The path to transferring technology innovations into the marketplace: a prospective study of NIDILRR grantee practices.

Michelle M. Lockett, Vathsala I. Stone, Jennifer L. Flagg
Knowledge Translation for Technology Transfer, University at Buffalo, Buffalo, NY

ABSTRACT

A five-year prospective case study on the technology development and transfer activities of NIDILRR's Technology Grantees is under way at the University at Buffalo's Center on Knowledge Translation for Technology Transfer (KT4TT). The goal is to identify the steps involved in developing and moving new technologies into the hands of those who need them, and to uncover the common barriers or challenges that impede technology transfer (TT), as well as practices that facilitate it. The researchers are following 19 development projects -14 enrolled in 2013 and five in 2014, and conducting sequential interviews to track the methods and activities they use for developing and transferring their outputs. Data will be used to refine and contextualize the commercial devices version of the Need to Knowledge (NtK) model to benefit future Technology Grantees in both grant proposal development and project implementation. Recommendations to NIDILRR for policy or program changes will promote an increase in the projects' successful transfers, ultimately benefitting people with disabilities.

BACKGROUND

Section 200(3) of the Rehabilitation Act charges the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) with promoting the transfer of rehabilitation technology to individuals with disabilities. Various grant programs such as Rehabilitation Engineering Research Centers (RERCs), Small Business Innovation Research programs (SBIRs), Field Initiative Projects (FIPs) and others are funded by NIDILRR each year to accomplish this mandate. However, recent reviews suggest that few technologies are being created or transferred (Lane, 2008; National Research Council, 2012).

The National Research Council (2012) recently completed a review of NIDILRR's grant making processes and products, where the review committee critically analyzed the quantity and quality of the Grantee projects' outputs. The committee found that an overwhelming majority (70%) of outputs were publications, and that the project results were mostly used by Grantees to generate new projects. Aside from this, the committee also found it difficult to link knowledge outputs, such as publications, to the creation of actual consumer products.

Many NIDILRR Grantees find it daunting to get their inventions into the hands of their intended user, particularly when the invention is a technological product. Through a retrospective study, Lane (2008) found that only 25% of development projects proposed by RERCs had actually shown progress towards transfer of the innovation. But why?

Lane's study suggested that many of the Grantees were lacking the tried and true models, methods and metrics employed by new product development (NPD) managers within industry. If Grantees implemented similar NPD best practices used by successful private sector companies, the likelihood in transferring their inventions would increase.

NIDILRR recognized the need to provide technical assistance to its Grantees in an effort to improve TT rates, consequently creating a center on Knowledge Translation for Technology Transfer (KT4TT). The KT4TT Center was charged with conducting rigorous research, development, technical assistance, dissemination and utilization activities to increase successful transfer of rehabilitation technology products developed by NIDILRR funded Grantees.

The study described here is one of several KT4TT projects designed to increase NIDILRR Grantees' TT rates, and their understanding, and capacity for TT. It represents a collaborative follow-along of multiple NIDILRR grant projects in an attempt to uncover barriers to, and facilitators of TT. Future Grantees will be presented with real life scenarios of what works and what doesn't in the transfer practices for assistive technology devices. In addition, we will outline the processes of the projects that do successfully transfer their outputs, identifying a general technology development and transfer path NIDILRR Technology Grantees may follow in order to optimize their chances of successful transfer.

PURPOSE

The overall purpose of the KT4TT Center is to enable and support NIDILRR Technology Grantees to successfully create and transfer innovations. To this end, this study will make a twofold contribution. One, it will study the process used by the Technology Grantees

to plan and implement activites of TT or commercialization of their intended project outputs, and identify best practices. Two, it will use these identified best practices to enhance the Need to Knowledge (NtK) model (Flagg, et al., 2013) and make the model more relevant to federal Grantees intending to improve the lives of people with disabilities through the commercialization of assistive technologies.

By adding a valuable resource in the form of a successful TT model relevant to their collective context, the study will thus offer indirect technical assistance to Grantees. However, the project team will refrain from providing direct technical assistance to participants during the study, in the interest of ensuring unbiased and non-intervening research procedures. Nevertheless, this does not preclude the researchers from being open to any Grantee request during interactions and channeling it to appropriate expertise or resources for technical help. Two main research questions are guiding the study:

RQ1: What paths do NIDILRR Technology Grantees follow to accomplish innovation and what are their respective rates of progress/success towards transfer and the corresponding barriers and facilitators?

RQ2: What are the strengths of the NtK Model and what needs refinement?

METHOD

Subjects

All newly funded NIDILRR Technology Grantees who proposed to develop and transfer either a commercial product, a standard / guideline, an instrument / tool, or freeware are invited to participate in the prospective case study. A total of 19 cases are currently enrolled in the study. The breakdown of participants can be seen in Table 1.

Table 1: Number of Participating Cases by type of Grant and Year of Funding

Type of Grant	Number of years in funding cycle	Number of Cases - Funded in 2013	Number of Cases – Funded in 2014	Total Cases
RERC	5	10	0	10
DRRP	5	1	0	1
FI	3	3	3	6
SBIR 2	2	0	2	2
Total Cases		14	5	19

The funding period for this prospective case study ends in 2018, which restricts the type of grant that can enroll in the study, among those funded beginning in 2015. If an RERC or DRRP grant were to enroll in the study in 2015 or 2016, the researchers would not be able to follow them to conclusion due to budget constraints beyond 2018. Because of this, Phase II SBIRs were the only grants which were sent recruitment materials for the 2015 funding period.

Most enrolled participants are the overall PIs of the entire grant, although some are RERC Co-PIs who are leading individual development projects. The ages, gender and experience as a NIDILRR PI vary.

Instrumentation

Data is collected through phone interviews with participants, using structured questionnaires that allow for clarification through probing. The NtK serves as the frame of reference that guides the interview questionnaires. The original Need to Knowledge (NtK) model for commercial devices contains all of the activities and decisions necessary to generate technology-based products/services for the commercial marketplace, under 3 phases: Research, Development & Production. Each questionnaire corresponds to a particular stage of the NtK, of which there are nine – three stages for each phase. Questions are designed to identify if and how each project completed the steps within each stage of the NtK, or what alternative steps were carried out to complete that stage. All questionnaires are created using Microsoft Word and e-mailed to each participant prior to the scheduled phone interviews.

Phone interviews are conducted via a teleconferencing phone by a team of two researchers using the meeting facilities at KT4TT Center, and it allows the interviewers to connect up to two different phone numbers. An Olympus WS-803 digital voice recorder placed next to the conference phone records the interviews. The digital recorder is very effective in capturing the conversation and easily downloads audio files into the analysis and transcription software.

NVivo 10 is the analysis and transcription software used by the researchers. All data, audio and text, is stored, coded and analyzed within NVivo. The transcription service used to transcribe the interviews is called TranscribeMe and is embedded into NVivo.

Procedures

The abstracts of newly funded grant projects found in the NARIC database are examined to determine if the project intends to develop a technology output that will be transferred to an external end user. Recruitment letters are then sent to eligible Grantees to congratulate them on their new award and inform them of the opportunity at the KT4TT Center to participate in the prospective case study. Approximately one and a half weeks later, a recruitment e-mail is sent out, providing

a little more information about the study and how it can benefit the Grantees. Links to the KT4TT website are included in the email. A third email is sent out a couple of weeks later to any non-respondent Grantees. If they do not respond to the third contact, the researchers call them to clarify any questions they may have about the KT4TT Center or the prospective case study. It usually takes several phone calls to either get in touch with the grantee or to get a response.

Once a grantee has agreed to participate in the study, a request is made for them to share their final project proposal with the researchers. Review of the proposal assists the researchers in thoroughly understanding the proposed project and their planned technology development and transfer activities. The proposal narrative is also used to plot their planned activities against an NtK checklist, to foresee how many of the steps they might accomplish. In the case of a participant's inability to share their proposal, it would be requested through Freedom of Information Act (FOIA), however all participants have been able to share their proposals. Participants are also sent a contact/demographic form and the Institutional Review Board (IRB) consent form to fill out and sign, all of which can be done electronically through e-mail.

Once these forms are returned and the proposal reviewed, the researchers then send the participant the first questionnaire through an e-mail attachment suggesting potential dates and times for the first interview. It is requested that the questionnaire be completed and returned within a day prior to the agreed upon interview date. This allows the researchers time to review the answers and prepare any follow up questions, and frees up time to get in-depth clarifications. Interviews are kept to a one-hour limit, unless the participant is willing to extend it a little longer. No interview is recorded without prior consent of the participant. All except for one participant have consented to the recording.

Interviews occur every three to four months. Before each new interview, an email is sent out with two suggested dates and times for the upcoming interview along with two attachments - the new questionnaire and the transcript from the previous interview. The transcripts have been helpful for both participants and researchers in recalling what activities were last discussed and what activities were planned to happen in the interim. One participant had this comment regarding the transcripts: "…actually it (the interview transcript) was very helpful to review." Another participant asked to have the transcript sent to him as soon as it was available because it would help him prepare for a meeting with his project officer.

Reviewing the transcripts prior to the interview also assists with probing questions such as, "How did that advisory board meeting go that you said you were preparing for last time we talked?" These questions help both the interviewers and interviewees to keep their ongoing activities on track and allows for discussion of any barriers that may have arisen. Reviewing the transcripts also prepares the interviewer to revisit any questions that may have gone unanswered in the previous interview. This helps to match and verify if or when the project activities represent completion of specific NtK steps.

The two researchers transcribe and code the transcripts, individually and in triangulation, in between interview sessions. This also assists with identifying new questions for each of the participants and formulating possible theories or themes for analysis.

EXPECTED OUTPUTS AND OUTCOMES

Considering this study is ongoing through 2018, the findings and conclusions are beyond the scope of this paper. However, the results are expected to lead to the following outputs and outcomes.

Outputs

1. Individual case summaries for each participant and their respective development project. Each case summary will describe the development path taken by highlighting both the NtK steps that were fulfilled and those that were not. Activities performed which differed from the NtK will be noted. Barriers and facilitators to the project will be described, along with recommendations for future projects.
2. A complete analysis of all cases combined, with recommendations for both NIDILRR Grantees and the funding agency, NIDILRR, on how to increase the likelihood of getting development project outputs into the hands of the end beneficiary. The NtK provides us with a frame of reference or a theoretical pattern against which we can match the observed patterns identified by the project activities of the Grantees (Trochim, 1989; Kane & Trochim, 2007). As a result of such process pattern matching, best practices that contribute to transfer success can be identified.
3. A more contextualized and refined NtK model for use by NIDILRR Technology Grantees, including integration of three variant NtK models for Standards & Guidelines, Instruments & Tools, and Freeware & Software.

Outcomes

1. A Technology Transfer Planning Template (TTPT). One of the development projects with the KT4TT Center is creating an interactive online TTPT which will guide Grantees through the creation of their TT plan. Information obtained through the prospective case study will be utilized in the creation of the TTPT.

2. Increased Grantee knowledge on the steps necessary for successful TT. Grantees of future projects will learn about these steps through papers and presentations, and through use of the TTPT.
3. A refined grant review process whose criteria call for steps crucial to successful accomplishment of TT. Recommendations will be made to NIDILRR, suggesting changes to grant proposal criteria, the grant review process, and annual performance reporting.

CURRENT STATUS OF THE STUDY

The prospective study is approximately at the half way point of completion. Meanwhile, two of the participating projects had to terminate early due to lack of findings that would allow them to move forward. The case summaries for these two projects are currently being drafted and will be delivered to the participants upon completion. By the end of September 2016, there will be three FI and two SBIR-Phase II projects that will be finishing and ready for case summaries to be written.

Data coding and analysis is under way. One researcher is manually coding the transcripts using a framework created in Excel while the other researcher is using NVivo to code all the transcripts. Both researchers have reviewed each other's pilot coding work, and discussed and agreed on how the text should be coded. A third expert researcher has reviewed all coding done by the two researchers and participated in the coding discussions.

As the analysis continues, these concerns will remain in focus: How can the development projects do better and how can NIDILRR's policy changes support and increase the likelihood of seeing more beneficial products move out into the marketplace?

DISCUSSION

Grantee efforts to accomplish TT face challenges from multiple sources as they operate in a complex environment where multiple stakeholders interact. Policies – coming from funders, third party reimbursers, host institutions, or partner organizations - can either help or hinder these efforts. Internal to projects, staff capacity and organizational culture can also help or hinder technology transfer success. Lane (2008) attributed the lack of successful transfers to a few causes, mainly "deficiencies in problem selection and operational issues" (p.1). He further explains that many of the proven new product development methods used in industry are not common practice among academicians including those who lead many of the RERCs. The findings from the prospective case study will either corroborate these notions or dispute them, given that the NtK model incorporates the earlier mentioned new product development methods.

Summing up, the findings from the prospective case study will provide future Technology Grantees with the knowledge necessary to develop a winning grant proposal and to successfully implement and take the funded project to transfer of development outputs. These findings will be disseminated not only through outputs (papers and presentations) of the study but also through the forthcoming interactive Technology Transfer Planning Template and the variant models of the NtK.

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