

THE NEED TO KNOWLEDGE (NTK) MODEL VARIANTS: A COMMON FRAMEWORK FOR FOUR TYPES OF TECHNOLOGY PROJECT OUTPUTS

Joseph P. Lane, MBPA
University at Buffalo, SUNY

ABSTRACT

Government sponsors and grantees engaged in technology-based R&D intended to deliver beneficial socio-economic impacts can increase their success through proper project planning, implementation and management. The four NtK Model variants provide guidance for delivering outcomes in the form of commercial products, standards/guidelines, instruments/tools, or freeware.

Overview of the Need to Knowledge (NtK) Model

The Need to Knowledge (NtK) model is a reference tool for understanding how three distinct yet related methodologies combine to generate technology-based innovations intended to provide beneficial socio-economic impacts (Lane, 2012):

- Scientific Research methods are designed to generate new knowledge in the state of conceptual discovery outputs; new to the world facts about the physical world and the life forms within it.
- Engineering Development methods are designed to reduce such science concepts into practical forms; new to the world knowledge in the state of prototype inventions.
- Industrial Production methods integrate the conceptual discoveries from science and the prototype inventions from engineering, for the purpose of generating new products and services; creating new knowledge in the state of innovations for the global marketplace.

The NtK Model represents both how to verify and address a 'need for new knowledge' in all three states, and what actors 'need to know' in order to plan, implement and manage the technological innovation process (Lane & Flagg, 2010).

The creation of the original NtK Model was necessary because national government's sponsor university faculty and small business owners to undertake complex R&D activity for the purpose of generating the desired beneficial socio-economic impacts, such as in the field of assistive technology. Unfortunately, their record of success over several

decades demonstrates that these scholars and entrepreneurs – even with the best of intentions – often fail to deliver the promised results. Investigation revealed that most failures could not be attributed to ambitious and high-risk efforts. The more mundane reason was the investigators lack sufficient awareness of and experience the full range of required methods and management skills. Unfortunately, these projects often fail because the project managers don't know what they don't know about the broader innovation process. The failure results from not understanding and addressing the expectations, capabilities and constraints of downstream external partners.

In response to a request for an intervention, the author's created the original NtK model to represent the complex and extensive processes involved in generating technology-based products for the commercial marketplace. As such, it is based on the Product Development Managers Association's best practices in new product development. Being mindful of the need for Federal grantees conducting research and development projects, to communicate the results of their work to broader stakeholder communities, the NtK Model also integrated the knowledge to action strategy formulated by the Canadian Institute for Health Research (Flagg, Lane & Lockett, 2013). In short, the NtK Model explained what agencies and grantees 'need to know' from the outset, in order to increase the odds that their project outputs will be transformed into viable commercial market outcomes with the intended impacts.

Three Variants to the NtK Model

Of course, not all sponsored R&D projects intend to generate commercial products. A prior study of grantee efforts revealed three other categories of technology-based outputs (Lane, 2008). Consequently, the project team has since created three variants to the original NtK Model as follows.

1) NtK Model for Industry Standards & Clinical Guidelines

The written documentation of practices, methods, processes or criteria which are adopted as convention by a governing body, regulatory agency or professional practice group, through formal directives,

voluntary compliance or generally accepted norms. Industry Standards codify the requirements and specifications for delivering consistent quality in materials, products and processes. Clinical Guidelines codify the characteristics and procedures for delivering consistent quality in treatments and services.

2) NtK Model for Hardware Instruments or Tools

Hardware means any device comprised in whole or in part of tangible bio-electro-mechanical components. Instrument and Tool both mean an implement designed to perform a specific function in a valid and reliable manner. An Instrument is used for data collection, storage, analysis, management or monitoring. A Tool is used to measure, manipulate or fabricate any type of material.

3) NtK Model for Freeware Hardware or Software

The "free" in Freeware means there is either zero or negligible monetary cost to acquire the product or service (ware) from the creator. Freeware may consist of either 'Do It Yourself' instructions to fabricate/assemble hardware, or a software program downloaded from host sites (e.g., Apple or Android). The Freeware category of output excludes the exchange or acquisition of tangible physical materials or components from the creator.

New or improved outputs in any of these non-commercial categories may arise from advances in materials, techniques or applications (e.g., carbon fiber fabrication), or be prompted by the introduction of a new functional capability in commercial products/services (e.g., tilt-in-space seating).

All three variants contain the same three phases (i.e., Discovery, Invention, Innovation) as the original NtK Model. Although they share additional content with the original NtK Model, they each variant model diverges widely due to their unique requirements, the role of external stakeholders, and their intended eventual deliverables.

It is important to note that all four NtK Models share the same two initial Stage/Gate elements: 1. Define Problem & Validate Solution; 2. Scope Problem and Solution. These critical early project steps are intentionally portrayed as identical because when done well they establish the parameters for achieving beneficial socio-economic impacts. Doing them well is more difficult than it appears and rarely done in practice.

It requires a careful scrutiny of plans, implementation and management by experts in all three methodologies. These experts must be present as staff or consultants to the proposal review panel, the sponsor agency and the project team. This is the essential message the author's attempt to convey to all stakeholders involved in the challenges inherent in the technological innovation process.

All four NtK Model variants can be accessed and viewed at the author's project website:

<http://sphhp.buffalo.edu/cat/kt4tt/best-practices/need-to-knowledge-ntk-model.html>

ACKNOWLEDGMENTS

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). The contents do not necessarily represent the policy of NIDILRR, ACL, HHS, and you should not assume endorsement by the Federal Government.

REFERENCES

Flagg, J.L., Lane, J.P., Lockett, M.M. (2013). Need to Knowledge (NtK) Model: an evidence-based framework for generating technological innovations with socio-economic impacts, *Implementation Science*, 8:21. Retrieved February 1, 2016, from: <http://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-8-21>

Lane, J.P., (2012). The "Need to Knowledge" Model: An operational framework for knowledge translation and technology transfer, *Technology and Disability*, 24,187–192. Retrieved February 1, 2016 from: <http://content.iospress.com/download/technology-and-disability/tad00346?id=technology-and-disability%2Ftad00346>

Lane, J.P. (2008). Delivering the "D" in R&D: Recommendations for increasing transfer outcomes from development projects, *Assistive Technology Outcomes and Benefits*, Fall Special Issue. Retrieved February 1, 2016, from: <http://www.atia.org/files/public/ATOBSIF2008.pdf>

Lane, J.P., Flagg, J.L. (2010). Translating three states of knowledge — discovery, invention, and innovation, *Implementation Science*, 5:9. Retrieved February 1, 2016, from: <http://implementationscience.biomedcentral.com/articles/10.1186/1748-5908-5-9>