RSCH-16: Roles of 3 Related Systems in Realized Evidence-Based Products

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http://sphhp.buffalo.edu/cat/kt4tt.html

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Funded by NIDILRR, ACL/DHHS PR# 90DP0054

What's this presentation about?

It's about narrowing the gap between government funding for R&D and society's need for beneficial deliverables:

- The free market forces of industry address most societal needs for technological innovation, except those too large, too small, too late or premature . . .
- Government's address some of these "market failures" by investing public funds, but success requires proper alignment between investment, value chain and results.
- STI Policies based on linear model of university-led R&D are generally *ineffective*; requiring realignment of sector funding to deliver intended socio-economic impacts.

Commercial Innovation Markets

Industry delivers technological innovations to society when they meet standard commercial market requirements (market size; customer affluence; high profit margin; low entry barriers):

Market Opportunity

↓

Industry R&D&P

↓

Deliver Product/Service to Markets

Conditions of Market Failure

- When standard business conditions are not met -- but a need is deemed important to society -- government's supply resources to fill market gaps.
- STI Policies address societal needs for new *knowledge* under conditions of market failure.
- Problems arise when 'new knowledge' is defined only in the long-term and indefinite context of university-based scholarship and publications.
- New knowledge is not limited to scientific findings, but instead includes prototypes and products.

University/Government/Corporate R&D Laboratories – States of Knowledge

Public tax dollars are allocated to generate new knowledge outputs embodied in 3 different *states*:

- Scientific research ➔ *Conceptual Discovery Output* (*know what ?*)
- Engineering Development ➔ *Tangible Invention Output* (*know how ?*)
- Industrial Production ➔ *Commercial Innovation Output* (*know why ?)*

Each *state of knowledge* has its own trajectory and impact.

Public funding fills gaps.

- *But why aren't we seeing more progress in features, functions, prices and payments?*
- Current "STI" policies result from a status quo Academic/Bureaucratic complex.
- Returns from public investment – both social benefit and tax revenues -- comes from the private sector's delivery of products/services.
- Society's bottom line is creating new net wealth at some boundary between sellers and buyers.

So What is Path To Transfer?

- *What do R&D project leaders need to know?*
- *What best practices exist to link sponsored R&D to external product or service creation?*
- *What models, methods and metrics help plan, manage and monitor such transfer efforts?*
- *How do the activity stages within product/service creation link with critical decision gates?*
- *How to treat knowledge disclosures to balance scholarly, commercial and public benefit goals?*

The Way Forward: Integrate *Conceptual* but Differentiate *Operational*

- *Consider three distinct states:* Know role of Research, Development and Production methods in context of each project – plan and budget accordingly.
- *Engage Industry early: G*overnment/Academic projects intended to benefit society fail to cross gaps (death valley vs. Darwinian sea) to business & open markets.
- *Apply evidence-based framework:* Link three methods; Communicate knowledge in three states; Integrate key stakeholder who will determine eventual success.

Need to Knowledge (NtK) Model

Need to Knowledge (NtK) Model for Technological Innovations

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 Prepare for Production
	👍 👎 ?
	Stage 8: Launch Device or Service → Innovation Output!
	Communicate Innovation State Knowledge 👍 👎 ?
	Stage 9: Life-Cycle Review / Terminate? 👍 👎 ?

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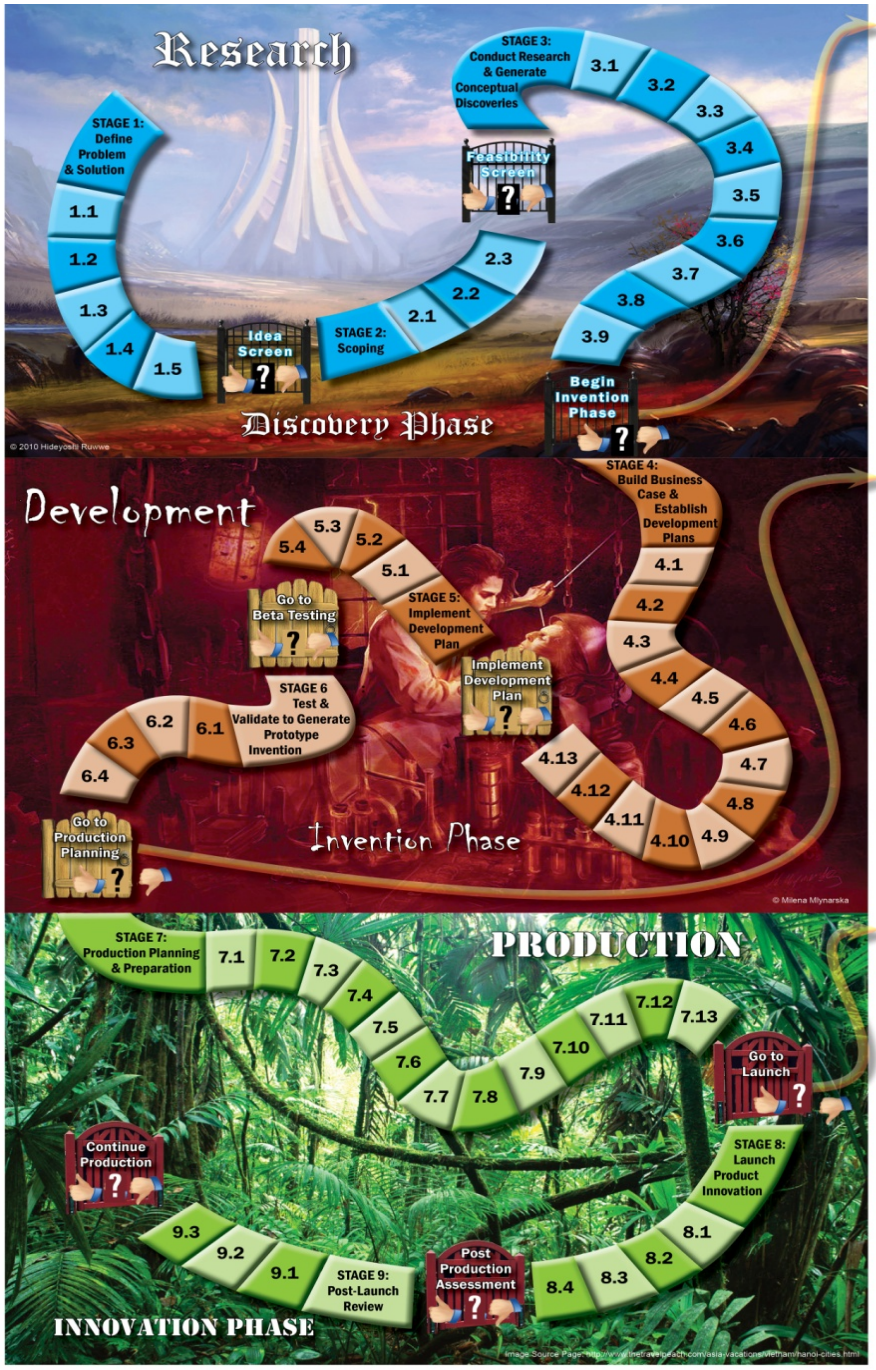
"Gamification" of Technological Innovation

Progress may be circuitous and iterative, punctuated and prolonged, risky and unpredictable.

Yet, it must be deliberately and systematically planned, implemented and managed.

Serendipity is not a plan!

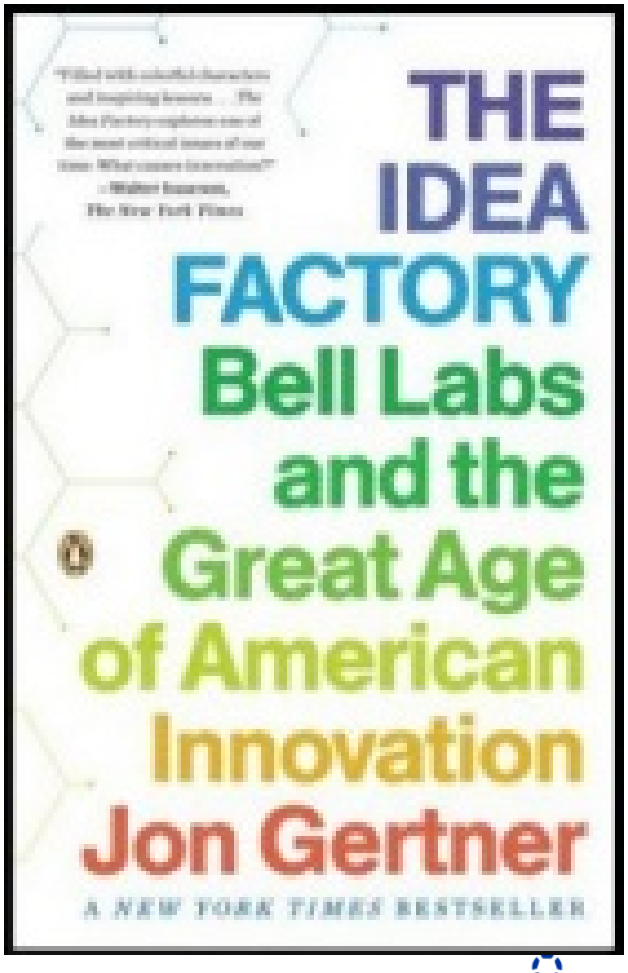


TT Lessons from Literature

- Literature from both Industry and Academia converge on *best practices* in new product development, where due diligence supplants *ad hoc* approaches and objectively tests *subjective* assumptions of value.
- Excerpts cluster differently for each Phase of R/D/P, but the topics of *Cross-Functional Teams* & *Analytic Tools* dominate papers addressing the required expertise.
- Stage/Step level activity do not require a linear progression, but *Decision Gates* cannot be properly addressed without all the necessary facts.

Commercial Market is Path to Impact

- *Time to return to successful practices!*
- *Industry leads R&D efforts intending to generate innovations.*
- *Industry has incentive, expertise and structure to create, retain and exploit new knowledge.*



NtK Model Utility

- Clarifies processes and mechanisms underlying technology-based Innovation, by integrating academic & industry literature and analytic tools.
- Establishes linkages between three distinct methods and their respective knowledge outputs for implementation/communication.
- Offers a structure to sponsors & grantees for program/project planning, proposal submission & review, project implementation, progress monitoring and summative evaluation.

Related Publications

- *Lane,JP, Godin, B.* (2013) ***Methodology Trumps Mythology***, *Bridges, Office of Science & Technology, Embassy of Austria, Washington, DC, 36.* *http://ostaustria.org/programs-projects-english/event-management/2013-04-23-10-55-57/2003-2001/382-categories-all/magazine/volume-36-december-14-2012/opeds-a-commentaries/6002-methodology-trumps-mythology*

- *Lane, JP, Godin, B, (2012)* ***Is America's Science, Technology, and Innovation Policy Open for Business?*** *Science Progress, June 12, 2012,* *http://scienceprogress.org/2012/06/is-america%E2%80%99s-science-technology-and-innovation-policy-open-for-business/*

- Flagg, J, Lane, J., & Lockett M. (2013) **Need to Knowledge (NtK) Model: An Evidence-based Framework for Generating Technology-based Innovations.** *Implementation Science*, 8, 21, http://www.implementationscience.com/content/8/1/21

- Stone, V. & Lane J (2012). **Modeling the Technology Innovation Process: How the implementation of science, engineering and industry methods combine to generate beneficial socio-economic impacts.** *Implementation Science*, 7, 1, 44. http://www.implementationscience.com/content/7/1/44.

- Lane, J & Flagg, J. (2010). **Translating 3 States of Knowledge: Discovery, Invention & Innovation.** *Implementation Science*, 5, 1, 9. http://www.implementationscience.com/content/5/1/9.

- Edquist, C, *et al* (2015). **Public Procurement for Innovation**. Cheltenham, UK: Elgar Publishing Inc. http://www.e-elgar.com/shop/public-procurement-for-innovation.

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ACKNOWLEDGEMENT

The contents were created under a cooperative agreement from the National Institute on Disability, Independent Living, and Rehabilitation Research (#90DP0054). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS).