The Social Model for A/T Technology Transfer – AAATE 2010

"*From Problem Identification to Social Validation: An Operational Model*"

Joseph P. Lane, Center on Knowledge Translation for Technology Transfer, University at Buffalo

Successive Trends

- ***Convergence of Science & Technology***
  - Public funding for *Basic Research* generates a repository of conceptual knowledge;
  - Innovation expected via *Diffusion Model*.
- ***Convergence of Science, Technology & Society***
  - Public funding for Applied R&D generates a repository of prototype devices/services;
  - Innovation expected via *Linear Model*.
- ***Convergence of Government, Academia, Industry***
  - Integrate three sectors in Problem Solution.
  - *"Open"* innovation and "Challenge" orientation.

Convergence of Science & Industry:

- *Knowledge embodied in three distinct states:* generated by Research, Development and Production methods respectively.
- *Industry is critical missing partner: G*overnment and academia projects intended to benefit society fail to cross gaps to becoming market innovations.
- *Evidence-based framework exists:* Links three methods, communicates knowledge in three states, and integrates key stakeholder.

3 Methods = 3 Knowledge States

- Research methods generate knowledge in *gas state* of **Conceptual Discoveries**.
- Development methods create knowledge in *liquid state* of **Tangible Inventions**.
- Production methods formulate knowledge in *solid state* of **Market Innovations**.

1) Discovery State of Knowledge

- ✓ Research methods create new knowledge.
- ✓ Process – Empirical analysis reveals novel insights regarding key variables.
- ✓ Output – **Conceptual Discovery** expressed as manuscript or presentation.
- ✓ Value – **Novelty** as first articulation of new concept as contributed to knowledge base.

2) Invention State of Knowledge

- ✓ Development methods apply knowledge.
- ✓ Process – Trial and error experimentation and testing demonstrates proof-of-concept.
- ✓ Output – **Tangible Invention** embodied as operational prototype.
- ✓ Value – **Novelty** of conceptual discovery + **Feasibility** of tangible invention.

3) Innovation State of Knowledge

- ✓ Production methods codify knowledge.
- ✓ Process – Systematic specification of components and attributes yields final form.
- ✓ Output – **Market Innovation** embodied as viable device or service in a defined context.
- ✓ Value – **Novelty**, **Feasibility** + **Utility** defined as revenue to company and function to customers.

Delivering Solutions to Problems involves progress across three Knowledge States

Research → *Discovery* →Translation → Utilization ↓

Development→ *Invention*→ Transfer→ Integration ↓

Production → *Innovation* → Release → Lifecycle ↓

Knowledge Translation
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Milestones align three Methods to improve project planning, implementation and evaluation.

Evidence Milestones	*Research Discovery*	*Development Invention*	*Production Innovation*
Identify Opportunity	Knowledge gap in literature	Supply Push or Demand Pull	Feature/function gap in device or service
Establish Scope	Volume of topic discussion in literature	Inventor described or Analysis defined	Statement of need by Users or Vendors
Propose Solution	Experimental Hypothesis	Champion's vision or Stakeholder defined	Value Proposition for customers/company
Validate Originality	Literature Review	Assumed or State of Market Survey	Prior Art and State of Practice Search
Conduct Process	Control variables for objective results	Manipulate variables for subjective results	Optimize function within constraints
Conclude Results	**Discovery documented**	**Invention claimed**	**Innovation specified**
Internal Delivery of Output	**Scholarly manuscript**	**Proof of Concept Prototype**	**Market Ready Device or Service**

Issues & Confounds

- Each Method *has own* rigor and jargon.
- Actors *over-value* the method in which they are trained and operate.
- Academia & Government focus on “R&D” fails to connect actors, methods & goals.
- Lack of policy/program foresight precludes adequate preparation of knowledge for successful Industry absorption.

Why should these confounds matter to A/T Technology Transfer?

Knowledge Translation
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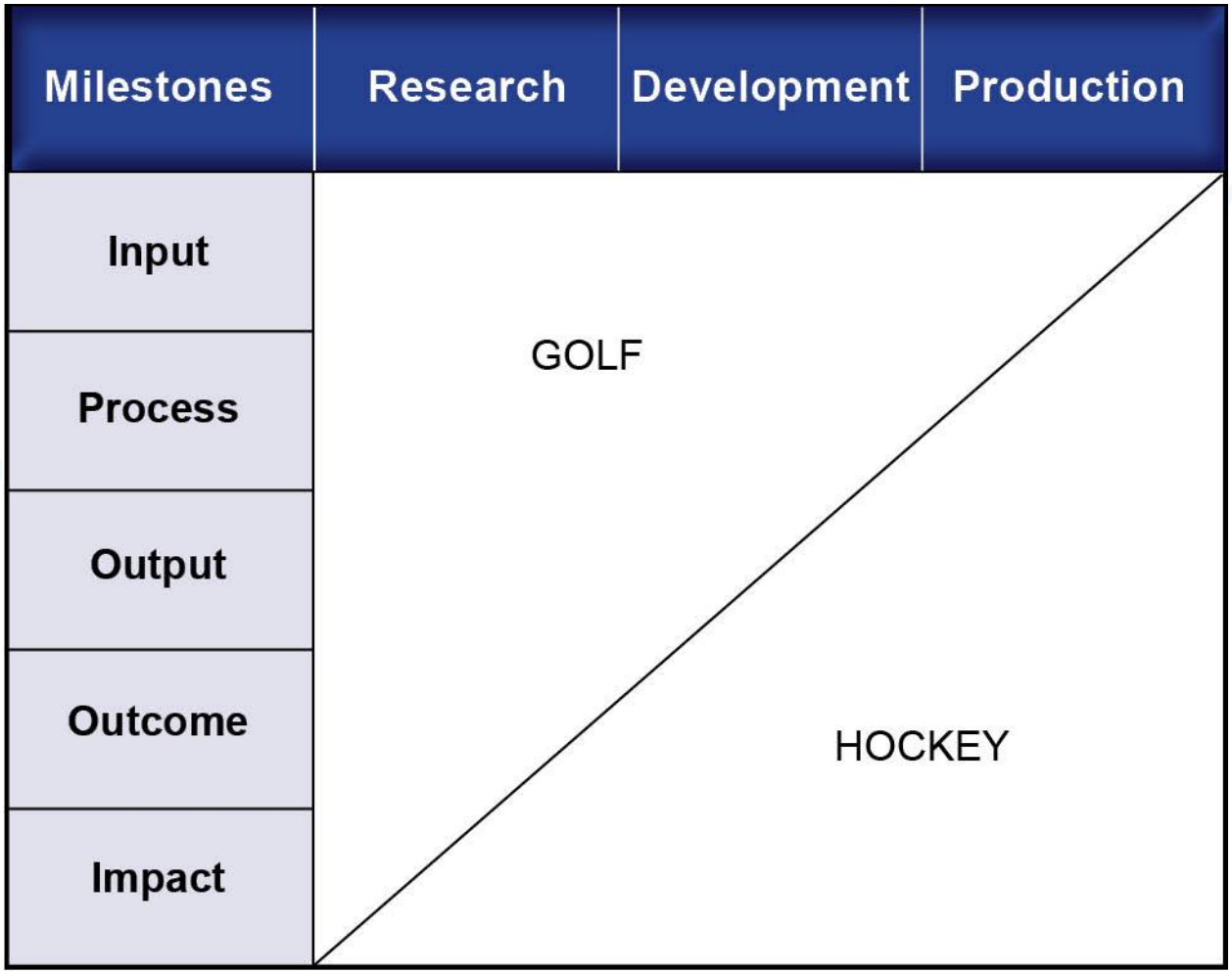
Think Golf versus Hockey

Should Golfers play Hockey?



“Translating Three States of Knowledge: Discovery, Invention & Innovation”

Lane & Flagg (2010)

Implementation Science

http://www.implementationscience.com/content/5/1/9

Need to Knowledge (NtK) Model

- ***Integration*** – PDMA's NPD practices with CIHR's KTA Model.
- ***Validation*** – All R&D projects intending impact must start with a real problem and potential solution validated by stakeholders.
- ***Orientation*** – Actors need to know problem, stakeholders, methods and role in advancing process toward the Goal.

Elements of NtK Model

- Full range of activities includes 3 Phases, 9 Stages & Gates, Steps, Tasks and Tips.
- Supported by primary/secondary findings (scoping review of 250+ research and practice articles), and A/T case examples.
- Logic Model orientation – “Begin with the end in mind” (Stephen Covey), and work backwards through process to achieve it.

Phases	Stages and Gates
Discovery (Research)	Stage 1: Define Problem & Solution
	👍 👎 ?
	Stage 2: Scoping
	👍 👎 ?
	Stage 3: Conduct Research and Generate Discoveries → Discovery Output!
Invention (Development)	*Communicate Discovery State Knowledge* 👍 👎 ?
	Stage 4: Build Business Case and Plan for Development
	👍 👎 ?
	Stage 5: Implement Development Plan
	👍 👎 ?
	Stage 6: Testing and Validation → Invention Output!
Innovation (Production)	*Communicate Invention State Knowledge* 👍 👎 ?
	Stage 7: Plan and for Production
	👍 👎 ?
	Stage 8: Launch Device or Service → Innovation Output!
	Communicate Innovation State Knowledge 👍 👎 ?
	Stage 9: Life-Cycle Review/Terminate? 👍 👎 ?

Let’s take a look!

http://kt4tt.buffalo.edu/knowledgebase/model.php

AT-TT Recommendations

- *Change governments policies – directly link Science and Technology R&D to Production Outcomes.*
- *End "Rush to Research" – Subsume applied research under a broader innovation framework, to verify if new research will add value, is relevant or even necessary.*
- *Require technology-oriented research projects to address downstream development and production plans.*
- *Add voices of Stakeholders (particularly Industry & Customers) to ensure public S&T investments generate innovations that benefit society – The GOAL!*

Review three key points

- *Knowledge embodied in three distinct states:* generated by Research, Development and Production methods respectively.
- *Industry is critical missing partner: G*overnment and academia projects to benefit society fail to cross gaps to become market innovations.
- *Evidence-based framework exists: Links* three methods, communicates knowledge in three states, and integrates key stakeholder.

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