

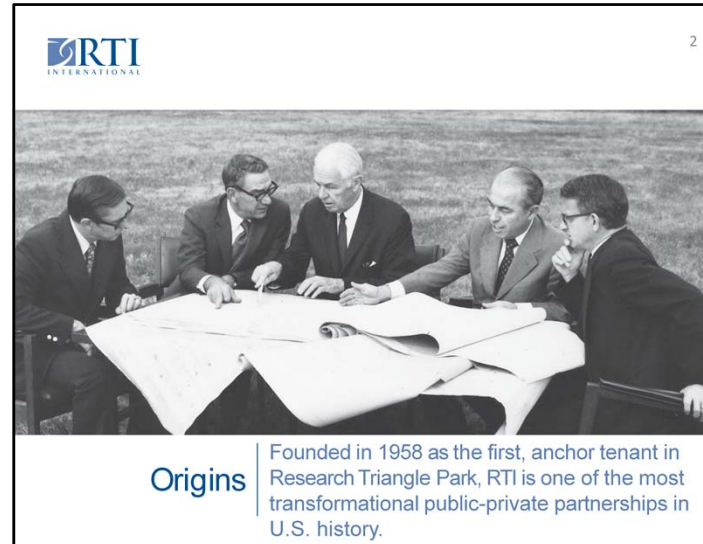
Models of Federal Research & Development National Commission on Forensic Science

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Growing from a handful of scientists in central North Carolina in 1959 to a staff of **more than 3,700 in more than 75 countries today**, RTI is one of the world's **leading independent, nonprofit research and development organizations**. Our activities both **mirror and support national priorities and policies, as well as diverse commercial, industrial, and academic endeavors**. For instance, as public and government interest in environmental protection grew in the 1960s, so did related programs at RTI, building on our expertise **in statistical, physical, and life sciences**.



Today, all of RTI's research activities are guided by our mission to improve the human condition.

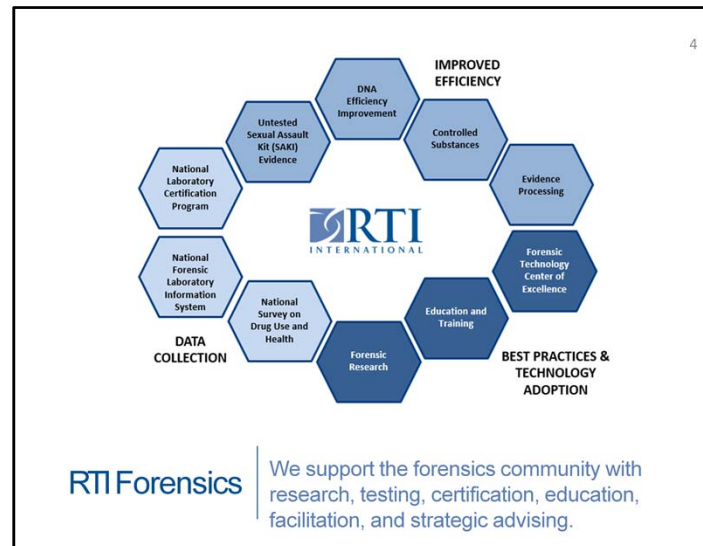
Researchers hold advanced degrees in more than 125 disciplines; their collaborative expertise is recruited to better understand, analyze, measure, and solve many of the most complex challenges to the planet and humankind. Health research, RTI's largest field of study, spans a range of specialties from the human genome to local health education. Researchers across the institute are studying substance abuse among teenagers, the relationship between children's television viewing habits and obesity, and the health implications of the dietary supplement ephedra. Others are evaluating the prevalence of sexual assault among prison inmates and the relationship between hypothermia and infants with encephalopathy. While one multidisciplinary team of researchers recently forged a unique private-public partnership to bring an affordable new tuberculosis drug—PA-824—to clinical trials, another group developed a data-mining and predictive analytics software program to help police forces optimize their resources to improve public safety. RTI's medicinal chemistry researchers discovered two successful cancer drugs, Camptothecin and Taxol. Pfizer and GlaxoSmithKline market the Camptothecin chemotherapy agent as Camptosar and Hycamtin, respectively, for the treatment of ovarian and colon cancers. Taxol is a successful option for breast cancer.

RTI scientists also are involved with semi-conductor research, hardware, and algorithm developments with historic successes. One of these successes is our work with wind shear detection, where RTI engineers worked with NASA to build an airborne simulation model of the Doppler radar system and then tested its feasibility in flight. The success of this experimental device led several private companies to manufacture wind

shear detection systems. In 1996, the Federal Aviation Administration (FAA) required all airlines to have such devices on board at all times. Since then, there has not been a wind shear crash of any airliner so equipped.

Another successful technology resulted from our work with cochlear implants. RTI researcher Blake Wilson, who is now at Duke University, is credited with inventing most of the speech processing strategies used in the original and subsequent generations of the device. One of Wilson's papers, published in 1991 in the journal *Nature*, is among the most highly cited publications in the field of cochlear implants. In 1997, Wilson and RTI received the American Ontological Society's Presidential Citation for "major contributions to the restoration of hearing in profoundly deaf persons."

RTI also has several centers focused on forensics and criminal justice issues.



There are three primary groups within RTI that support policing and forensic efforts in research and technology innovation: the Center For Justice Safety & Resilience (Social Science and Evaluative Research); the Center for Forensic Sciences (Research, Laboratory Accreditation, Education and Training , and Technical Assistance); and Innovation Advisors (Technology Adoption and Commercialization). This slide represents a snapshot of projects we have maintained, in some cases for more than 25 years (NSDUH, NLCP) and highlights our project focus on improved efficiencies, education and training, data collection, best practices and technology adoption.

Two of our newest awards include the most recent Bureau of Justice Assistance award for the Technical and Training Assistance Program for Sexual Assault Kit Initiative Sites, which is so new, the project has yet to begin. We are very excited about this project because we are partnering with many great stakeholder organizations, including the IACP.

RTI seeks to extend our value to our clients by combining disparate strengths from across the institute. This is the case with the Forensic Technology Center of Excellence, or FTCoE, which includes the centers just mentioned for subject matter expertise, along with the innovation management practices of our Innovation Advisors group.



Innovation discussion today uses the term “open innovation” to describe the need for organizations to be open to R&D from outside. We at RTI have helped clients both push (out-license) and pull (technology scouting) technology and understand the two sides to the equation. Our Innovation Advisors group has “grown up” supporting NASA. Specifically, RTI has supported NASA’s technology transfer efforts via both push and pull for more than 50 years.

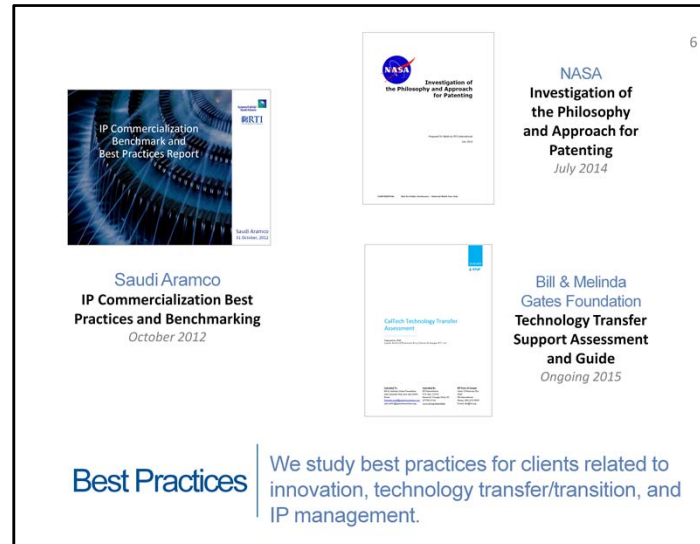
This effort started with a team at RTI that supported NASA’s user needs focused on health and efforts such as:

- adapting technologies developed for spacecraft into an implantable insulin-delivery device for managing diabetes and other chronic illnesses.
- transforming the control mechanism of NASA’s lunar rover to help physically handicapped people drive a vehicle via a single-stick device that controlled direction, speed, and braking, and
- developing “cool suits” derived from the garments of astronauts for people without sweat glands or individuals who have been paralyzed. These suits help prevent heat stroke, a common ailment among the paralyzed. “We work with companies and organizations like the Paralyzed Veterans of America and with burn surgeons. We listen to what they need, then we write up a problem statement and submit it to NASA engineers for a possible solution.”

With the passing of the Bayh-Dole act, RTI helped NASA stand up their licensing function and we continue to support the out-

licensing of NASA inventions. Some examples include

- Emulsified zero-valent iron (EZVI), which was developed at Kennedy Space Center to remediate groundwater pollution. EZVI successfully treats halogenated solvents, which are notoriously stubborn chemical contaminants that sink through soils and into aquifers, offering a tremendous improvement over past remediation methods. As a result of RTI's collaborative efforts with NASA, EZVI is now available on the market from five licensees. The technology holds great promise in the cleanup of hundreds of contaminated sites across the country, including more than half the sites on the Superfund National Priorities List.
- Aluminum silicon alloy was developed at Marshall Space Flight Center NASA to offer high-temperature performance and increased wear. After working to understand the value provided by this new material, RTI explored a wide range of potential applications. We marketed the technology and ultimately connected with a scout from Bombardier Recreation Products. A new line of engines by Johnson Evinrude E-Tec emerged, creating more than half a billion dollars per year in revenues and numerous environmental excellence awards.



RTI staff serve as practitioners (scientists and engineers) who specialize in technology scouting, landscaping, assessment, commercialization, and as such are often called on to not only “do” but to advise. As such, we are often called on to research best practices related to innovation.

Examples include RTI’s support for the world’s largest company, Saudi Aramco, to consider how to best leverage their investment in R&D to the benefit of the Saudi economy, and as mentioned, our consideration with NASA related to the changes in the U.S. patent system, and NASA’s future, including alternatives to patenting.

In addition, RTI’s has conducted recent work with the Bill & Melinda Gates Foundation to stand up the Sanitation Technology Platform, or STeP, program for their Reinvent the Toilet project. STeP has been established to provide a broad array of services to technology and commercial partners of BMGF to support development and launch of new sanitation products by streamlining and de-risking field testing and commercialization. For partners, STeP is field testing prototype technologies through hands on, in-country logistics and management, as well as integrating market intelligence, user insights, and technology transfer in the business planning and commercialization process. In lock-step with partners on their journey from “prototype to product,” STeP is delivering a needs-centered, disciplined, adaptive approach to integrate the many elements needed to ensure market and technical success. This project highlights that the BMGF has recognized that beyond funding the technology development, their

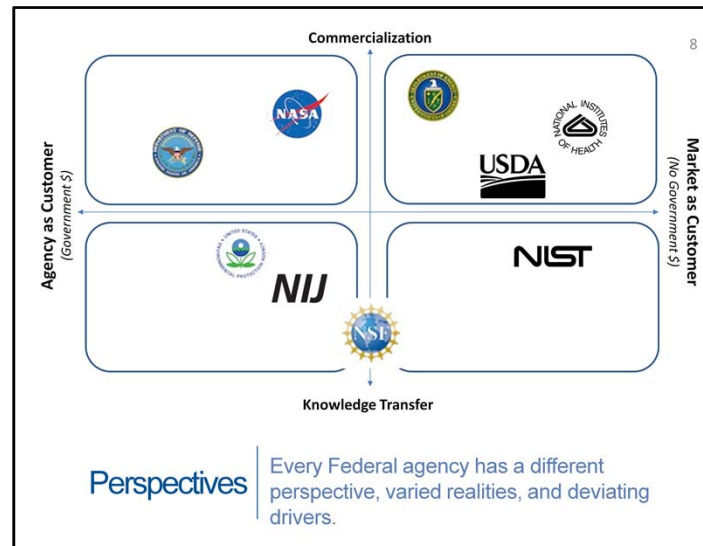
grantees need support in proving the impact, and supplying the solution via partners, IP management, etc. For STeP, we are presently assessing the technology transfer support available to, and leveraged by, Principal Investigators.

AGENCY	TRANSITION GOALS	FACTORS
NASA	Improve aerospace industry and U.S. economy via SPINOFFs	• Prime Contractors, SBIR • Mandated secondary application
DoD	Transfer benefits to the warfighter	• Prime Contractors, SBIR • Agency is a major customer
NIST	Eliminate barriers for U.S. industry	• Infrastructure • Consortia-like
NSF	Promote progress of science	• No labs • Funding ~24% Fed. basic research
NIJ	Provide knowledge and tools to reduce crime and promote justice	• No labs • Varied stakeholders

Impacts

Technology transition “best” practices are defined by the desired outcome, which is not always the same. *“One size does not fit all!”*

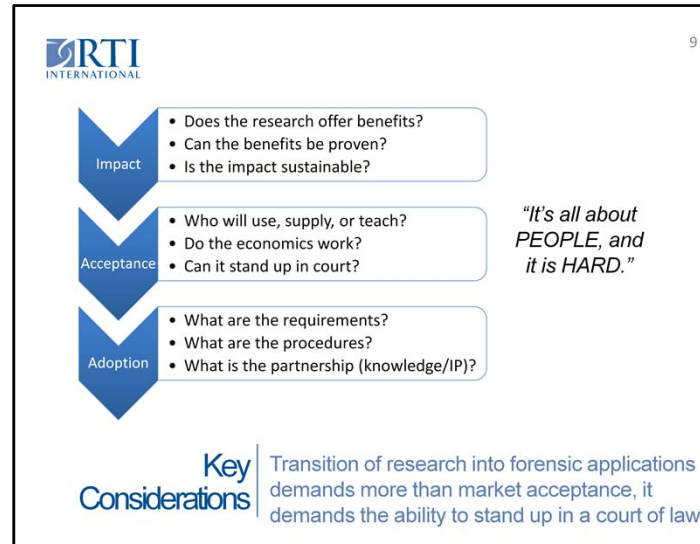
In considering “Models of Federal Research & Development” and the transition of research to application and impact, RTI considers agencies we have worked with. In considering “best practices,” we believe that you first have **to factor** the goals of the agency and specific variables. As illustrated in the table, the realities of each agency can vary greatly in terms of how research is done (external funding versus labs), how transition may occur passively (via contracts, and partnerships), and how transition may occur actively (out licensing). We believe that **through this process**, one important learning reality emerges...one size does not fit all.



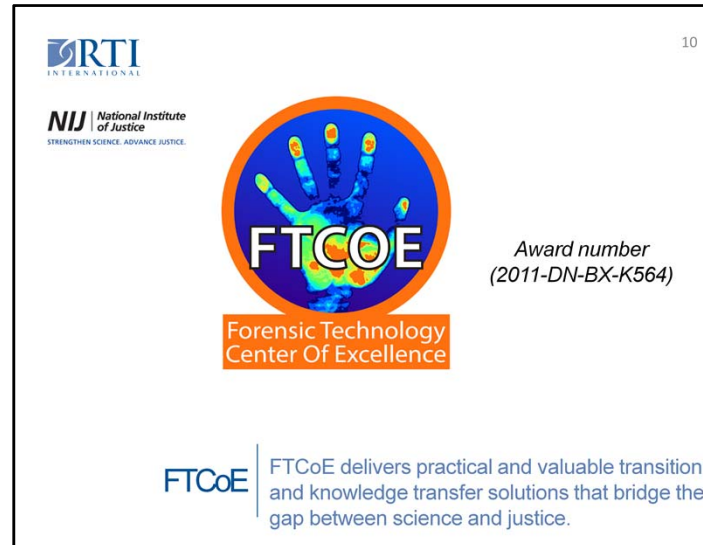
Again, in respect to the varied agencies and transition, we consider two axes:

- 1) Commercialization vs. knowledge transfer – These are not directly in opposition, but are two opposite options for transition. An agency could be fully balanced in doing both (and would sit at the origin). However, in terms of active efforts, there are differences in agencies, with those in the upper two quadrants representing agencies with strong licensing programs. (Vertical placement in upper quadrants is based on licensing metrics from <http://www.nist.gov/tpo/publications/upload/Federal-Laboratory-TT-Report-FY2012.pdf>).
- 2) The second axis is whether the agency (and the government) is the source of most of the money in the market. Easy examples on the two ends of this axis are the U.S. Department of Defense, where much of the R&D funded by DoD is linked to procurement from DoD, such as aircraft, weapons systems, warfighter support in equipment, clothing, and food, versus the National Institutes of Health, where a significant amount of the market value comes from our healthcare system via insurance and expenses paid by companies and individuals.

This graphic illustrates that agencies like the U.S. Environmental Protection Agency and the National Institute of Justice are different...the government is part of the equation, but the market drivers vary.



RTI recognizes that for all transition efforts, the benefits need to be understood in terms of impact (or value) and to whom. If there are performance benefits and associated value, then the economics need to be understood. The path from research to applications is a difficult one, even with a strong market pull and significant economics (e.g., consumer products), as with regulatory barriers (e.g., pharma). Yet for research focused on criminal justice and forensics, it is even harder because of the limited financial drivers, and the added burden of proof related to the application in the justice system.



Building on this kind of understanding, RTI works with NIJ to operate the FTCoE. RTI and its FEPAC (Forensic Education Program for Accreditation) accredited academic partners were awarded the FTCoE in 2011.



The FTCoE is lead by RTI International and currently has 3 FEPAC-accredited academic partner organizations — University of North Texas Health Science Center, Virginia Commonwealth University, and Duquesne. The FTCoE also has many other collaborations within the forensic community that enhance the capacity of the FTCoE. This is a representative list of collaborators.

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ORTI
INTERNATIONAL

NIJ | National Institute
of Justice
STRENGTHEN SCIENCE. ADVANCE JUSTICE.



Impact | FTCoE strives to address emerging needs and opportunities related to technology; share knowledge; and advance technology.

FTCoE strives to address emerging needs and opportunities related to technology; share knowledge; and advance technology.

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The FTCoE Addresses Key Challenges to Forensics



Forensic Optical Topography

- Reviewed technologies for collection of 3D data
- Established working group to address issues
- Supported validity testing
- Provided guidance to practitioners

Sexual Assault

- Organized best practices (national)
- Identified systemic challenges
- Created awareness of resources
- Presented strategies for the derivation of victim-centered policies for the national response to sexual assault

www.forensicCOE.org

The FTCoE is aware of the emergence of key issues based either on needs (e.g., sexual assault) or on enabling technology developments. For these areas, we recognize that the forensic community may need more detailed, specialized assistance with coordinating knowledge transfer, adopting new technologies, and advancing research and development into the hands of practitioners. Often, these areas face special challenges such as multi-disciplinary national communication and coordination in order to achieve successful implementation of new ideas, policies, and practices.

The FTCoE has derived a team with specialized expertise to specifically address these concerns and provide workable solutions to these exceptionally challenging situations. Two examples of special initiatives that were started over the **past 2 years** include a review of the use of Forensic Optical Topography as a complementary technology in ballistic comparisons, and providing a forum and resources for the ongoing national efforts addressing sexual assault.

Forensic Optical Topography is a technology that uses 3D imaging such as microscopy to investigate the surface detail of casings for ballistic evidence. Although this technology has been available to forensic laboratories for some time, and NIJ has funded several R&D projects, it has not fully been implemented into laboratories widely. RTI is supporting a working group and an in-field evaluation of these technologies in several locations, including the Contra Costa Police Department in California, the National Institute of Standards and Technology, and FBI laboratories.

and professionals and developing a process map outlining some of the decisions made when analyzing a sexual assault kit, as well as sharing examples when decisions vary by jurisdiction, case situation, and victim decisions.

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The FTCoE is a Resource for Valuable Insight and Information



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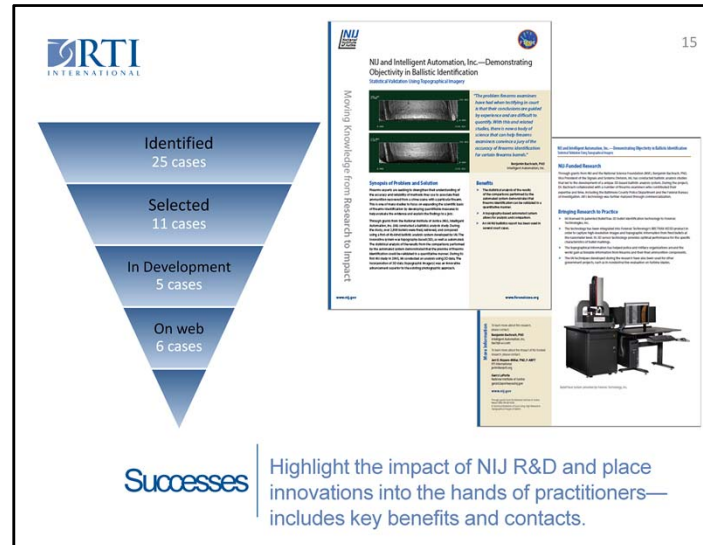
- Education**
 - Online Educational Offerings (90+)
- Events**
 - Industry forums
 - Symposium and workshops
 - Technical Working Groups (TWG)
- Resources**
 - Newsletter
 - Success Stories
 - Databases
 - Reports
 - ✓ Translational technology reports
 - ✓ Landscape studies

The FTCoE also provides a significant amount of education in the form of traditional and virtual (online) education focused on a full range of criminal justice and forensic topics, as well as Technology Transition Workshops, which are small group events where practitioners receive hands-on experience with new technology. Examples of these online educational events include the ASCLD Series, Trace Evidence Series, Impression and Pattern Evidence Series, R&D Series, Familial DNA Series

The FTCoE also releases numerous reports focused on knowledge sharing. These include translational technology reports that involve in-field operation technology evaluations where practitioners are “testing the practicability” of a specific technology and/or platform; and landscape reports that offer insight on adoption issues/strategies, and various solutions that are emerging and on the market, such as product features and pricing (similar to consumer reports). Recent landscape study reports released by the FTCoE include reports on mobile ID fingerprint devices and DNA mixture interpretation software. The FTCoE also generates guidance documents for best practices or state of the technology, or reports that focus on working group and forum findings.

In reviewing NIJ’s portfolio, the FTCoE became aware of research investment that has started to have impact for the forensic and criminal justice communities. To augment the adoption of these available advances (whether knowledge or products for sale), the FTCoE has begun to create “success

Y-STR Database (University of Central Florida), Cheminformatic ForensicDB (RTI International), and Frog_KB (Yale University).



At present, we have identified 25 cases of interest and reached out to the PIs to consider the opportunity to be showcased. Of these, we have published six success stories, which are on the FTCoE website and which NIJ highlighted on their website. We have an additional five pending stories that are slated to be released in December.

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The FTCoE Drives Technology Toward Forensic Adoption



www.forensicCOE.org

Evaluations

Unbiased translation of data and information

Research

Consideration of NIJ's R&D portfolio to identify research that can have greater impact with support

Opportunities

Establish relationships with partners for

- ✓ technology transition
- ✓ licensing and commercialization
- ✓ evaluation
- ✓ knowledge transfer
- ✓ lessons learned—community of practice

The FTCoE considers the research that the NIJ has invested in, and in appropriate cases enables, further support. In some cases, the additional help might come in the form of an evaluation. The basis for advancing technology for forensics is related to relationships between people to enable transition, license for commercial development, share via education or training, and ultimately, to enable and maintain communities of practice to improve processes and outcomes.



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Impact of Rapid DNA on Case Resolution for Law Enforcement

Evaluation of deployment, including

- agency policies, management systems, and inter-agency communications
- performance metrics
- impact of cross-agency communication, evidence management systems, and organizational policies
- training and internal validation

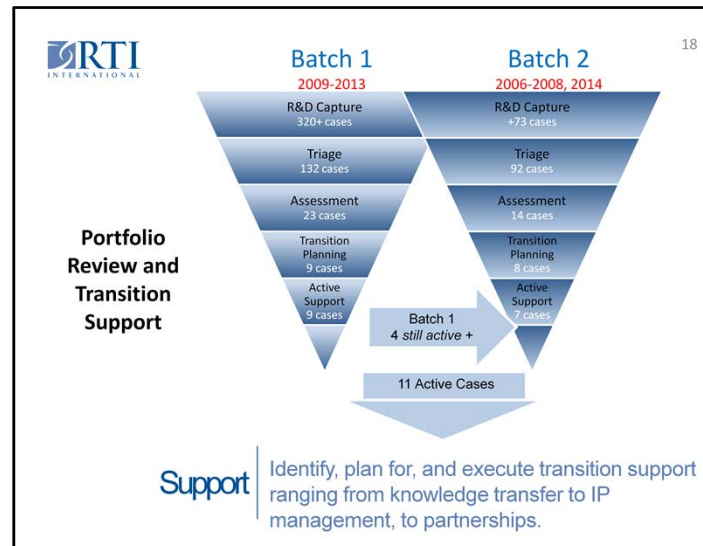



Evaluation

Objectively compare selected technologies to assess the capabilities, requirements, benefits, and challenges. Provide findings, pricing, training, conclusions, and recommendations.

EXAMPLE: In 2016, in collaboration with the Arizona Department of Public Safety and Dusquesne University, the FTCoE will examine the policies and inter-agency dynamics that are associated with the successful implementation of a Rapid DNA system. The team will work collaboratively to consider validation and implementation of Rapid DNA systems, which will include

- examining the law enforcement agency policies, management systems, and inter-agency communications required to implement the Rapid DNA process,
- evaluating the performance metrics that agencies are collecting to measure success of the implemented system,
- determining the impact of cross-agency communication, evidence management systems, and organizational policies on the implementation process,
- reviewing the training and internal validation procedures used to determine the more efficient processes,
- evaluating if the lack of an electronic evidence management system affects the implementation process, and if so, if there are procedures and policies that can assist case resolution for law enforcement, and
- collecting, analyzing, consolidating, and disseminating through a guidance document the processes that will best facilitate the implementation of a Rapid DNA system.

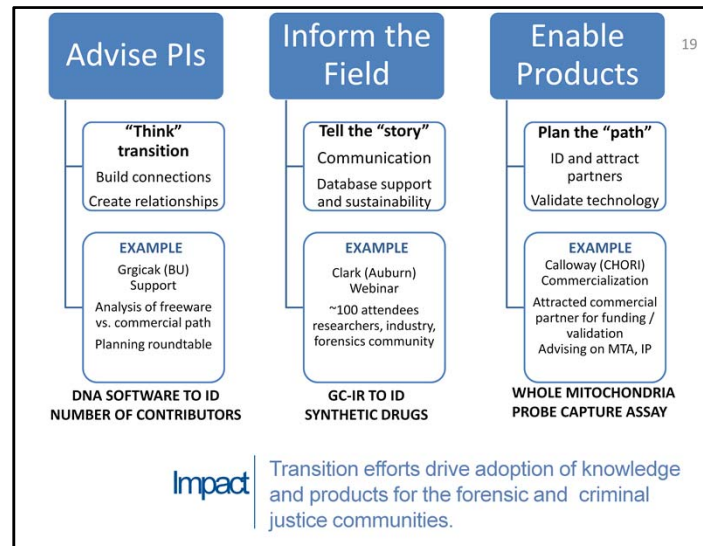


RTI has captured NIJ's portfolio as the foundation of a review and transition support process. Building on the best practices of other agencies research to application efforts, like traditional "Technology Transfer" or "out licensing" (e.g. NASA, universities), Tech-to-Market (e.g. DoE ARPA-e), Research to Applications (e.g. DoD), Market-based Approaches (e.g. Bill and Melinda Gates Foundation) RTI has helped NIJ stand up a portfolio approach for NIJ's research investment.

With any research portfolio, such as NIJ's, one must evaluate the project's needs and that potential for a project to move towards implementation and adoption. Not all have the same maturity level or "pull" from users; and in the case of NIJ, unfortunately, not all fit within the timing/financial resources/capabilities of the FTCoe. So with each step of our transition support process, we refine our selection and move to active transition support identified technologies with the most potential for impact with support.

Batch 1 - we processed more than 320 active and inactive R&D projects and evaluated in greater depth the technology adoption potential of 23 some of which received support, or presentation as success stories to enable greater awareness and adoption; four of these remain active

Batch 2 – we considered an additional 73 cases and revisited some we had put on hold in batch one. Of these 92 cases 14 gained in depth analysis and 7 are in active support



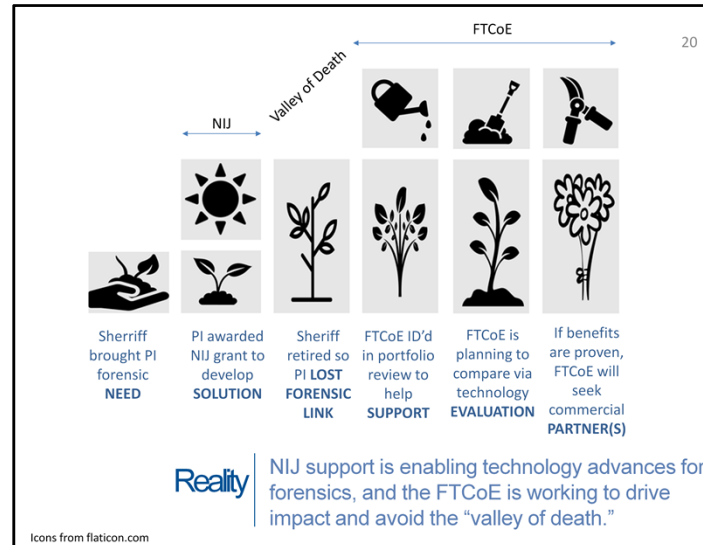
Support and impact can vary from case to case.

In many cases, the FTCoE becomes an advisor to the PI and their technology transfer office. In many cases, PIs are “about the research” and need support in terms of advice and action. Ultimately, we help the PI shift to transition-type thinking, often by building connections to the forensic community and creating relationships with industry. An example of this approach is the FTCoE’s work for Katherine Grgicak at BU where the FTCoE has helped to consider if a freeware option is better, or if a commercial software strategy will ultimately bring the greatest benefit to users. We are also planning a roundtable in the late spring of 2016 that will bring together a discussion between industry and practitioners to get a sense of needs and the challenges related to adoption.

Another common support element is to help tell the story. Increased communication can translate into interested partners for use or supply. An example of this is work conducted for Dr. Randall Clark at Auburn University. The FTCoE recently hosted a webinar on Regioisomer Differentiation for Substances Using GC-IR. The webinar brought together practitioners and industry to consider how advantages in identifying synthetic compounds, new precursors, and isomers to address the proliferation of new synthetic drugs.

Beyond knowledge transfer, one goal is to enable better products for the forensic and criminal justice community. This often requires understanding benefits and using those benefits to identify and attract partners, validate the technology, and enable a partnership. Intellectual property is often foundational in these cases. One example of this is the FTCoE’s work for Sandy Calloway at Children's Hospital Oakland Research Institute and her whole mitochondria probe capture assay. The FTCoE recognized the value of the invention and helped to find

validation partners, which resulted in an additional joint grant being funded by NIH. The FTCoE continues to advise Sandy Calloway and her technology transfer office on issues, including MTAs with potential commercialization partners, as well as planning for future licensing.



One of the cases that is still in active transition is illustrative of the classic issues related to research to application work. It is a case where the idea came from the criminal justice community, and NIJ invested to drive it forward. Unfortunately, with the loss of the forensics champion, the effort virtually withered until the FTCoE portfolio review identified the potential that may still exist. With FTCoE support, the case is now moving toward a technology evaluation, and if results are favorable, potentially to commercialization so that a supplier can enable the technology to be used by the forensics community.

Thank you!



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