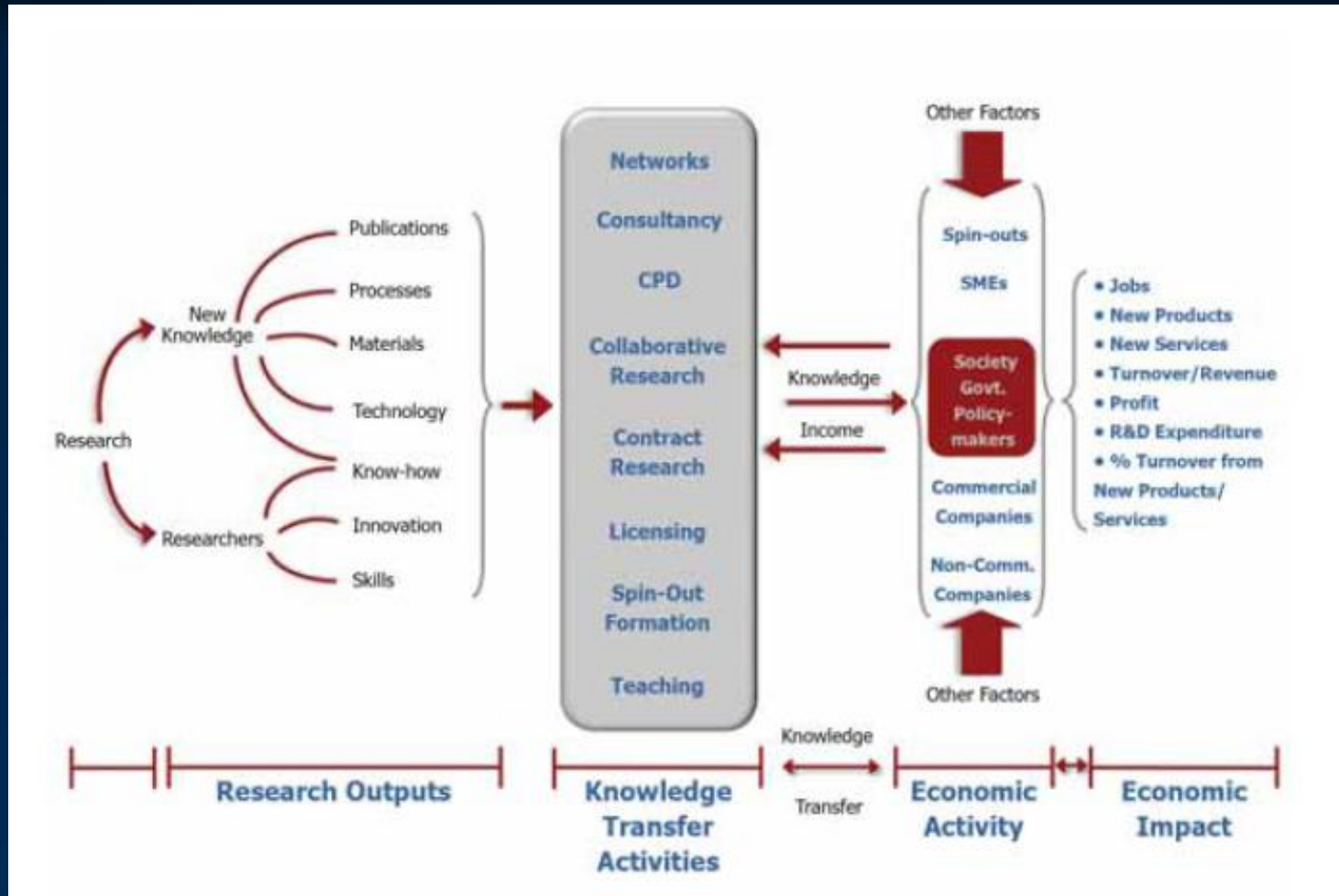
- **Agricultural R&D (Alston)**
 - 282 studies, 1852 estimates of rates of return based on econometric models with appropriate lags
 - Estimates at level of national investment in R&D and national gains in productivity
- **Biotech as an example (Zucker and Darby)**
 - Movement of ideas through people and firms
 - Better people associated with more products in development and on the market, employment growth, patents granted
 - Requires specialized dataset following people and firms

Nanoscale Science and Technology Star Scientists & Firm Entry, U.S. Regions, 1981-2004



Source: Zucker and Darby 2011

“Institutional Economic Engagement Index”



Source: Association of University Technology Managers, from University of Glasgow

Our underlying concepts

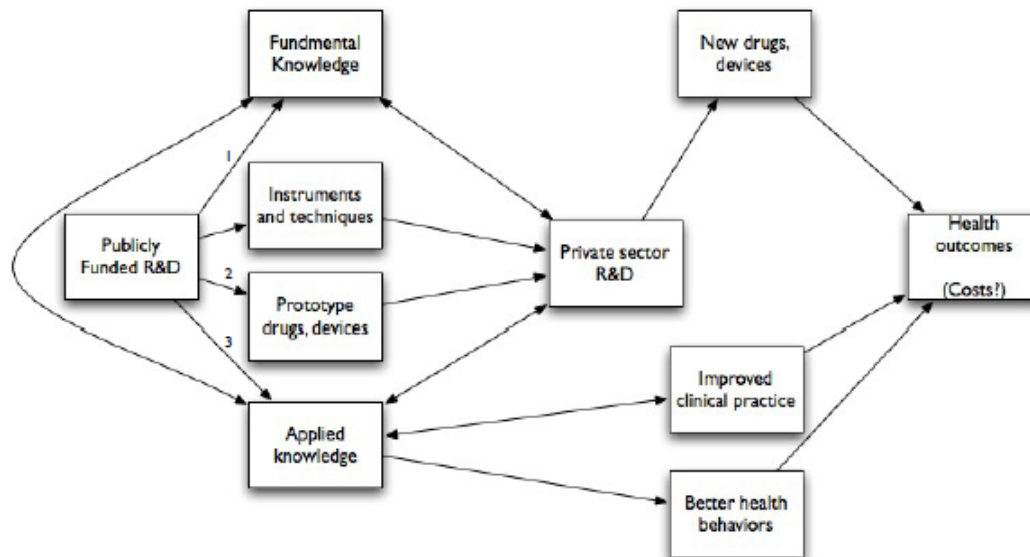
- **Faculty consulting**
 - Note: can sort out who they are consulting with
- **Relationships with firms**
 - Contracts
 - Licenses
 - Material transfer agreements
- **New companies launched**
 - Follow-up would require collecting new data
- **Royalties**
 - Indicate sales of products in the marketplace

Societal impacts

- **What did the literature reviews say?**
- **Policy (Cozzens and Snoek, SOSP workshop)**
 - Beyond citations in regulations
 - Participation in policy networks
- **Health (Sampat and Azoulay, NAS report)**
 - Focuses on impact through private R&D/ drugs and devices
 - Some tracing and network studies
 - Some econometric estimations by disease area
 - Some surveys (Mansfield-style)
 - Noted very little on health outcomes

Maybe similar for energy?

Logic model*



*Yes, it's too stylized, simple, and linear

Source: Sampat and Azoulay 2011

The Payback Framework

- **Originally developed for health services research**
- **Research tool that**
 - facilitates data collection and cross-case analysis
 - provides common structure
- **Consists of**
 - a logic model of the complete research process
 - categories to classify paybacks
- **Multi-dimensional categorization of benefits**
 - knowledge production
 - research capacity building
 - wider benefits to society

(Almost) linear models

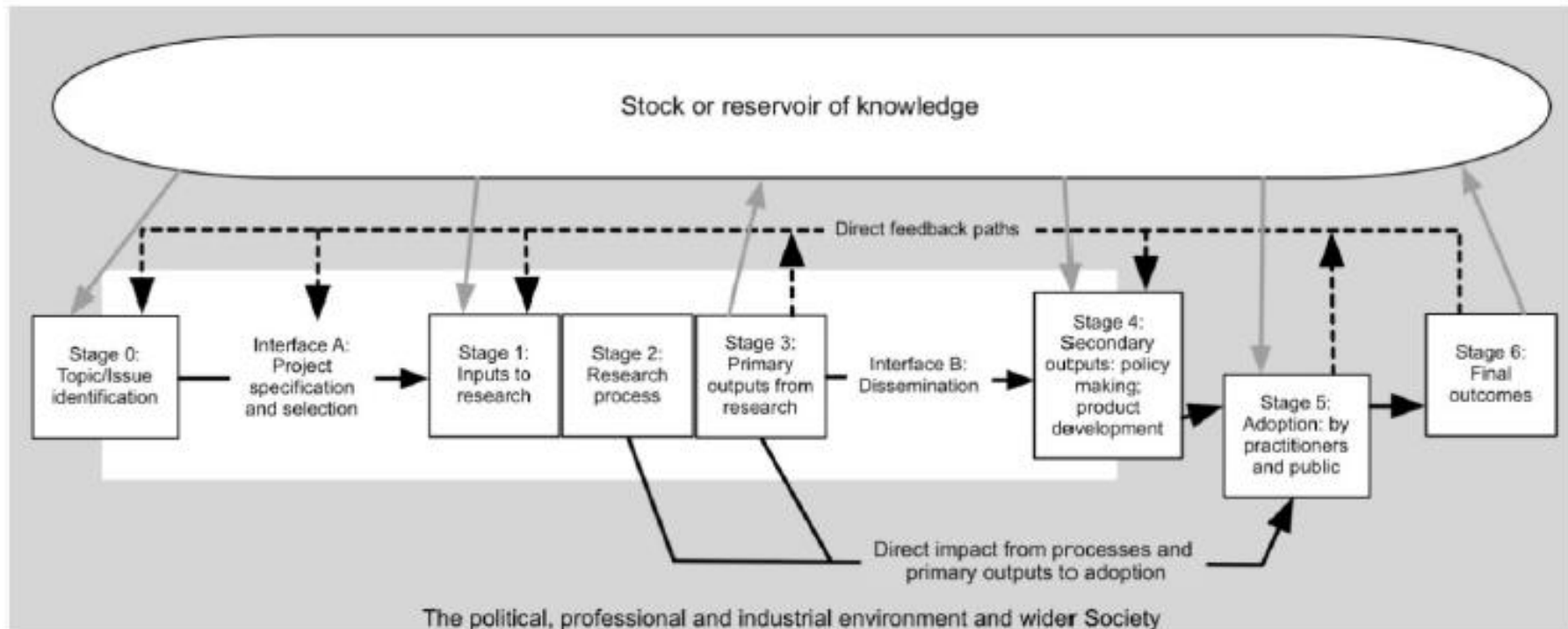


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From Donovan and Hanney 2011

SIAMPI approach

- **Social Impact Assessment Methods: Productive Interactions**
- **Goal is learning, not judging**
- **Key term: “productive interactions” with stakeholders**
 - Direct or personal interactions
 - Indirect interactions through texts or artifacts
 - Financial interactions through money or in-kind contributions
 - Productive = used by a stakeholder
- **Generalized, not limited to technologies**

SIAMPI results

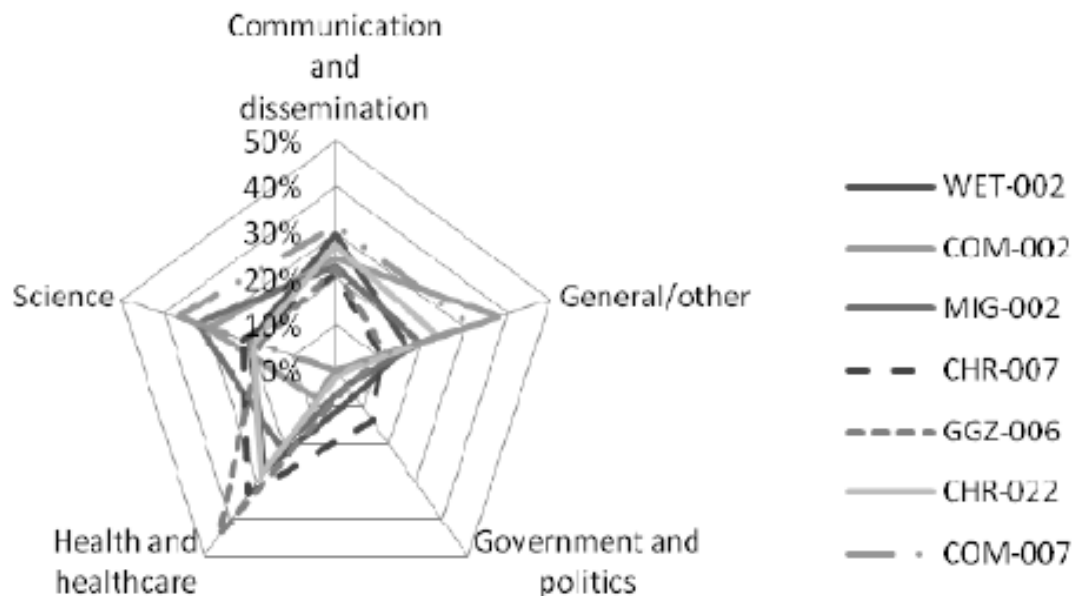


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From Spaapen and Drooge 2011

On campus, many practical problems

- **Experimenting with**
 - Tracking policy impacts in Congressional Record
 - Public events from university calendar
 - Literature-based Grand Challenge profile
- **Not possible yet**
 - Media coverage
 - Most is not research-related
 - Case studies of outcomes
 - Need broader set of cases than just what is patented
 - Perhaps use “relationships” data collected from consulting and contracts

Workforce impacts

- **What did the literature say?**
 - Many relevant survey datasets exist (note: for STEM).
 - Even richer sources of non-survey data now available.
 - Linking researchers in the various datasets is the big challenge.
- **Common long-term outcome measures in surveys**
 - Career trajectory
 - Remaining in research or related job
 - Publication productivity
 - International experience
 - Etc.

On campus, scattered incomplete data

- **Development Office probably has the best data.**
 - Datasets developed to identify potential donors.
 - Alumni groups keep contact information updated.
 - Information rather closely held.
- **Alumni surveys**
 - Ask primarily about value of educational experience.
- **Graduation surveys**
 - Ask only about first job, if they have it yet.
 - Some information available on industry and position.
- **Area is ripe for a few additional questions asked in current survey efforts**

Research impacts

- **What did the literature say?**
 - Pleasant surprise – skipped right over
 - But we needed to look at this as a university
- **Our experts recommend**
 - Leiden rankings:
 - Mean normalized citation score (GIT is #14)
 - Proportion top 10% publications (GIT is #15)
 - Research benchmarking at researchbenchmarking.org
 - Field specific
 - Several indicators; publication and citation based
 - Georgia Tech #4 in materials sciences, #7 in computer science and engineering

Summary of the indicator set

- **Economic impact**
 - Consulting
 - Relationships with firms
 - New companies formed
 - Royalties
- **Societal**
 - Congressional mentions
 - Public events
 - Grand challenges
 - Consulting
- **Workforce**
 - Graduation survey
- **Research**
 - Citation measures

Using the indicators prospectively

- **Benchmarking with our peer institutions**
 - A few of the data sources could be used for this
- **Beginning to build an evidence base**
 - Adding survey questions
 - Starting to collect instances to follow prospectively
- **Changing the concept of impact on campus**
 - Broadening beyond scientific impact
 - Broadening beyond patents and commercialization
 - Broadening beyond industry
- **Concrete examples of new investment areas**



**Thank you for your attention.
Your comments are welcome.**

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