**2015 KT Conference: KT Solutions for Overcoming**

**Barriers to Research Use**

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Session: Linguistic and Conceptual Barriers that Hamper Effective Communication with Policymakers & Implementers

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Joann Starks: Joe Lane, Director of the Center on Knowledge Translation for Technology Transfer or KT4TT. The purpose of the Center on KT4TT, located at SUNY Buffalo, is to improve and convey best practices regarding the models, methods and metrics involved in achieving—to improve the quality of life for persons with disabilities. Joe, we are ready for you to go ahead and start if you are ready.

Joseph Lane: All right. Thank you, Joann. Thanks for the opportunity to be here, and good afternoon to everyone who is listening in.

The purpose of my talk today is to talk about Linguistic and Conceptual Barriers that do hamper effective communication with both policymakers and what we would call policy implementers.

And I know in the last Q&A session there was some discussion of that, about dealing with sort of the career staff people as well as dealing with the policymakers or people who work in agencies who are decision-makers who actually implement programs. And they are certainly both important. You know, we have people who make legislation and decree new acts, standards, and regulations, but then we have the people who have to carry out that work. So part of this discussion is to talk about both. Because I am coming from the Center on Technology Transfer, my discussion will be oriented as much towards technology development as it is towards scientific discoveries or scholarly outputs. But I hope to cover both.

 I'd like to start with this quote that I saw recently. It's not a new quote, but I thought it was very relevant. The single biggest problem in communication is the illusion that it has taken place. And I think this quote is so pertinent to knowledge translation or to pretty much anything we do.

I am participating right now, the last couple of days, in a Technology Transfer Society conference, and people sit in a room and someone speaks in front of the room, and just like here with the webcast, we have comments and PowerPoints, but how do we know we've really communicated? And I think that's really the heart of what we are talking about when we are talking about knowledge translation, that having the formats and the formality is sufficient -- or necessary, but it's not sufficient to determine that communication has actually taken place.

This talk is really about relevance, and from the area of technology transfer -- and that is trying to move ownership and control over intellectual property in the form of discoveries and prototypes from the source to the potential user, be it an intermediary user like a manufacturer or an educator or an employer, or if it's moving it to the end customer, be it a person with a disability, a care provider, or professionals, it's really all about relevance. Relevance is the key to effective communication. Policymakers and policy implementers are especially attuned to relevance for their constituents. And I think that also came up during Kathryn's comments in the question and answer session that we really have to be attuned to the interests, motives, and incentives of the target audience if we want to communicate effectively.

Basically, what we have been learning from our work in this area is that achieving relevance requires rigor in determining what new knowledge to generate as much as in how to communicate that new knowledge to audience. But an essential point is we still won't control the consequences, even when we've prepared our materials for communication, even though when we assume we've communicated effectively, we won't quite know what the results of that communication effort are until something is realized in terms of outcomes or impacts.

 Now, part of the issue here is that we are dealing with a high level of noise to signal. And it's just increasing every day. Policymakers and policy implementers are constantly bombarded with new knowledge from innumerable sources. There is new knowledge communicated to them for their adaptation, adoption, and application. There's new knowledge communicated by them for adaptation, adoption, and application by others. And I found an interesting recent statistic that Americans are estimated to receive an average of 74 gigabytes -- that's 9 DVDs' worth of new information each and every day, and that's pretty impressive. If you think that's the average American, just imagine the amount of information that's presented to people in positions of power and people in positions of influence.

It's a staggering amount, and that's the problem. How do they sort, how do they determine the distinction? How do policy-level actors sort through the constant stream of noise to detect meaningful signals? And part of determining what is a meaningful signal is ensuring that we understand what is important to that policymaker or that policy implementer/actor in order to present them with a clear signal that can cut through the noise and perhaps actually reach them or some sort of effective result or action.

Certainly, you know, how do you, as a researcher, ensure that your messages reach and influence those who make and implement policy? Because as you can imagine, much of the time of policymakers and policy implementers is screening out what they consider to be noise, and there's often teams of people, you know, you have elected officials, they have advisory staff, who each one in a specialty area, and they rely on those people to screen the incoming information and to basically tell them what's important for them to consider, what's important for them to pay attention to, and what's important for them to act upon.

 So I collect images, as you can see, from different places that sort of represent to me what happens when we’re trying to communicate information, both from the presenter side and from the recipient side.

 Of course, relevance is a two-way street. You know, we have to use shared communication or we have to use shared terminology in order to communicate effectively.

One of the issues we are dealing with -- and it was certainly a point of constant discussion in the past two days in this Technology Transfer Society conference I am attending, is that scholars are trained in the shared language of scienific research, but few, if any, of the other stakeholder groups we are communicating with are trained in that same language. Scholars pursue fundamental discoveries, and they may be content to operate within that referent peer group, but that's certainly not enough to communicate effectively to external stakeholders.

 Those scholars who are sponsored by programs intending societal benefit must bear some additional responsibility for framing their activity into the context of the broader society in which they contribute. And that was a good part of the discussion today. There was a gentleman, Marcus Perkman from the Imperial College of London who made a presentation on the impact of science, and there's been a lot of studies on what's important to science. Marcus said that even in the UK's colleges and universities that are known to be most highly connected to industry, most highly connected to funding from the private sector, most highly connected to translating and transferring their scholarly outputs to society, they still most highly rate those core scholarly principles of research, publication, training of graduate students.

You know, those incentives still drive their actions. So when we are talking about programs that are supposed to move beyond generating new knowledge to apply that new knowledge for societal benefit, that's where the additional awareness and responsibility has to come in in terms of communication as well as in terms of operational activities.

And we are seeing in the U.S. and in other countries as well, national and program budgets are shrinking. There's simply less money to go around. So effective communication is critical to preserving the flow of public funding. I know that's a point raised in the prior session as well, that people who are skilled at explaining the value of their work will be in a better position to justify continued funding to their area than those that are not in a position to explain their work. And this contraction of budgets is common to pretty much every country on the planet.

 Now, we talk about scientific research, there are some assumptions, and those assumptions tend to shape the way scholars communicate. Because scholars assume that their research has benefits to societies, and they see two related pathways it occurs. Basic science is initiated by autonomous scholars, and it contributes to the global knowledge base as a reservoir of knowledge. And there's an assumption that for basic research, that's enough. The information is published, it's out there, it's available for other people to access, and many scientists are content for that result.

But it's really only regarding the fundamental forces and mechanisms that shape our existence. There's very little direct evidence of societal benefit occurring directly. So what we have is we have indirect back-tracing, anecdotal narratives that talk about serendipity and overextended time frames, which are largely independent of that investigator. Yet we try to attribute credit back to the source of the basic research for future inventions, innovations, and social and economic impacts.

And even closer to application is applied research, which is initiated by engaged scholars, and they are more interested in the orientation and application of their work, so they explore their subject matter related to solving specific problems. In that case, where it occurs, societal benefit occurs directly, intentionally, and over shorter time frames. And those likely directly involve the investigator. So we have a lot of good examples of the human genome and Google and other things where we know of the actors who generated the actual work because there was a direct link between the scientific research, the outputs of that work, and the application of those outputs to benefit society.

The only issue we run into is the distinctions between basic and applied research are somewhat of a misnomer because neither one determines the actual future application. It's the relevance of the material that determines that. Many people who think they are basic scientists actually see their work eventually applied to society's benefit. And an even larger segment of people who believe they are doing applied research are not successful in transferring that knowledge out into the marketplace for the benefit of society. So it's not so much the intention of the investigator as the perceived relevance by the external audiences. And that level of relevance, the assessment of that level of relevance, requires much more input from other skills and sectors, and that was part of the discussion earlier today in this tech transfer meeting, where you have wonderful basic science discoveries, but we say science discoveries stand on the shoulders of giants.

But the transfer of those discoveries also stands on the shoulders of giants, and those giants are in the fields of engineering development and industrial production. And the government agencies that support that work and the societies that are enlightened enough to sponsor the work.

So in all cases, the outputs from the scientific research can initiate benefit, but the relevance must be recognized by others, and it requires others to invest much more time, resources, and energy to realize the benefits for society. Now, these couple of citations came up in recent discussion about the NIDILRR's new stages of development, what is the difference between research activity and development activity. Unfortunately to enlighten our collective discussion, the U.S. Catalog of Federal Regulations had clearly defined and differentiated scientific research from engineering development, and essentially, the CFR says what must grantees do in carrying out research? A grantee must identify one or more hypotheses; based on hypotheses identified, perform an intensive systematic study directed toward the generation of new or full scientific knowledge; or some greater understanding of the subject matter or the problem studied.

It's important to pause there because that is truly the purpose of science. It's truly the output of the scientific research method is to establish a hypothesis, perform systematic studies to test the hypothesis, and then report the results. So it's scientific knowledge or understanding of the subject matter.

 Separately, we have development activities, and that's engineering. In my field, for technology, it's engineering development activity. And I think this definition holds well in carrying out development activity, a grantee must use knowledge and understanding gained from research. Now, it's not necessarily sequential. This knowledge and understanding could be gained from research conducted by anyone from any institution basically at any time anywhere in the world. But it is the application of scientific knowledge to create materials, devices, systems, or methods, which are intended to be beneficial to the target population, and that activity, that engineering development activity includes design and development of prototypes and processes.

So we have clear distinction and delineation in the U.S. Catalog of Federal Regulation that scientific research generates new knowledge in the form of conceptual discoveries, and separately, engineering development generates new knowledge in what we consider to be the state of prototype inventions. And I will spend a little bit more time talking about those distinctions.

 If we lay those distinctions out in a logic model and compare the two, it's very clear how they work from input to process to output; that the input to the research is the identified hypothesis, the process is the systematic study to test the hypothesis, and the output is greater understanding of the subject or problem. And that is the sum substance and total of what the scientific research method purports to do

What we struggle with is we often have people intending to be champions for the scientific research method and for university-based research to overstate the potential utility of the outputs from the scientific research method that many things are spoken in aspirational terms; that this discovery may some day lead to or this new finding is likely to cause a cure for ... But we have to be careful we make those kinds of aspirational claims when we are talking to policymakers and policy implementers because they tend to represent the interests of society, and they are not thinking long-term, they are not thinking in general terms; they are looking at what benefit can we receive from this output in the short-term in direct benefit to society through social or economic benefits to improve people's quality of life.

 So presenting to policymakers and policy implementers some new results from a study, we have to be careful to sort of compartmentalize or limit the claims for its utility, certainly, then, in the case of technology-based or technology-oriented research, we can then go on to talk about the development activity to say if we can apply now that research-based understanding or new finding in the creation activity of the design, construction, testing, we can yield some new material, device, system, or method that, in turn, could then be transferred out through manufacturers, suppliers, clinicians to benefit society. But it's certainly important for us to be careful in how we set expectations for policymakers and policy implementers, that we limit the claims to what we know our methods can generate.

When we combine sort of all three of these activities -- hold up here.

 Basically, part of what I was here to discuss at this conference is that we have to appreciate that societal benefit derived from technology-based solutions really requires new knowledge in all three distinct states of activity. You know, the state of conceptual discovery is critical, and that arises from the scientific research methods. However, reducing those concepts to some practical -- reducing those concepts to some practical form is equally critical. We can discover the attributes of new carbon fiber materials, but until those are reduced to practical form, we don't know to what extent they will be useful to society.

We can look at new genetic screening tools, and we know we can identify different disease components inside the genome, but how does that work in practice? We have to reduce those concepts to a prototype invention, say yes, this appears to be feasible to work in practice. But neither of those is sufficient. We have to also include the state of commercial innovations, and those arise from industrial production methods. All three are related methods. All three are designed to generate knowledge in very specific states. But each has a set of unique attributes, and this was covered in a paper now -- it doesn't seem like it could be that long back -- back in 2010 we wrote a paper about translating knowledge into three different states of discovery, invention, innovation. And when translating knowledge and making claims for the utility of that knowledge to society, again, it's very important to sort of set the boundaries for the potential application of this output from a particular methodology.

To just drill a little bit deeper into this, each of these states of knowledge are quite unique, and we can demonstrate their uniqueness by looking at their individual purposes, the process involved, their outputs, even their legal intellectual property status, as well as their value. And so for example, conceptual discovery, state of knowledge from scientific research, it does use the scientific research method to create new-to-the-world knowledge, and I think the catalog of federal regulation clarified that as well.

The process involved in scientific research is empirical analysis to reveal novel insights regarding some key variable precipitated by the push of curiosity or the pull of some gap in the field. They are both legitimate.

 The output of scientific research can only be expressed as a manuscript or presentation because it's still -- it's a new insight, a new point of fact, it's a new knowledge. It's what we call the "know what" of knowledge. It's to learn something new.

Interestingly, when you think about it from the legal intellectual property status, the only thing you can do with a scientific discovery is copyright it. That's the only protection allowed. Why? Because its value is its novelty as the first articulation of a new relationship or some effect which contributes to the global knowledge base. And we can explain that to a policymaker or a policy implementer and say, here's an exciting new discovery, but we also want to bound our claims to the fact that this is the "know what."  Now we have to worry about the next stage of what we do with that new knowledge.

So from a technology perspective, we move into the invention state of knowledge. Here the purpose of engineering development methods are to combine and apply scientific knowledge as functional artifacts. We have to reduce that new discovery into some practical form. How is that done through engineering development? It's really trial and error experimentation and testing which demonstrates the proof of concept. It's a little bit different. In scientific research, we are trying to control the variables and limit those we manipulate to discover relationship. In engineering development, we try to vary all the variables. If that doesn't work, let's try this. How about if we combining these things? We are not worried about the final form; we are only trying to make sure that actually in theory can work in practice.

This work is also initiated through opportunity supply or some operational demand forces out there in society or in the marketplace.

Now, the output from engineering development is a state of knowledge. It is a prototype invention. And this is where we can use the word "invention" because you can claim a prototype which is embodied to demonstrate the functional feasibility as the "know how."  We can demonstrate how something works, and that's why the term "know how" is usually used when we talk about some new product or some new service.

 Now we can apply the intellectual property status of patent protection. And why? Because the value now has increased from not only the novelty of a conceptual discovery, but now we can add the value of the feasibility of a tangible invention. And if you understand patent claims, you need to provide both in order to be successful in claiming a patent rights. You have to demonstrate that it's novel, and you have to understand that it's feasible. You have to demonstrate that it's feasible in practice.

So one can speak about a patent in prototype and its potential utility to policymakers, policy implementers, and decision-makers differently than you can talk about the outputs from scientific research.

 And then we have the innovation state of knowledge. Now, this is really the industrial production methods that codify knowledge drawn from scientific research and industrial engineering development into products or product components that can be positioned as new or improved products or services in the marketplace.

The process involved in industrial production is a systematic specification of the components and the attributes of those components to yield some final form. I mean, we are surrounded by commercial products. Each one is an intentional combination of components designed to deliver a specific function under certain price point and within the boundaries of whatever regulations apply.

 The output from industrial production is a market innovation, which is embodied as a viable device or service within a defined context, which typically is initiated through a commercial market opportunity. There has to be a "know why."  Companies need to know why they should invest money in a new product or service before they do it.

 Now, the interesting thing, again, we have a separate legal intellectual property status for the outputs from industrial production, and that's a trademark. You bring a new product to the market, Nike, Apple, any company out there, whatever components were demonstrated to be novel and feasible have already been protected through a patent. But now you can add a further protection of a trademark. And the value here is not only is it novel and feasible, but now it's demonstrated to have utility. And that utility is defined as revenue to the company who manufactures it and utility as function to the customers who acquire it. So now you have three levels of value and in communication to policymakers and policy implementers, it's much easier to talk about the value of a product or service to society than it is to talk about the short-term value of engineering development inventions or conceptual discoveries from science.

Now, both innovation and impact require the engagement with industry, and one of my talks at the meeting on that now was about needing to sort of reorient our national R&D program to make sure that we are serving the needs of industry, and that is not to involve basic scientific research, but it's for those hybrid programs that are supposed to be generating innovative products and services that are supposed to generate social and economic benefit for society.

The problem here is we have been using these terms of innovation and impact loosely. We haven't been careful with the terms. So traditionally, each sector -- whether it's the academic sector, business sector, or government sector -- they have defined terms in their own narrow context, not really concerned with downstream market activities or the broader social benefits. And everyone's been comfortable in the status quo of fairly large and expanding budgets and paradigms in the last part of the 20th century, but that's changing. And it's interesting that it's changing both in Europe and in the U.S.

In fact, the U.S. National Science Board in 2012 accepted the OECD Euro stat definition from 2005, and they've very much compartmentalized the term to mean the introduction of new or significant improved products (goods or services), processes, organizational methods, and marketing methods, but only in the context of internal business practices or in the open marketplace. So when communicating the outputs for projects or proposals for new activity, it's important to be concerned that the terms used, like innovation and impact, are carefully bounded because you don't know to what extent the policymakers or implementers or their advisory staff are aware of these terms and aware of the current definitions of terms that bound this work to make it easier for policymakers to decide which programs to support.

The bottom line here is that innovation, especially technological innovation, is a business enterprise issue. So we have to be careful to restrict the use of the term, the project outcomes with some potential market value. But any form of R&D, any form of methods and stages that involve scientific research and engineering development can really generate four different types of actionable knowledge outcomes. R&D programs can generate industry standards and clinical guidelines. They can generate analytic instruments and fabrication tools that may not be designed for the marketplace but may be designed for use in a specific laboratory. They can generate freeware, software applications or do it yourself hardware kits; and lastly, they can produce commercial products and services. Only the fourth category, commercial products and services, typically involves industrial production, but you can see that all four of these need to engage the other stakeholders in order to ensure there are recipients for the outputs from R&D projects. This was outlined in a great amount of detail in a prior publication.

Pretty much the publications I list in these presentations are all open access so easy for people to click in and get access to those materials if they so choose.

Now, we have to talk about the consequences of communication, that when you approach a policymakers and others, like implementers and decision-makers, they may have four different levels of new knowledge engagement. They may have no awareness whatsoever. They have no clue what you are talking about. They may have some awareness, but they may not have any particular interest in it. It sort of dwells in their zone of indifference. They may have some interest in the topic you are describing, and they retain the information you provide in order to explore it further. Or you may get some signal of that interest and, therefore, you have a basis to follow up with them or even their support staff, or you have a decision to actually apply the knowledge, apply the new knowledge, whatever state it's in, which is active implementation. But of course, you still have to be careful that the use of new knowledge, maybe as intended by you as the creator -- in which case we are looking at direct adoption -- or we may be talking about use as modified by the actor, by the recipient of the knowledge.

In that case, it may be adapted before it's adopted. So one has to monitor the actual recipient of the knowledge to know which way it might go. And it doesn't end there. Policymakers and others, their own intents, their own incentives drive three different forms of knowledge use. You know, there's what we know to be instrumental use, where they are going to take your new knowledge, your new finding, your prototype or your product, and they are going to work very hard to move it forward, to promote it, disseminate information, engage others to use it. That instrumental use is quite specific and direct. Or they can use what you present in a conceptual level. They can use it as general enlightenment, and it may not have an effect on their actions immediately, but it may be retained for use in other ways.

Then, of course, we have strategic use, which may legitimize a prior perspective or may provide some other form of benefit. Kathryn mentioned that in the one study, where the group in the north part of the country was quite excited because it raised -- their actions had raised their profile, and rather than necessarily the specific adoption of their findings, and that is clearly an example of strategic use. They are all relevant. They all count. But, of course, it depends on your objective. And there's no reason why any one of these levels of use can't be modified through additional engagement with the stakeholder audiences to shift from one to another.

So they are all in play at that point. Now we get back to the notion of knowledge translation and being a center on knowledge translation for technology transfer, we certainly had a look at this very closely. And what we found in our analyses was all the knowledge translation and the knowledge-to-action models, especially those from the Canadian Institutes for Health Research, assume some inherent relevance and value within scientific research findings. There was not anything in the models that say prior to grant or prior to funding or prior to engagement we need to verify that the plan will generate novel information, that that novel information fills a gap both in theory and in practice, and from a technology perspective, that there is an opportunity to move that knowledge forward through translation, transfer, and eventual commercial transactions to be applied in the marketplace.

So that's something that we've certainly worked to add, especially to those types of projects.

And what we also find in the knowledge translation models is some articles and some scholars talk about a persistent lack of absorptive capacity among nonacademic stakeholders. So there's a question whether stakeholders can really perceive the value in a paper that's prepared for presentation in a scholarly journal. So that's another assumption that we tried to clarify and thought we should explore in some greater detail. To what extent is this, in fact, a lack of absorptive capacity on the part of recipient audiences? And is that why we have less translation and application than we'd like to see?

And a related point that it's assumed that engaging stakeholders at any point after a project commences is sufficient to initiate successful translation. And again, as a center looking at knowledge translation for technology transfer, we had to examine all of these assumptions and test them and see what else might be appropriate when we are talking about effectively communicating knowledge that relates to technology-based knowledge in the state of scientific research discoveries, engineering prototypes, or commercial products.

And some of you are familiar, I think, with the papers cited at the bottom of this page, and some of you may even have been involved in the three RCTs that we ran to test some of these knowledge translation assumptions, where we looked at three studies conducted -- we conducted three studies using published findings from completed projects that came from three different fields of assistive technology -- AAC, mobility, recreation. And we only picked those that we had panels judge them to have potential stakeholder relevance. There was no sense in trying to translate and promote uptake in use of knowledge if the knowledge didn't appear to be at least on face to have some utility to the target stakeholder audiences.

 We then set up a study to compare the relative effectiveness of three different communication methods. We have the standard traditional passive diffusion, and that's really the model of traditional scholarship, that the study is conducted, the results are compiled in a manuscript, they are submitted for publication, reviewed, determined to be a contribution of knowledge base, and they are published. And the scholar walks away, and the expectation is that somehow that finding diffuses out to the various sectors and someone stumbles upon it and says, aha, this is very useful to what we do.

I think over time, especially in the applied fields that we work in, in the areas that our sponsors fund, that we are supposed to be generating social and economic impact; they've said that's not enough. So we went through more than a decade's worth of what we call knowledge, dissemination, and utilization, and the folks in Austin are probably most familiar with that activity, and that really is about dissemination. It's about trying to get information out into the hands of the stakeholders so they can put it into practice. But as I mentioned earlier, there's still that question, well, even though we are trying to do that, we are still not getting sufficient uptake in application of this knowledge, and that was first, I think, recognized in the fields of medicine and nursing, and that's where knowledge translation as a concept came from.

They said we have to do more. It's not enough to just share the scholarly works with different stakeholders. We have to rephrase their value in the language of the different target stakeholders, and we have to provide them in the formats and the media that are familiar to those stakeholders.

So basically, we thought it was appropriate so let's test those three. Let's compare the relative effectiveness -- passive diffusion, active dissemination, and what we call targeted translation. And we did that across five different stakeholder groups. We recruited researchers, clinicians, consumers, manufactures, and what we called brokers. Depending on whether it was AAC, mobility, or recreation, we were talking about very different specific types of people we recruited for these five generic categories depending on the kind of information we were trying to convey.

Then we ran those studies and we randomly assigned people, we did pre and interim and post measures after we intervened at the levels of the translation, the dissemination, and of course, the control group was diffusion to look at changes in level of knowledge use pre and post. What did we find? Those studies showed that both dissemination and translation are effective at moving people up the continuum from unawareness to interest to actually even towards actual use. So we saw a significant change for the people who actively received some additional information than we did for the control group that we were just relying on what changed in their own environment from pre to post study.

The more interesting discovery, from my perspective, was that both dissemination and translation were equally effective for most audiences. Although translation calls for changing the language, in some cases simplifying the language, explaining why that finding or that prototype or that product is especially useful for you as a clinician or you as a consumer or you as a manufacturer, and providing that information in either lay language or multiple formats, like a summary document, a webcast, so multiple media as well, it didn't really make a difference. The language and format were not the critical factors in changing people's levels of use. It turns out that the stakeholders involved in the study were very able to extract the message of utility, even from the scholarly journal publication.

Those people who only received a copy of the journal publication were equally able to perceive value in the publication and put it into practice moving up from interest to use as those who received a careful description and multimedia demonstration of utility of that study for their use. And furthermore, people in groups with the highest stake in each item, the categories of stakeholders who were closest to benefiting from that finding or that prototype, demonstrated the highest level of use. And the bottom line to me -- and hopefully to others who look at the study -- is the RCTs demonstrate beyond a shadow of a doubt -- because I don't think you will get clearer findings than from an RCT -- that relevance drives use -- not the form, not the format, not the language.

So to the extent we are still challenged to say why aren't we seeing more uptake in application, we can't continue to say it's the study itself. We have to consider the fact it really is about how relevant is the finding to the user. I am missing a photo there. Basically, my position is that knowledge translation is sort of blaming the victim, that it may be easier to blame a lack of comprehension on the part of the audience than for the recipients of the R&D funding to assume greater responsibility for ensuring that studies and findings are relevant. So you know, my retort is insufficient absorptive capacity indeed. There is a picture, actually, of Andrei Sakharov holding his head in his hands, and I think it's an appropriate picture at this point because we still are not at the point where the people who are in a position to bear the responsibility, the funding agencies and the grant recipients, aren't yet acknowledging their critical role in delivering relevant results for those programs that intend to generate social and economic benefit.

Oh, here we go. Here is Andre. It's also important to consider two neglected factors that actually, at heart, seem to drive uptake and use. I think that came out of prior questions and issues about how do we engage policymakers, decision makers and implementers, that we have to consider their personal perspectives. There are a couple of great book called Freakonomics and another book called Super Freakonomics, some of you may know. They tend to up-end assumptions about studies and assumptions about relationships between various factors. And at heart, the two studies conclude that we are really talking about two factors that drive the uptake in use of new information, the kinds of factors that cut through the noise and reach and detect the signal. It's the power of personal incentives. What is in this knowledge for me? What makes this life -- my life -- easier? What improves my position in society? What makes me more functional in the community? Those are the incentives that drive knowledge use.

And we have to consider the law of unintended consequences because sometimes what we think we are going to achieve or what we think we are going to promote isn't exactly what happens. So both of those principles are important to keep in mind, and if you haven't read either of those books, you might find them interesting, and the Super Freakonomics I would recommend the hardcover because the margins are full of dozens of other examples that are as entertaining and as enlightening as the core paragraphs in the document itself.

 So essentially, the core message of my talk is that relevance drives effective communication; that when we are talking about how to communicate with policymakers, implementers, and in fact, any audience -- you know, educators, employers, consumers, clinicians -- we have to make sure we are speaking in language and providing results -- I should say the results more so than the language -- because we've demonstrated the language isn't as important as a common framework that ensures proper use of terminology recognized by all the stakeholders.

So we talk about science versus engineering rather than research and development. We talk about science and engineering as opposed to science and technology because science it a method and technology is an output. Obfuscating these terms has caused any number of problems. We have to clearly discriminate between discoveries, inventions, and innovations because mixing those terms can set the wrong expectations on the part of stakeholders we are trying to reach.

We have to address the influence of personal incentives on the intended and unintended use prior to knowledge creation. We have to consider our target audiences before we initiate any new project, especially for those that are technology oriented and especially for those that are the hybrid government programs that are intended to generate social and economic benefit. If we don't engage the stakeholder audiences prior to initiating the project, we are essentially relying on serendipity to achieve our ends. And we know the yield from serendipity over the past 50 years of funding projects that don't engage the stakeholders prior to initiation.

So essentially, my position is that only prior to grant knowledge translation, not integrated KT or end of grant KT, can ensure relevance and anticipate the unintended consequences of knowledge use. And again we talked somewhat at length about that, and I want to acknowledge our past collaboration with the Canadian Institute for Health Research and Ian Graham in particular discussing these distinctions between integrated and end-of-grant KT versus the requirements to prior-to-grant KT when the intention is application from the outside. With that, I would like to certainly acknowledge our sponsor. Some of our work and some of our findings may run counter to long-held assumptions in government and academia, but we certainly credit NIDILRR and the Administration of Community Living within DHHS for allowing us to share the findings wherever they have led us. And with that, I will close and be ready to have discussion.

 Joann Starks: Well, thank you very much, Joe. That was a really nice presentation on all the work you've been doing over quite a number of years.

 I do have a question for you. If relevance is the key ingredient, do you have any suggestions to researchers and developers who want to ensure that their outputs can be relevant?

Joseph Lane: Yeah, that's the heart of the matter. The heart of the matter is who do you expect to apply the outputs from your work? And what work has already been done? How do you know what you are contributing is new -- how do you know what you are contributing is new, feasible, and useful to your target audience? And answering those questions can only come from engaging the community of stakeholders you intend to interact with.

We often use the analogy of a game of billiards. We say that especially for technology transfer, moving from a scientific research laboratory out to engineering development out to the regulatory environment to corporations to distribution in the marketplace to consideration for referral by clinicians out to the end user who we know have high levels of abandonment, it's like a billiard game. You have to ensure you can sink all the balls on the table. If you leave any stakeholder out of the assessment, the prior assessment, that stakeholder or that stakeholder group can stop the project dead.

What you need is to make sure that you've got buy-in and support from all of the stakeholders who have some decision-making role or some feedback role to the process from the beginning. I know people often say, well, how do we do that before we get the funding? Well, there have been some great studies that have been done. There's actually a business case development program called Strategyzer, and that program has some great examples where groups of students have, on the cheap and over a matter of days -- done incredibly effective market studies to determine potential application of a new prototype, the market receptivity of that prototype, and in fact, developed multiple markets of such prototypes, all by engaging the target stakeholder groups. So that's the core message for ensuring relevance is giving people what they want, or as Steven Covey said in Search of Excellence, begin with the end in mind.

Joann Starks: Great. Thank you very much, Joe. Did not want to forget a question that came up earlier from Pamela Long. What timespan have you noted that most policymakers view as short-term? I am sure that varies, but --

Joseph Lane: I think that varies to some extent, and I think that's a really important point to make when you are talking about what boundaries to set around your claims about the relevance of your work. If you bound it by saying I am a scholar, I conduct scientific research, I have this discovery, but as we know, that discovery needs to go through other levels of refinement before it can be put into practice. Now you can set the expectation for a timeframe of 5 years, 10 years, 15 years. If you are talking about a prototype, you can set a shorter timeframe and say, well, we just received our patent. We are looking for licensing partners. We are looking for investment partners. We are looking at having this in the market in 18 to 36 months.

If you are talking about we have a new product, we are putting it into practice in clinics, now we are talking about, well, policymakers are going to say, well, can you give me something I can take to a funding agency or I can take to a regulatory board in the next 18 to 36 months? I know that's often a complaint where people say policymakers say they want research, but when they ask a scholar for an answer, the scholar goes about designing a study that will provide the answer, but when they come back with the answer, the policymakers decided they had to make a decision a year prior.

So typically -- many times it's immediate, and the idea of engaging these stakeholders before you need to share information is critical, and I know Jim Leahy at our center over the past 25 years has done that quite effectively, where he builds relationships with people so that he's not knocking on the front door when an opportunity arises. He already knows the people in the agencies, he knows their incentives and agendas, he has a sense for the direction they are going in. So he can work his proposal or idea or offer right into the flow of internal conversation. And the trick seems to be make sure your partners treat the idea as their own. You may have done all the work, but you want them to come up with the notion that they discovered the finding or they are the ones that were tracking the research.

Because if you get ownership from the partner stakeholders, now you have an internal champion because it's also important to consider that any new opportunity requires, as I mentioned earlier, some investment of time, money, and effort internally. You know part of the noise signal issue is many people are vying for the attention of these people in positions of power and influence. And they all have probably mostly legitimate offers. So how does yours rise to the top? How does yours become urgent? How does yours win out over competing opportunities or competing options for action that are being promulgated by other policymakers or decision-makers? That's why you need an internal champion, and that internal champion is based on a relationship that you've built over time, you have built a level of trust, you have built a level of credibility, and now you come in and say remember the thing we've been discussing for so long?

We finally have some output that's actionable for you to take in whatever direction you need. And that way you are working into the incentives and you are trying to guard against the unintended consequences of what can happen if you are not aware of the other competing opportunities. I see Kathleen posted the link to Strategyzer.

Joann Starks: We have another comment. What you are talking about suggests the key role of knowledge brokers since many researchers might be introverts and relationship-building might not be a relative strength of theirs.

Joseph Lane: That's another really good point. There are so many programs out there that are trying to provide entrepreneurial training to scholars. And I have to say they are not the same person. If someone was an entrepreneur, they likely didn't spend five to eight to ten years getting a PhD and doing post-doc work in developing those kinds of credentials. They would have been out there selling lemonade on the corner since they were 12. It's a different breed of person. I think, again, that's when we try to overreach and a lot of that responsibility, I think, falls to university presidents and university lobbies in Washington. When universities, back in the early 20th century, claimed that they were the source of new knowledge to the world, their contributions built a global knowledge base, they were very safe in saying that, and they were clearly within the boundaries of the scientific research method. Of course, the problem was they were mostly supported by private donors, and there were only about 400 universities in the U.S.

Fast-forward to post-World War II, where the claims were that science was the well-spring of all new inovation, university presidents said just keep giving us more money, and we will solve more of the country and the world's problems. I think it was definitely a level of overreach. What we got was 4,000 universities -- from 400 to 4,000 institutions of higher education. Each one growing at tremendous rates, each one needing more and more funding. So it's almost a vicious cycle that the more you have to promise, if no one is asking you to verify it, you are fine. But now we come to the point where the budgets start to contract, we get into GPRA, in part, legislation where people are being asked to demonstrate results. Now we are going to question, well, what exactly are we getting from this work?

So I think if we could only look at this -- and in fact, one of the discussions today was on the impact of science, and the discussion I had with the author afterwards was why do we try to set ourselves up to try to parse out the impact of science? Science in universities would be much safer, if not more comfortable, by putting themselves within this ecosystem that generates innovations; that they realize that they are one method and one partner among others who end up benefiting society.

 I wouldn't necessarily compromise their ability to get funding. And in fact, if you look at things like AT&T through Bell Labs and Western Electric back in the prior century, corporations used to spend a lot of money reaching into universities to access the faculty and the graduate students. But companies don't necessarily have the slack resources to spend outside. So if we were more equitable in sharing the money, we could have the extroverts doing some of this outreach in relationship building. When necessary, they could turn to their introverted partners and say here's a bundle of cash. Go do the work I need, and I can take it back out to the outside partners. So the relationship-building really would be stronger if we had better relationships between the academic sector, the R&D laboratory sector, and the business and manufacturing sector.

 Joann Starks: Thanks, Joe. We have about four or five minutes left, and we have a question from Angie. Do you think if there was more collaboration with agencies we would realize how many of them do pieces of the puzzle but don't know what each other is doing?

Joseph Lane: Another great point. Going back to the AT&T example, there was a wonderful book written a couple years ago called The Idea Factory, and it explained how research and development was related to industrial production back in the prior century. And what you had was you had people hired in Bell Laboratories as scientists and engineers who could do very basic research. But what they did is put their work in laboratory notebooks. Those lab notebooks were reviewed at the end of the each week by managers. Those managers then went to meetings with higher-level managers and managers of all the other laboratories. So there was some continuity in the discoveries. It was very easy for these managers to say, oh, you've got a guy working on A. I have somebody working on A-squared. We should put them together. And oh, someone else says if you guys finish with your A and A-squared, we can link you to B.

We don't have that. We've lost that. It's back to this assumption that, well, as long as the work is done and it's put out there for passive diffusion, someone will find it. It does argue for a more systematic collection and tracking of work. Now, there are arguments that say some redundancy is fine because not any one project or group has the only answer, but it's a shame, especially in a field like ours where we have such limited resources, to have the opportunity cost of projects being done that were either done by someone else or the work's already been completed or it isn't really relevant to application where the field is going.

 So I think, yeah, anything we could do to increase that kind of communication at a higher level so we have a repository of relevant information that could carry forward independent of the individual investigator, no matter where they take their own work, you know, we should have projects that progress no matter if the PIs come or go. And that's really the private sector project.

 In academia, you have a co-PI or PI for a project. They take a different position or change rules. But the project may stop.

 If the project was important in society, if a company is doing it and the project manager leaves, the first thing the company says is who are we going to get to replace the project manager? So I think we should be looking at the same standards for our R&D projects that are intended to benefit society. If it's important enough to fund and seems to be relevant to society, the project should continue no matter what the interests and obligations of the investigators involved.

Joann Starks: Well, we do have a couple more questions, but I think we can hold on until we get to the discussion questions since we are about ready to go to the break time. That was a really stimulating discussion at the end of your presentation, so I think we will keep it going once we get back from the break. We will be going to break shortly, and we will be back at 15 minutes before the hour. I want to thank you very much, Joe, for being with us, and we'll look forward to being able to participate in the discussion a little later on.

Joseph Lane: Thank you. My pleasure.