Best Practices in Technology Transfer

Jennifer L Flagg

Center on Knowledge Translation for Technology Transfer

University at Buffalo

ACKNOWLEDGEMENT

The contents of this presentation were developed under a grant from the U.S. Department of Education National Institute on Disability and Rehabilitation Research grant #H133A130014.

The opinions contained in this presentation are those of the grantee, and do not necessarily represent the policy of the U.S. Department of Education, and you should not assume endorsement by the Federal Government.

Learning Objectives

- Identify 9 stages of activity involved in NPD and TT
- Describe 7 universal design tools
- Use online NtK Model to access best practices and tools

History

- Center's core team funded since 1993
  - 1993-98: Supply push (technology driven)
  - 1998-2003: Demand pull (market driven)
  - 2003-08: Corporate collaboration
  - 2008-13: Generate models, methods, metrics
  - 2013-18: New! Tools and technical assistance

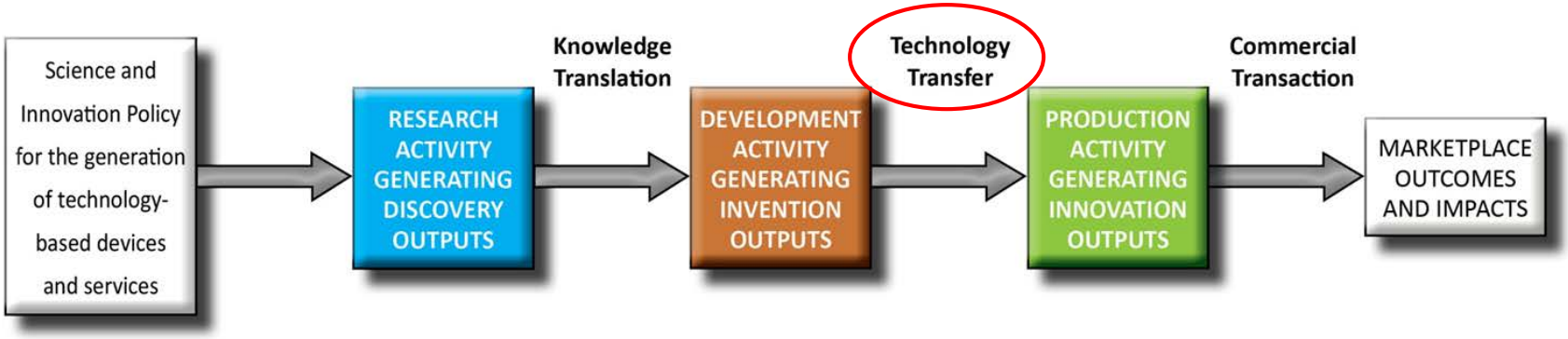
What is Technology Transfer (TT)?

- The *process* of changing ownership and control over an invention from the creator to a party intending to generate a commercial product or service.

When does TT happen?

- The *actual transfer of intellectual property* is typically an *intermediate step* between development activity that generates invention outputs and production activity where commercial innovations are formed. *However,* ***market and business viability should be explored prior to initiating projects*** *intended to produce innovations.*

Three Methods & States



The Need to Knowledge Model

- Stage gate model for generating and commercializing technology based innovations.
- Represents all stages and steps from initial conception through launch, maturity and decline of a product.
  - 3 phases (Research, Development, Production)
  - 9 stages/gates
  - 58 steps
  - 3 transitions between stakeholders
    - Knowledge Translation (KT)
    - Technology Transfer (TT)
    - Commercial Transaction (CT)

PDMA NPD Handbooks

Stage/Gate Structure

CIHR KTA Model

Scientific Method

Need to Knowledge (NtK) Model

Literature Review to Identify Supporting Evidence

Keyword Searches: **12,692 articles**

Inclusion Criteria Applied: **298 articles**

Review of Abstracts for Relevance: **212 articles**

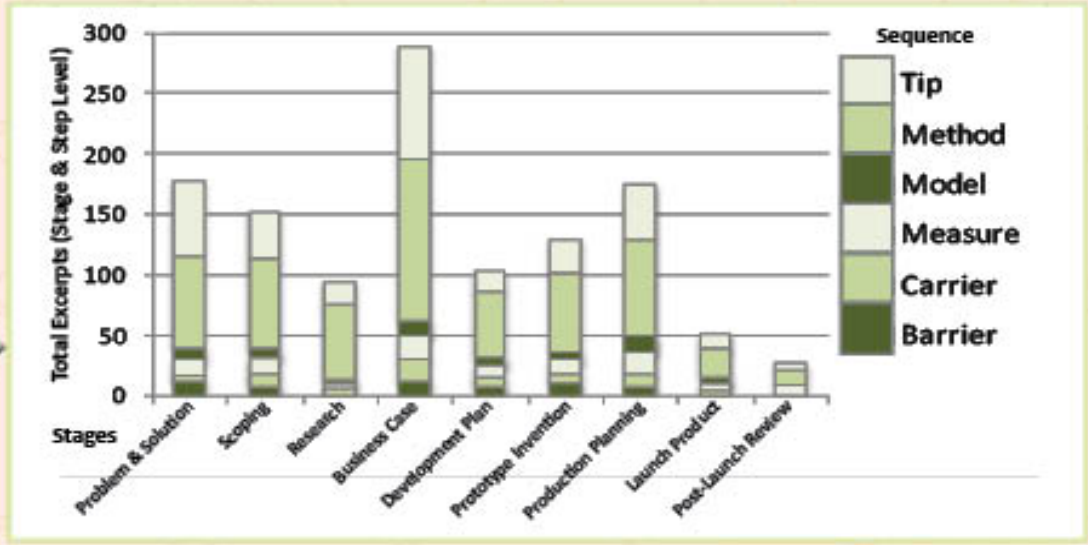
Review of Articles for Key Lessons: **1208 excerpts**

Information Gathered from Each Article

- Citation, Annotation, Potential User Groups
- Relevant work settings, Study methodology
- Excerpts classified by:
  - Placement within NtK model
  - Type of information: method, model, measure, barrier, carrier or tip
  - Primary Excerpts: Author's conclusions
  - Secondary Excerpts: Paraphrased conclusions from prior publications

NtK Model Components

- **3 Phases -** represent activities/decisions to generate outputs in three states
  - **9 Stages and 9 Gates** (537 excerpts)
  - **58 Steps** (674 excerpts)
  - **70 Tips** (71 excerpts)
- **3 KTA cycles** (264 excerpts) - stakeholder mechanisms for moving knowledge from one state to another



TOOLS
Embedded at Step level

RESOURCES
- Publications
- Tech Transfer Template
- Modules/Guides

CASE EXAMPLES
Embedded at Stage level

Knowledge Base

- Search for citations or excerpts
- Search by: Keyword, Knowledge User Group or Settings

In the past year, NtK Model Used/Noted by:

- PDMA - The Source
- Technology Transfer Tactics
- NIDRR Grantees
- AAATE, ATIA, CIHR

Knowledge Translation
KT4TT
Technology Transfer

Screen Shot of NtK

Discovery Phase

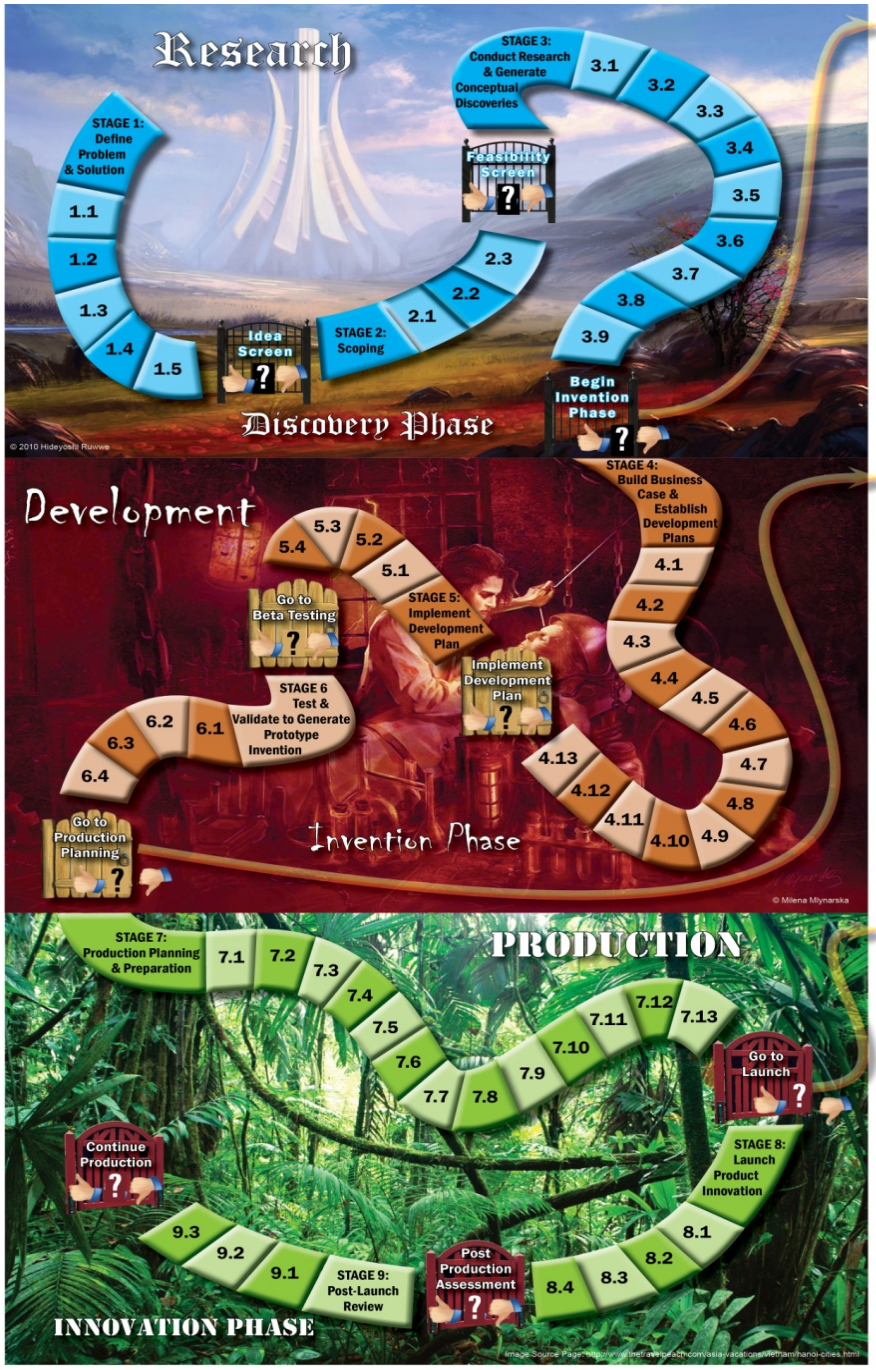
Stage 1: Define Problem and Solution Pill crusher example 	• 1.1 Opportunity for KT: Assess needs for device or service with input from relevant stakeholders from the six knowledge user (KU) groups. • 1.2 Identify a problem (need). Identify audience for solution. Identify context for both. • 1.3 Propose plausible solution (goal) to problem in the form of a device or service. • 1.4 Determine scope of project (role); output as conceptual discovery, prototype invention or device/service innovation? • 1.5 Consider path to market.	• Limit disclosure of information regarding solution and document all original thinking related to solution). • Scope of project determines segments of KT4TT model involved with research generating discovery, development generating invention and production generating innovation level outputs. • Consider resources, timelines, and partners when defining path to market. • Opportunity for Universal Design (UD). Be mindful that the problem might be shared by others.
Gate 1: Idea Screen. PI decides to either terminate or move forward with project to develop solution to problem.		
Stage 2: Scoping (Initial screen to validate innovativeness and value to target markets) Caller connect example 	• 2.1 Define innovation opportunity.	• Delineate positioning strategy of future device/service.
	• 2.2 Opportunity for KT: Expanding on previously identified needs, perform preliminary valuability assessments (business, market and technical) on device/ service with input from stakeholders in the six KU groups. • 2.3 Identify potential barriers.	• Preliminary market assessment- Create potential value proposition including target price and performance parameters. Is concept novel and useful? Will prototype have value to intermediary stakeholders? Will device/service have value by the time it reaches the marketplace? Are there others who could also use this solution, thereby broadening the market? • Preliminary business assessment - For profit, cost recovery or freely distributed? Development and production phases internal or via stakeholders? Conduct SWOT analysis to identify barriers. Develop intellectual property strategy (e.g., NDA agreements), examine regulatory and reimbursement issues. Consider opportunity to achieve economies of scale for traditionally niche products, by expanding functional design to accommodate more user groups. • Preliminary technical assessment – Is it technically feasible and do capabilities exist internally or externally to develop and/or produce?
Gate 2: Feasibility Screen. PI must decide if envisioned project output and eventual device/service outcomes are still considered innovative in the light of results from assessments. PI decides if generation of new knowledge is required. If no, PI decides if project should move directly to invention phase or terminate. If yes, should they pursue external funding to conduct remainder of discovery phase?		
Stage 3: Conduct Research and Generate Conceptual Discoveries	• 3.1 Opportunity for KT: Identify expertise needs and assemble transdisciplinary research team (i.e. methodologist, statistician, etc.)	• Develop research problem/question.

Knowledge Translation
KT4TT
Technology Transfer

“Gamification” of Technological Innovation

~~~

Click on the path to reveal step names and links to more information



University at Buffalo
The State University of New York
~~~

Where are the Best Practices?

- *NtK combines PDMA, KTA, and scientific research processes*
- *Supporting evidence associated with each stage, step, and tip offer best practices as defined by academic and practice literature*

- *Effective practices derived from real life case examples for each stage*

Knowledge Translation

Need to Knowledge (NtK) Model for Technological Innovations

Phases	Stages and Gates
Discovery (Research)	Stage 1: Define Problem & Solution
	👍 👎 ?
	Stage 2: Scoping
	👍 👎 ?
	Stage 3: Conduct Research and Generate Discoveries → Discovery Output!
Invention (Development)	*Communicate Discovery State Knowledge* 👍 👎 ?
	Stage 4: Build Business Case and Plan for Development
	👍 👎 ?
	Stage 5: Implement Development Plan
	👍 👎 ?
	Stage 6: Testing and Validation → Invention Output!
Innovation (Production)	*Communicate Invention State Knowledge* 👍 👎 ?
	Stage 7: Plan and Prepare for Production
	👍 👎 ?
	Stage 8: Launch Device or Service → Innovation Output!
	Communicate Innovation State Knowledge 👍 👎 ?
	Stage 9: Life-Cycle Review / Terminate? 👍 👎 ?

Knowledge Translation

KT4TT Technology Transfer

NtK Model Tools

Electrical Engineering	Material Science	Mechanical Engineering	Business Tools	Business Tools, Ct.	Universal Design
Digital Logic Design Software	Density Measurement	Computer Aided Design (CAD)	Affinity Diagrams	Information Technology	Anthropometry (Human size)
Electronics Simulation Software	Dynamic and Fatigue Testing System	Computer Integrated Manufacturing (CIM)	Analytic Hierarchy Process (AHP)	Internal Idea Capture System	Design Exclusion Calculator
Emissions Testing	Electrical Resistivity	Material Requirements Planning (MRP)	Beta Testing	IP Agreements	Design Guide for Aging and Disability (ISO Guide 71/ CEN/CENELEC Guide 6)
Home Printed Circuit Board Manufacturing	Finite Element Analysis Tool 1: ALGOR	Six Sigma	Brainstorming	Lead User Analysis	Inclusive Design Toolkit - Disability Simulators
Immunity Testing	Finite Element Analysis Tool 2: Ansys		Brand-Equity Analysis	Market Structure Maps	SWiFT 9:2012 Universal Design for Energy Suppliers
Industrial Printed Circuit Board Manufacturing	Hardness Measurement		Business Process Re-Engineering	Multiple-Attribute Decision Analysis	Transgenerational Tools
Measurement of inductance and capacitance	Heat Capacity		Clinical Trials	Net Present Value	Universal Design Product Evaluation Tools
Measurement of Voltage, Current and Resistance	Impact System		Competitor Benchmark Matrix	Netnography	
Pick and Place Machines	Pull Tester		Concept Testing	One on One Interviews (customer visit teams)	
Printed Circuit Board Design Software	Static Hydraulic System		Conjoint Analysis	Open Innovation	
Robotic Electronic Circuit Board Testing Equipment	Strain Measurement		Critical Path Analysis	Patent Mapping	
Safety Testing	Stress Measurement		Customer Idealized Design	Product Benchmark Matrix	
SPICE (Simulation Program with Integrated Circuit Emphasis)	Thermal Conductivity		Delphi Method	Quality Function Deployment	
	Thermal Expansivity		Empirical Methods for Feasibility Testing	Suh's Design Axiom	
	Toughness Measurement		Ethnography	Surveys	
			Failure Mode Effects Analysis (FMEA)	Team-Based Knowledge Work	
			Field Testing	Technology Road Map	
			Focus Groups	TRIZ	
			Human Performance Technology (HPT)	University Research Centers	
			Idea Generation (wildest idea, morphological analysis, metaphor use)	University-Based Industrial Extension Services	

University at Buffalo
The State University of New York

CAT

NIDRR
NATIONAL INSTITUTE ON DISABILITY AND REHABILITATION RESEARCH

Knowledge Translation

KT4TT

Technology Transfer

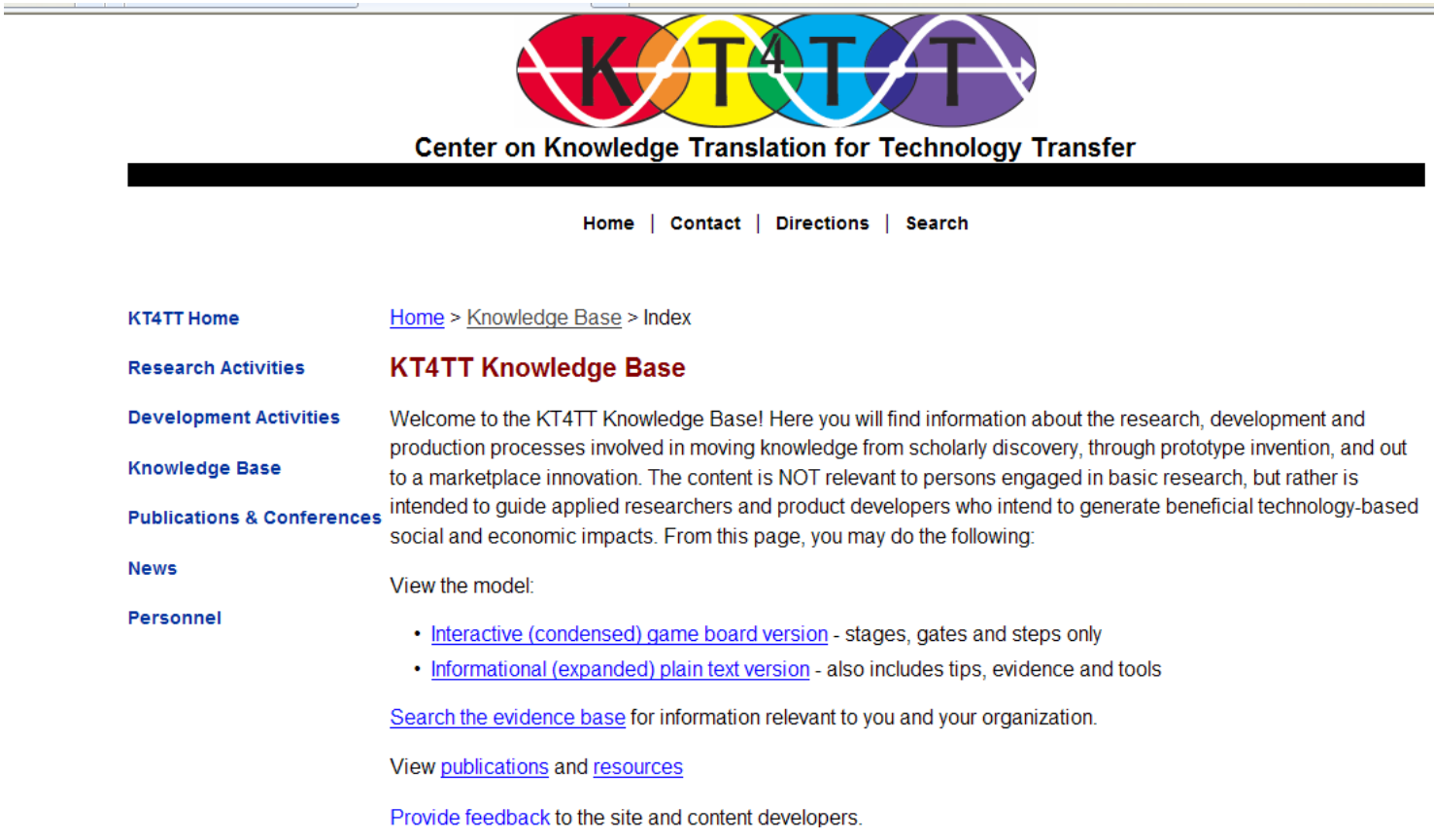
UD Tools within the NtK

		UD Specific Tools						
NtK Stage	NtK Step	Anthropometry (Human Size)	Design Guide (aging & disability)	UD Product Evaluation Tools	SWIFT 9.2012	Transgenerational Tools	Inclusive Design Toolkit	Design Exclusion Calculator
1	1.2: Identify Problem	x		x	x			
2	2.1: Define Innovation Opportunity	x		x	x			
2	2.2: Valuability Assessments	x		x	x	x	x	x
4	4.2: Propose Draft Solution	x	x	x	x	x		
4	4.3: Outline Preliminary Business Case	x		x	x			x
4	4.11: Gather, Analyze and Prioritize Customer Needs.	x		x	x	x		
4	4.12: Identify Device/Service Features and Specifications			x	x	x	x	x
4	4.13: Complete Business Case					x		x
5	5.1: Build Alpha Prototype Models	x	x					x
5	5.2: Monitor Development Process						x	
5	5.3: Test Alpha Prototype Models			x	x	x		
5	5.4: Refine Models							x
6	6.1: Test Beta Prototype with Consumers			x	x	x		
6	6.2: Refine Beta Prototype Models							x
6	6.3: Test Refined Beta Prototype with Consumers			x	x	x		
6	6.4: Refine Beta Prototype Models Further							x
7	7.10: Finalize Marketing and Sales Activities			x	x			
7	7.11: Develop Post-Launch Evaluation Plan			x	x			
8	8.2: Monitor Performance			x	x			
9	9.1: Continue Production, Monitoring and Support			x	x			

Knowledge Translation
Technology Transfer

Accessing the NtK and Tools

Visit http://kt4tt.buffalo.edu/knowledgebase



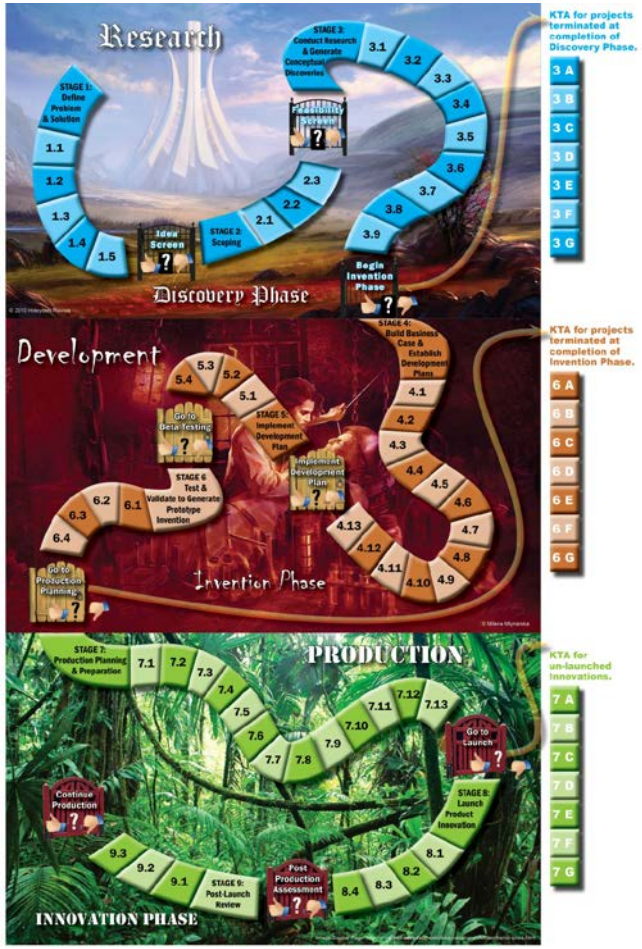
University at Buffalo
The State University of New York

NIDRR
NATIONAL INSTITUTE ON DISABILITY AND REHABILITATION RESEARCH

Knowledge Translation

KT4TT Technology Transfer

2 versions of the NtK



Discovery Phase

Stage 1: Define Problem and Solution Pill crusher example	• 1.1 Opportunity for KT: Assess needs for device or service with input from relevant stakeholders from the six knowledge user (KU) groups. • 1.2 Identify a problem (need). Identify audience for solution. Identify context for both. • 1.3 Propose plausible solution (goal) to problem in the form of a device or service. • 1.4 Determine scope of project (role); output as conceptual discovery, prototype invention or device/service innovation? • 1.5 Consider path to market.	• Limit disclosure of information regarding solution and document all original thinking related to solution). • Scope of project determines segments of KT4TT model involved with research generating discovery, development generating invention and production generating innovation level outputs. • Consider resources, timelines, and partners when defining path to market. • Opportunity for Universal Design (UD). Be mindful that the problem might be shared by others.
Gate 1: Idea Screen. PI decides to either terminate or move forward with project to develop solution to problem.		
Stage 2: Scoping (initial screen to validate innovativeness and value to target markets) Caller connect example	• 2.1 Define innovation opportunity.	• Delineate positioning strategy of future device/service.
	• 2.2 Opportunity for KT: Expanding on previously identified needs, perform preliminary valuability assessments (business, market and technical) on device/ service with input from stakeholders in the six KU groups. • 2.3 Identify potential barriers.	• Preliminary market assessment- Create potential value proposition including target price and performance parameters. Is concept novel and useful? Will prototype have value to intermediary stakeholders? Will device/service have value by the time it reaches the marketplace? Are there others who could also use this solution, thereby broadening the market? • Preliminary business assessment - For profit, cost recovery or freely distributed? Development and production phases internal or via stakeholders? Conduct SWOT analysis to identify barriers. Develop intellectual property strategy (e.g., NDA agreements), examine regulatory and reimbursement issues. Consider opportunity to achieve economies of scale for traditionally niche products, by expanding functional design to accommodate more user groups. • Preliminary technical assessment – Is it technically feasible and do capabilities exist internally or externally to develop and/or produce?
Gate 2: Feasibility Screen. PI must decide if envisioned project output and eventual device/service outcomes are still considered innovative in the light of results from assessments. PI decides if generation of new knowledge is required. If no, PI decides if project should move directly to invention phase or terminate. If yes, should they pursue external funding to conduct remainder of discovery phase?		
Stage 3: Conduct Research and Generate Conceptual	• 3.1 Opportunity for KT: Identify expertise needs and assemble transdisciplinary research team (i.e. methodologist, statistician, etc.)	• Develop research problem/question

Knowledge Translation
KT4TT
Technology Transfer

Supporting Evidence

Discovery Phase

Stage 1: Define Problem and Solution

Pill crusher example

- 1.1 Opportunity for KT: Assess needs for device or service with input from relevant stakeholders from the six knowledge user (KU) groups.
- 1.2 Identify a problem (need). Identify audien… solution. Identify context for both.
- 1.3 Propose plausible solution (goal) to problem in the form of a device or service.
- 1.4 Determine scope of project (role); output as conceptual discovery, prototype invention or device/service innovation?
- 1.5 Consider path to market.

KT4TT Home

Research Activities

Development Activities

Knowledge Base

Publications & Conferences

News

Personnel

Home > Knowledge Base > Step 1.1 related research

Step 1.1: Opportunity for KT: Assess needs for device or service with input from relevant stakeholders from the six knowledge user (KU) groups.

Navigate Findings

- Primary barriers
- Primary carriers
- Primary model
- Primary methods
- Primary measures
- Primary tips
- Secondary barriers
- Secondary carriers
- Secondary model
- Secondary methods
- Secondary tips

Primary findings

Barriers

Activities that may complicate team-based knowledge work include: framing the nature of the problem, scoping boundary conditions, identifying current and needed resources, establishing adequate task time frames, and clarifying roles and expected deliverables.
Case study and interviews.
(View full citation)

Communities may have considerable distrust of research, possibly due to negative prior experiences with research and/or authority in general.

University at Buffalo
The State University of New York

CAT

NIDRR
NATIONAL INSTITUTE ON DISABILITY AND REHABILITATION RESEARCH

Knowledge Translation

KT4TT

Technology Transfer

Tools

Stage 1: Define Problem and Solution	• 1.1 Opportunity for KT: Assess needs for device or service with input from relevant stakeholders from the six knowledge user (KU) groups. • 1.2 Identify a problem (need). Identify audience for solution. Identify context for both. • 1.3 Propose plausible solution (goal) to [illegible] in the form of a device or service. • 1.4 Determine scope of project (role); output as conceptual discovery, prototype invention or device/service innovation? • 1.5 Consider path to market.
Pill crusher example	
Gate 1: Idea Screen. PI decides to either terminate or move forward with project t	

Home > Knowledge Base > Toolbox results for Step 1.2

Toolbox entries for Step 1.2: Identify a problem (need). Identify audience for solution. Identify context for both.

Business Tools

- Affinity Diagrams
- Brainstorming
- Customer Idealized Design
- Delphi Method
- Ethnography
- Focus Groups
- Internal Idea Capture System
- Lead User Analysis
- Market Structure Maps
- Netnography
- One on One Interviews (customer visit teams)
- Open Innovation
- Patent Mapping

Universal Design Tools

- Anthropometry (Human size)
- SWIFT 9:2013 Universal Design for Energy Suppliers
- Universal Design Product Evaluation Tools

University at Buffalo
The State University of New York

CAT

NIDRR
NATIONAL INSTITUTE ON DISABILITY AND REHABILITATION RESEARCH

Knowledge Translation
KT4TT
Technology Transfer

Detailed Tool Listing

Anthropometry (Human size)

Competency group: Universal Design

Type: Design

Description: Anthropometric data sets represent a range of physical sizes of people (and their body segments) in a measured population. They show size dimensions for people according to age and gender. Size information about people is very useful in design as it gives target dimensions for a potential user base.

Citation for Description: Described by Authors

Units: Quantitative data for design applications

Advantages: After user group has been identified design specifications can be taken directly from the database.

Limitations: If the group is very specialized with very specific needs - some of this information can be misleading.

Target Audience: Marketing, Engineering, R & D

Relevant to Universal Design: Yes

Stages and Steps:

1.2
2.1, 2.2
4.2, 4.3, 4.11
5.1

Free Resource: My Anthro Itunes application (app) http://itunes.apple.com/us/app/myanthro-basic/id303465843?mt=8

Purchase Resource: Open Ergonomics. (n.d.). Visual Anthropometry Software. Retrieved from http://www.openerg.com/index.htm

Purchase Resource: Sammie CAD.(n.d.). HADRIAN (Human Anthropometric Data Requirements Investigation and ANalysis). Retrieved from http://www.lboro.ac.uk/microsites/lds/sammie/reshad.htm

Case Examples

- Caller Connect (Stage 2)
- Lids Off Jar Opener (Stage 4)
- Wheelchair Braking System (Stage 7)

Key Takeaways

- Due diligence saves money and time
- Reduction to practice is a necessary part of the process, but ideas are often adopted more readily than hard forms
- Manufacturing partners expect industry standard methods
- Broaden the target market when possible

Recap on Accessing the NtK Model and Tools

Visit: *http://kt4tt.buffalo.edu/knowledgebase/index.php*

- *Click link for Informational (expanded) plain text version of model.*
- *Scroll down page to review stages, gates, steps and tips.*
- *Click magnifying glass icons for supporting evidence.*
- *Click toolbox icons for tools.*
- *Case example links found on left side of each stage.*

Resources

- ***Need to Knowledge Model:*** *http://kt4tt.buffalo.edu/knowledgebase/model.php*
- ***Publications Page on Website:*** *http://kt4tt.buffalo.edu/publications*
- ***Website Resources:*** *http://kt4tt.buffalo.edu/publications/ResourceMaterials/index.php*
  - **Primary Market Research Training Module**
  - **Intellectual Property Training Module**
  - **Inventor's Guide**
  - **Evaluation Resource Guide**
- ***Focus Technical Briefs***
  - KTDRR's KT Library- Technology Transfer section: http://www.ktdrr.org/ktlibrary/articles_pubs/tt.html

Session Evaluation Reminder

- ***Go To:***

"Session Evaluation" Tab in ATIA Mobile Phone App to evaluate this session.

- ***Session:***

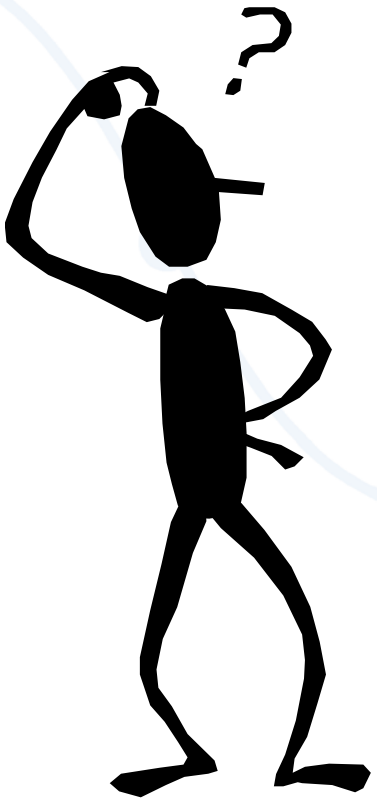
RSCH – 11

"Best Practices in Technology Transfer"

Continuing Education Credits

ACV-RSCH-11

Code for Academy for Certification of Vision Rehabilitation & Education Professionals

Thank you!

Any Questions?