# AEA 2017 Panel Session 2099 - “Translational Research: Bench to Bedside and Beyond”

**Title: A prospective study of the translational process in the technology development and transfer projects of NIDILRR’s technology grantees: A Qualitative Study in Progress[[1]](#footnote-1).**

*Vathsala I. Stone[[2]](#footnote-2), Joseph P. Lane2,[[3]](#footnote-3) and Michelle Lockett2*

# ABSTRACT

This paper presents and discusses the rationale and methods of a longitudinal qualitative study currently ongoing at the University at Buffalo (SUNY). The study seeks to understand the knowledge translational (KT) process, including best practices and barriers, implemented in projects (n=19) sponsored by the National Institute on Disability, Independent Living and Rehabilitation Research (NIDILRR). These projects develop (assistive and rehabilitation) technologies and interventions seeking to improve health, function and independent living for people with disabilities. Adapted from the Canadian Institute for Health Research (CIHR)’s Knowledge Translation (KT) framework, NIDILRR’s translational model reflects elements of both Translational Research (TR) and Research Translation (RT), while including Technology transfer (TT). Using the National Institute of Environmental Health Sciences (NIEHS)’s TR framework as basis, the paper highlights parallels of KT with: (a) the stages of movement of research to impact (TR) and (b) the process of communicating research to non-research stakeholders (RT).

# Summary of Presentation

# Introduction

# (Title Slide)

This paper summarizes the rationale and methods of a longitudinal qualitative study currently in progress at the University at Buffalo. It is a long term study we are conducting at the Center on Knowledge Translation for Technology Transfer (KT4TT), and we don’t have findings to report yet.

Our Center is funded by NIDILRR (National Institute on Disability, Independent Living and Rehabilitation Research). NIDILRR’s mission is to improve the health & function and quality of life of people with disabilities, thus their abilities for community living and participation. So a big part of the funding supports Technology innovation projects, where the grantees develop innovative technologies i.e., assistive, rehabilitative, service and system technologies- for people with disabilities.

The issue addressed by the study is the same as the one we are discussing in this panel. That is…..

***How to get the Knowledge generated from Research to move through multiple stakeholders who uptake and work with the knowledge, to finally reach and benefit the target populations?***

NIDILRR, which sponsors our Center, addresses the issue using a KNOWLEDGE TRANSLATION or KT framework, which is the context for the study that is being presented.

# The Study Context: ACL/NIDILRR’s KT Framework focused on Technology Innovation and Use

# (Slide 2)

(Animation Section One)

The KT framework gives NIDILRR its program theory or logic model if you will – in particular, as applicable to its Technology Portfolio program, which funds its “Technology Grantees”. As we see in Fig. 1 in this slide, KT involves a comprehensive translational process that links the knowledge base in the far left of the figure -- i.e., **knowledge** accumulated in fields relevant to rehabilitation science, disability and related others ---- all the way across to the **impact**/**benefits** in the far right of the figure, which is, improved health and function, and abilities of persons with disabilities for community participation. This “horizontal” KT process, graphically speaking, is a knowledge **communication** process that bridges key stakeholders along the way to impact. As NIDILRR sees it, it involves a strategic, multi-prong effort to communicate knowledge to target stakeholders, through targeted and tailored dissemination, technical assistance and training, among other strategies. The role of this knowledge communication process is to facilitate the use of newly generated knowledge and products. (ACL/NIDILRR, 2017).

For this presentation, I take the broader view of KT being “the movement of knowledge” from origin to impact, where strategic communication between stakeholders is one important component. On the other hand, the very processes of generating the new knowledge/products that feed into and move forward through the communication chain, involve other components fundamental to KT - and these include knowledge transformation and transfer.

(Animation Section 2)

Within this overall structure, NIDILRR funds and supports two major translational processes, shown as vertically flowing down in this figure. These KT processes involve the **transformation** and **transfer** components of KT.

The first one is the translational process involved in product innovations through ***Stages of Development.*** This includes both technological and non-technological product innovations. For this presentation, I am focusing on technology innovations, which is a critical part of NIDILRR funding. Here, the grantees are R&D professionals – experts in scholarly research, practical engineering and commercial product development - who collectively generate the proof of **concept** of innovation through Scientific Research methods, then translate it into proof of **prototype** invention through Engineering Development methods, at which point they hand it over to industry which generates a market **innovation** through Industrial Production methods.  These activities correspond to the three Phases and methods of Scientific Research, Engineering Development and Industrial Production or **R, D, P** Phases. The transfer to industry (or the initiation of a start-up business typically) occurs between D and P.

Projects intending to generate beneficial socio-economic impacts through technological innovations represent NIDILRR’s Technology Grantees who propose and conduct technology-oriented development and transfer projects, and their translational processes are essentially **KT-for-TT** processes. And these projects are the focus of the current longitudinal study.

(Section 3)

The second translational process you see in this slide involves ***Stages of Research***. Where, NIDILRR’s academic and/or clinical researcher grantees uptake the technologies generated through the Stages of Development and translate them into ***evidence based interventions***. I am sure most of you recognize the parallel between these stages and the translational research steps proposed in the Translational Research Framework (TRF) just presented by Dr. Pettibone.

In a next step, horizontally speaking, Knowledge communication takes place for the uptake of these interventions by policy and service providers, which are eventually delivered to the targeted audiences.

Since technology innovation is key to NIDILRR’s mission, our center has developed an operational model to guide the translational processes involved in the development and transfer projects – or, the KT4TT processes. It is the Need-to-Knowledge, or, the NtK model.

# The Need-to-Knowledge Model: Three Methods generate three States of Knowledge (Lane & Flagg,2010)

# (Slide 3)

It is an evidence based framework consisting of Best practices in product development supported by an extensive scoping literature review we did in our last grant cycle. Please refer to the handout Fig. 2 for a summary view. It is based on the premise that product innovation involves (a) generating a Discovery (i.e., knowledge in a *conceptual* state) using the Scientific Research method; then (b) transforming the discovery into an Invention (i.e., knowledge in a *prototype* state) using the Engineering Development method; and (c) transferring it to industry stakeholders who use the Industrial Production method to solidify the invention into an Innovation (i.e., knowledge in a *product* state) and to transact their way to market.

Operationally speaking, the model offers a guide through a sequence of Best Practices that cover 3 phases R, D, P – research, development and production. I re-iterate that Technology Transfer (TT) takes place between the D and P phases The Knowledge-to-action or KtA processes shown in the figure are the activities channeling the project outputs horizontally-to other stakeholders for further translation towards the beneficiaries.

Note that the model begins with a step to verify the need for the knowledge itself. The idea is to build relevance (value) into the Knowledge early on so it increases the likelihood of the knowledge being uptaken by stakeholders going forward.

# The Need-to-Knowledge Model: An Operational Guide to KT for TT (Flagg, Lane & Lockett, 2013)

# (Slide 4)

As you will see on our website following the hyperlink on this slide, the R, D, P phases are further broken down into Stages, Steps and Gates. The steps are activities grouped under stages, and the gates are filters – they are check points in the process to decide whether to proceed further or to go back and improve previous steps.

The NtK model plays two important roles in the management of the KT for TT process.

First, because the NtK framework has been operationalized to such a detailed level, including tools and resources indicated, it makes it useful as a tool to ***plan*** technology transfer. In fact, our center has developed a Technology Transfer Planning Template (TTPT). You can also view it on our website following the link you see on the slide.

Secondly, we can also use the NtK framework as an evaluation tool, or a tool to ***track*** the implementation of the project’s translational processes. In fact, we are using the NtK framework as a tracking tool in the current study.

# Tracking the implementation of KT4TT through NtK Stages, Steps and Gates

# (Slide 5)

(Animation Section 1)

Here is how it can work as a tracking tool. For illustration purposes the slide shows just Phase One – Scientific Research. It shows the best practices of steps and gates all sequentially arranged in the form of a flow chart. The squares represent NtK steps and the hexagons represent the decision gates. The arrows represent the Knowledge-to-Action activities that carry outputs to other key stakeholders. The way we have used the flow chart is by shading the steps and gates to show their implementation status in a project. For example, here a dark green shade means the project implemented the step, a light green shows partial implementation and no shading means not implemented. This is a sort of visual “mapping” of the project’s processes overlaid on the NtK best practices. This will allow us to describe a project’s implementation “pattern” matched against the NtK recommended practices and to identify gaps and/or enhancements.

# The Longitudinal Study at the KT4TT Center

# (Slide 6)

The **Focus** of our study are the NIDILRR grantees’ development and transfer projects. The purpose is to analytically describe their translational processes;

In order to do so, our **approach** is to capture their translation stories by systematically tracking their project implementation from beginning to end.

The **Objectives** of the study are to:

(a) identify and document the barriers and facilitators in the translational processes of the (technology) development and transfer projects funded by NIDILRR. And

(b) use the findings to refine the NtK framework itself, and validate it to the grantee context – (using the NTK steps as the basis for capturing the translation stories of the grantees gives us this opportunity).

# Study Design

# (Slide 7)

***Design:***

The study design is to compile a Collective Case Study as proposed by Stake (1995,2003) by aggregating findings from individual case analyses of data captured prospectively and qualitatively.

***Participants:***

The study participants are the Principal investigators of development projects funded in the years 2013 and 2014. Each project is a “case” and we are following 19 projects or “cases”. Their participation is voluntary. And we have confidentiality agreements with them. As you see in the chart, some (the Rehabilitation Engineering Research Centers) are 5 year projects, others (Field Initiated Development projects) are 3 year projects or yet others (Small Business Industry Research II) are 2 year projects. But they are all development and transfer projects.

# Method

# (Slide 8)

Here is a snapshot of the method we are following.

Baseline Data:

* For a baseline view, we review each participant Grantee’s proposal and their tech transfer plans using a checklist based on NtK steps.

Follow-up data:

* Then we conduct follow up telephone interviews with the project PI every 3-4 months, once they start their implementation. We use questionnaires based on the appropriate NtK steps, and send it to the PI prior to the interview. The interview itself is one-hour long on the phone, with both myself and my colleague Michelle conducting the interview. Each interview is recorded – with the grantee’s prior consent - transcribed and sent to the PI for accuracy check.

Analyses:

* We code responses in the NVivo 10 software, and analyze them, through queries and related processes.

Findings:

1. We prepare a flow-chart mapping of the project processes using the NtK tracking tool as shown in Figure 3.
2. We also compile barriers and facilitators and organize them in emerging categories.

Reporting:

* We prepare a case report, send it to the PI for accuracy check. These are confidential documents, not for publication.
* Collective Case Study Report: Then we integrate them into a Collective Case Study report, keeping names and projects anonymous.
* We will make recommendations to Grantees on their processes; and we will inform NIDILRR’s policy concerns.

# Current Status

# (Slide 9)

So far we have completed 3 case reports. Finished data collection (interviews) with 9 cases.

The rest of the work is ongoing – both data collection and analysis being simultaneous for cases as applicable.

We hope to end when their projects end, so that we complete both the project’s implementation pattern map and their categorized barrier and facilitator descriptions and get grantee checks on the accuracy of each case report.

***Our Next Steps:***

We are therefore developing our own plan to continue tracking the projects through their no-cost-extension arrangements or new funding, as feasible – so we complete the Collective Case Study Report, give feedback to Grantees and inform NIDILRR’s policy concerns.

# REFERENCES

# (Slide 10)

1. ACL/NIDILRR (2017). Draft Long-Range Plan for the period 2018-2023. PDF Document for public comments (pp.1-33). Retrieved through [NIDILRR-announcements@naric.com](mailto:NIDILRR-announcements@naric.com), January 19, 2017
2. Canadian Institutes of Health Research (CIHR). *About knowledge translation.* Retrieved October 25, 2009, from<http://www.cihr-irsc.gc.ca/e/29418.html>
3. Flagg, J.L., Lane, J.P., & Lockett M.M.  [Need to Knowledge (NtK) Model: an evidence-based framework for generating technological innovations with socio-economic impacts](http://www.implementationscience.com/content/8/1/21), *Implementation Science 2013*, **8**:21.
4. Graham, I.D., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in translation: time for a map? *The Journal of Continuing Education in the Health Professions, 26*(1), 13-24.
5. Lane, J.P. & Flagg, J.L. (2010). *Translating three states of knowledge: Discovery, invention & innovation.* Implementation Science. <http://www.implementationscience.com/content/5/1/9>
6. NCATS/NIH (2015). <https://ncats.nih.gov/translation/spectrum>
7. NIEHS (2016). Draft Translational Research Framework for Environmental Health Sciences. Retrieved from *partners.niehs.nih.gov/assets/docs/draft\_translational\_research\_framework\_508.pdf*[Cached](http://webcache.googleusercontent.com/search?q=cache:Kg6VsiJoNZAJ:partners.niehs.nih.gov/assets/docs/draft_translational_research_framework_508.pdf+&cd=2&hl=en&ct=clnk&gl=us) Aug 30, 2016
8. Stake, R (1995). The art of *case study* research. (pp. 49-68). Thousand Oaks, CA: Sage
9. Stake, R (2003). Case Studies. In: Denzin, N. K & Lincoln, Y. (2003) (Eds.) Strategies of Qualitative Inquiry (2nd. Ed.). Thousand Oaks: Sage. (pp.134-164)
10. Stone, V.I., & Lane, J.P.  [Modeling technology innovation: How science, engineering, and industry methods can combine to generate beneficial socioeconomic impacts](http://www.implementationscience.com/content/7/1/44/abstract), *Implementation Science*, 2012, **7**:44.
11. Stone, et al. (2014). [Development of a measure of knowledge use by stakeholders in rehabilitation technology](http://journals.sagepub.com/doi/full/10.1177/2050312114554331). *Sage Open Medicine*, 2014, **2,**1-19.[SA1]
12. Stone, et al. (2015). Effectively Communicating Knowledge to Assistive Technology Stakeholders: Three Randomized Controlled Case Studies In: [Focused Issue: Knowledge Translation and Technology Transfer in Assistive Technology](https://www.atia.org/wp-content/uploads/2015/10/ATOBV9N1.pdf),  *Assistive Technology Outcomes and Benefits*, Winter 2015, **9**(1).
13. Sudsawad, P 2007. *Knowledge Translation: Introduction to Models, Strategies, and Measures.* Austin: Southwest Educational Development Laboratory, National Center for the Dissemination of Disability Research. (p.4; 21-22)
14. USDE (2006). NIDRR Logic Model: Targeted Outcomes Arenas. Federal Register/Vol. No. 31, February 15, 2006.: Appendix 2.
15. Wholey J S., Hatry H P., and Newcomer, K E (eds.) (2004). *Handbook of Practical Program Evaluation,* San Francisco: Jossey-Bass.
16. Weiss, C H (1979). The Many Meanings of Research Utilization. *Public Administration Review*, **39**(5): 426-431.

# ACKNOWLEDGEMENT

# (Slide 11)

The contents of this presentation were created under a cooperative agreement with the National Institute on Disability, Independent Living, and Rehabilitation Research (#90DP0054).  NIDILRR is an Institute within the Administration for Community Living (ACL) in the U.S. Department of Health and Human Services (HHS). The contents do not necessarily represent the policy of NIDILRR, ACL, DHHS, and endorsement by the U.S. Federal Government should not be assumed.

1. Paper presented at the AEA Annual meeting, November 10, 2017, for Panel session 2099 “Translational Research: Bench to Bedside and Beyond”. [↑](#footnote-ref-1)
2. Center on Knowledge Translation for Technology Transfer, University at Buffalo [↑](#footnote-ref-2)
3. Director, Center for Assistive Technology, University at Buffalo [↑](#footnote-ref-3)