Validating The Commercial Potential Of Your Research – Part 1

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President and Founder, Likarda, LLC

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Professor, Mechanical Engineering
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Beginning Steps of Translation

1. IDEA
   - Type of idea?
     - Build Team
       - Customer Discovery
         - Develop Minimum Viable Product
           - YES! Regulatory & Reimbursement
             - Intellectual Property & Conflict of Interest
               - NO Potential Pivot
                 - Funding a Startup
                   - Regional Resources

Sessions 1&2
Sessions 3&4
Sessions 5&6
First Step of Translation: Need Validation

What we are discussing today

IDEA

Project -> Research Grant -> Papers

“Papers are products too!”

Product

Service

Combo

Validate Need

Yes -> Build Team

No: Pivot

2nd Session
How do you know?
Project, Product, Service, or Combo

• Project
  – No tangible new “thing” or intellectual property (IP)
  – Projects can eventually result in a product or service

• Product
  – “Thing” with IP that is new and different than previous thing that serves a need

• Service
  – Product or technique that others would not (yet) buy, but is useful for their needs
Case Study Examples

• Idea for using existing suture for new surgical procedure
• New suture design for use in new surgical procedure
• Spinal fusion implant that generates electrical stimulation to heal bone with patient loading
• Likarda product/service
BioTech Startup School
Lisa Stehno-Bittel, Ph.D. | President & Co-Founder | Likarda, LLC | Jan 2018
Do you have a Product or a Service. The answer is not simple

- **Idea**: A thought as to possible course of action.
- **Product**: An article or substance that is manufactured or refined for sale. i.e., drug company
- **Service**: Generation of income by performing work instead of selling physical products. i.e., a public accounting firm

Try to name a single product/service/idea that doesn’t have aspects of the other two.

Potential start ups typically think that they only have one of these.
KUMC Examples

• Course content for residents
• Diagnostic for cardiotoxicity
  • SBIR
• Drug screen tool
Advanced Computing Facility
Analytical Proteomics
Animal Care Unit
Applied Bioinformatics
BIO Center
 Biological Irradiation
Biomolecular NMR
Center for Research Computing
Chemical Methodologies and Library Development
Computational Chemical Biology
Experimental and Preclinical Imaging
Genome Sequencing
Genomics and Bioinformatics
Genomics Facility
High Throughput Screening
Immunology
Infectious Disease Assay Development
Instrumentation Design
Mass Spectrometry
Medicinal Chemistry
Microfabrication and Microfluidics
Microscopy and Analytical Imaging
Molecular Graphics and Modeling
Molecular Probes
Nuclear Magnetic Resonance
Protein Production Group
Protein (X-ray) Structure
Solid State NMR
Specialized Chemistry Center
Synthetic Chemical Biology
X-Ray Crystallography

KU Lawrence Core Laboratories
27 labs listed

KUMC Core Laboratories
Cell Isolation Core

The Cell Isolation Core is a COBRE funded core that currently provides high quality hepatocytes and non-parenchymal cells from human, mouse and rat livers to investigators at KUMC and its campuses for support of their scientific research at a minimal cost. Currently hepatocytes are the main cell type isolated with future plans to offer specific non-parenchymal cell fractions. Liver cells can be used for a variety of translational and basic research studies that include the mechanisms and treatments of liver diseases, drug metabolism, toxicology and enzyme activity assays. The Core also provides expert advice on hepatocyte culture and experimental design. The Cell Isolation Core can provide snap frozen hepatocytes, non-parenchymal cells and liver tissue as well as cryopreserved non-parenchymal cells, RNA, DNA and protein fractions. With the cooperation of the KU Liver Center and KU Hospital, the Cell Isolation Core can provide research investigators with a link to clinical investigators that will allow for greater understanding of liver disease and how to treat it. The Cell Isolation Core is located in the state-of-the-art Hemenway Life Sciences Innovation Center and is part of the Department of Pharmacology, Toxicology and Therapeutics. The 400 ft.² lab is located in room 4062 HLSIC and contains all of the necessary equipment, reagents and consumables needed for liver cell isolation and culture. The Cell Isolation Core is IRB and IACUC approved for all current studies.

<table>
<thead>
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<th>Human Hepatocyte Pricing</th>
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<tr>
<td>As of...</td>
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<tr>
<td>Jul 1, 2015</td>
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<td>$20.00</td>
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<tr>
<td>per 6-well plate, 12-well plate, 24-well plate, 48-well plate, 96-well plate, 25cm flask, 75cm flask, or 10cm dish</td>
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<tr>
<th>Mouse and Rat Hepatocyte Pricing</th>
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<td>As of...</td>
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The REACH lab at KU Medical Center

The Research in Exercise and Cardiovascular Health (REACH) laboratory is comprised of dedicated students, researchers and volunteers from the community who work together to answer important questions about chronic disease and disability. The lab is focused on research that integrates three areas of study: cardiovascular physiology, brain aging and stroke recovery.

We are focused on using exercise interventions that maximize heart and brain health in people with and without disease. We use non-invasive methods to study the heart, lungs, brain and vascular system.

Fitness and Body Composition Services
REACH lab offers various fitness assessments to the community on a fee-for-service basis. These include cardiac risk assessment, body composition, and VO2 max testing.

- Cardiac risk assessment (screening including blood pressure)
Protein Production Group

About the Group

The COBRE Protein Production Group (PPG) focuses on the cloning, expression and purification of prokaryotic and eukaryotic proteins for COBRE and other investigators in Kansas and the region. The laboratory maintains a variety of equipment to support the production of properly folded proteins in quantities suitable for structural studies (X-ray and NMR), functional studies (catalytic or biological), label-free binding studies (SPR) and/or high throughput (HTP) screening studies.

The PPG employs both E. coli and insect cell expression systems. It has three FPLC systems including an AKTA Purifier and an AKTA Xpress that can run four columns in parallel. The AKTA purifier system is designed for high-performance purification and characterization of protein, peptides and nucleic acids. It is at home with routine procedures of any complexity, such as scouting or method optimization. The AKTA purifier system offers several key features: a high level of automation and a method wizard that minimizes preparation, run time and repetitive tasks while retaining flexibility for easy manual operation. The laboratory has a fully-automated Bioner ExiProgen system for protein synthesis and nucleic acid extraction. It uses E. coli cell-free lysate for synthesis of protein from plasmid or PCR-amplified DNA. The PPG also provides advice and consultation, training, access to equipment, and custom services in many aspects of protein production, starting with cloning.
Work Request -- COBRE-PSF Protein Purification Group

Please provide the following information. This information is intended to ensure that we know exactly what you want us to do. **The cost estimate we provide will be based on this information.**

- Type directly onto this Microsoft Word document; it will expand as you type, but please be concise, and please use 10 point Arial font for readability. **Please complete ALL sections.**
- Then Save the document as "Lastname - PPG Work Request" (without quotes) and submit it electronically to Dr. Philip Gao, Director, COBRE Protein Purification Core Lab <gao@ku.edu>.

1. Submission Date:                2. PPG Work Request #__(leave blank) 

3. Project Cost Estimate:__(leave blank)

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### 2. Submitter Information (PI / Faculty / equivalent)

<table>
<thead>
<tr>
<th>NAME</th>
<th>Phone</th>
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<tr>
<td>Dep't.</td>
<td>E-mail</td>
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</table>

Indicate location: ( )KU ( )KUMC ( )KSU ( )WSU ( )Other__________________________

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### 3. Laboratory Contact (research asst./assoc.)

<table>
<thead>
<tr>
<th>NAME</th>
<th>Phone</th>
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<tbody>
<tr>
<td>Dep't.</td>
<td>E-mail</td>
</tr>
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</table>

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4. **Description of work requested.**

4.1) Tell us exactly what you want us to provide; i.e. define the "deliverable" or "product" that you expect to receive from this work request. **Examples might include: consultation, training, protocol development, cloning, mutagenesis, expression system development or improvement, large or small scale protein expression and/or purification, and/or Biacore binding studies.**

4.2) Tell us what criteria the product must meet (quantity, concentration, buffers, purity, functionality, etc.).

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5. **Methods.** Do you have an established or preferred protocol that we should use, or will we need to develop one? If the product requested has been made before, please provide PDF copies of specific protocols or relevant literature methods with this form. Mention special precautions, if any.

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6. **Materials provided by Requestor.** What will you provide - clones, plasmids, antibodies, reagents, chips, etc.? If nothing, so state. Are any of these items "precious" (extremely costly or in very limited supply)?
KanPro

How does this benefit KU?

LAWRENCE — A University of Kansas scientist has launched a new startup company designed to tackle the most complicated protein production for academic and industrial clients.

KU biochemist Philip Gao has founded KanPro Research Inc., a contract research organization that produces challenging proteins for university and corporate researchers in the life sciences, biotechnology and medicine. In addition to protein production, KanPro will provide a range of consulting services for clients with protein-related needs.

"Proteins are widely used by academic researchers and bioscience companies," said Gao, director of KU’s Protein Production Group and president of the new company. "But for clients with highly specialized and complicated protein needs, there are only a handful of domestic contract research organizations, and few if any of them can match KanPro's capabilities. We focus on clients' most tricky protein needs ... basically, the projects that have failed elsewhere."

KanPro has two employees — a lab manager and a project manager — and is located in the Bioscience & Technology Business Center Main Facility on KU’s west campus. Gao said he foresees the company reaching an optimal size of five to 10 employees at the BTBC by 2017.

KanPro becomes the university’s 25th active startup and the third KU startup created since 2012. KanPro stems from Gao's work as director of KU's Protein Production Group, a federally sponsored lab that over the years has evolved into an in-house protein production center serving KU scientists in various fields. To date, the Protein Production Group has expressed and purified more than 500 proteins, including ones that had previously defied conventional methods. The Protein Production Group has served hundreds of clients, including Becton, Dickinson and Co., a leading global provider of medical products with offices in more than 50 countries.
Dedicated Protein Services

KanPro Research is a contract research organization (CRO) headquartered in the Bioscience & Technology Business Center at the University of Kansas. The company is based on successful operations of the KU COBRE Protein Production Group (PPG). The company is specializing in recombinant protein expression and purification from bacterial, yeast, insect, and cell-free systems. KanPro Research seeks partnership with academic and industrial researchers to develop contract research projects, produce challenging proteins failed elsewhere. Professional advice and consultation services are also provided.

Read more about “E. coli Protein Challenge” Promotion

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Business Description
KanPro Research is a contract research organization (CRO) headquartered in the Bioscience & Technology Business Center at the University of Kansas. The company is based on successful operations of the KU Enzyme Lab, KU Biochemical Research Services Lab and the KU COBRE Protein Production Group (PPG).

Mission Values
KanPro Research is a dedicated protein services to pharmaceutical and biotechnological companies as well as academic institutions of all sizes, advancing their research efficiency and core competitiveness and ultimately improving their productivity.

Contact Information
KanPro Research, Inc.
Bioscience & Technology Business Center
2029 Becker Drive, Suite 235
Lawrence, KS 66047
Phone: (785)-330-3228 and (785)-330-3226
Website: www.kanpro-research.com
Email: order@kanpro-research.com
KanPro

Clients

- exonbio
- IBT Laboratories
- TopgeniX
- SynAm Vaccine
- Houston Methodist
- ProteinCT
- KC Bio, LLC
- FastBio
Watch our Webinar on the New FDA DDI Guidance

Presented By
Dr. Brian Ogilvie,
VP of Scientific Consulting

Register Now to watch "Essential Considerations on the New FDA In Vitro DDI Guidance (the What, the Why, and the Wow)"

eStore

Sekisui XenoTech offers unrivaled quality and selection with an extensive array of products to assist all your in vitro ADME research needs.

Resources

At Sekisui XenoTech, we recognize the importance of having readily available, reliable information. Our customers rely on the following:

News and Events

Tuesday, December 19, 2017
Webinar: Comparison Between the New US FDA and Japan PMDA In Vitro DDI Guidance Documents...

After recent revisions to the Japan PMDA 2014 guideline and US FDA 2012 draft guidance for industry on in vitro drug-drug interaction (DDI) studies, Drs. Andrew Parkinson, XPD Consulting, and Brian Ogilvie, Sekisui XenoTech, will offer their expert perspectives on major changes and differences between the two agencies' in vitro guidance documents, and how to harmonize your drug development strategies to meet the expectations of both...

Wednesday, October 18, 2017
Sekisui XenoTech Appoints New COO
The University of Kansas Medical Center
Service Center Rate Approval Request

NEW OR REVISED: * Revised
Send with Restricted Fee Account Application to Control & Reporting, 120-H Support Service, 2100 W 36th Street, MS 2035

SERVICE CENTER NAME: (If applicable) Diabetes Research Lab

SPEEDTYPE NUMBER: (If applicable) RFF15360

DATE OF REQUEST: 10/29/14

REQUESTING DEPARTMENT/UNIT: Physical Therapy and Rehabilitation Science

Section 1:
DESCRIPTION OF GOODS OR SERVICES TO BE PROVIDED: *

Our KUMC research laboratory is set up to do contract research for a variety of procedures related to diabetes. We specialize in islet isolation from a variety of animals. Our specialty is mouse, rat, cat and dog islets. We also do a number of types of analysis of tissues. Our specialists have refined surgical skills for transplantation of islets in rats. We are also specialists in diabetes monitoring and wound formation procedures.

IS THIS AN ACTIVITY IN WHICH YOUR DEPARTMENT/RESEARCH LAB/UNIT IS ALREADY INVOLVED? Yes.

HOW IS THIS PROPOSED SERVICE CENTER RELATED TO THE INSTRUCTIONAL, RESEARCH AND/OR PUBLIC SERVICE MISSION OF THE UNIVERSITY?

By supporting private industry and other laboratories within KU with our specialized techniques and knowledge, we support businesses and research within the State of Kansas.

BENEFIT TO THE UNIT FOR PROVIDING THIS SERVICE:

We are able to generate income for the lab in addition to our grants. It allows for collaborations in publishing and reflects well on the reputation of KU Med. In addition, it teaches our PhD students how to interact with industry sponsors.
Diabetes Research Laboratory

Diabetes is a serious chronic condition – one which is steadily worsening in the United States. Research in the Diabetes Research Laboratory aims to address cardiovascular complications of diabetes.

Scientific work in the lab has been made possible by grant funding from the National Institutes of Health, the American Heart Association, and U.S. Department of Commerce.

Diabetic heart disease and the benefits of exercise

Among individuals with diabetes, cardiovascular disease (CVD) is the leading cause of death. As a result of diabetes, the heart muscle becomes stiff and weak and is therefore unable to efficiently supply blood to the body. Fibrosis of the cardiac muscle, which results from an increased accumulation of extracellular matrix proteins, develops during diabetes and this makes the muscle stiffer.

Diabetes also damages the structural components of cardiac muscles. Since physical exercise is known to improve heart performance, the lab is interested in uncovering the biochemical and molecular mechanisms that benefit cardiac muscle.

By using a non-invasive magnetic resonance imaging (MRI) technique, KU researchers have been able to demonstrate that physical exercise does indeed improve the diabetic heart’s ability to contract and relax. Additionally, research has shown that exercise corrected some of the structural defects of the diabetic heart muscle.

The lab has also found a specific drug which affects one of the critical molecules responsible for causing heart stiffness in individuals suffering from diabetes. This drug can partially mimic the effects of physical exercise and is an important resource in finding a pharmacological agent that would regulate the same molecule in a manner similar to exercise. This would be an invaluable resource for people with diabetes that are unable to exercise due to complications of the disease.
# KU Diabetes Research Laboratory

01/08/13

Prices below are subject to change. Please contact the laboratory for the latest charges.

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>COST</th>
<th>QUANTITY</th>
<th>AMOUNT</th>
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<tbody>
<tr>
<td>Rat Islet isolation *</td>
<td>$500/rat</td>
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<tr>
<td></td>
<td>Without animal cost $400</td>
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<tr>
<td>Mouse Islet isolation *</td>
<td>$500/mouse</td>
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<td></td>
<td>Without animal cost $400</td>
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<tr>
<td>Dog Islet isolation *</td>
<td>$2035/dog (without shipping)</td>
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<td></td>
<td>$3553/dog (with shipping)</td>
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<td></td>
<td>Without animal cost $635</td>
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<tr>
<td>Islet separation</td>
<td>$45/hour</td>
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<tr>
<td>IEQ (islet equivalency)</td>
<td>$45/count</td>
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<tr>
<td>Purity staining w/ dithizone</td>
<td>$35/staining</td>
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<tr>
<td>Viability staining /fluorescent</td>
<td>$55/staining</td>
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<tr>
<td>Rat islet transplantation</td>
<td>$725/rat</td>
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<tr>
<td>Dog islet transplantation</td>
<td>$1450/dog (without shipping)</td>
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<tr>
<td>Animal maintenance (checking blood glucose, glucose tolerance tests, weighing, pump implantation)</td>
<td>$50/hr</td>
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<tr>
<td>Human tissue accrual</td>
<td>Price of tissue + $50 handling fee</td>
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<tr>
<td>Protein extraction and purification (buffer preparation, homogenizing, aliquots)</td>
<td>$70 for Total tissue</td>
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<td>$140 for Tissue Specific</td>
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<tr>
<td>Protein assays</td>
<td>$85/sample</td>
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<td></td>
<td>$125/run</td>
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<tr>
<td>Enzymatic assays</td>
<td>$85/sample</td>
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<td></td>
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<tr>
<td></td>
<td>$175/run</td>
<td></td>
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<tr>
<td>Western Blot (membrane preparation, staining, stripping, result analysis)</td>
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<tr>
<td></td>
<td>$340/blot</td>
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<tr>
<td>Immunoprecipitation</td>
<td>$250/sample</td>
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<tr>
<td>ELISA (price may differ depending on target protein)</td>
<td>$80/sample (in duplicate)</td>
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</table>
A Case Study for this Course
Likarda Story

- KU Intellectual Property
  - 2 US issued (6 foreign)
  - 1 US issued (0 foreign)
Likarda Story

• Likarda Intellectual Property
  • 1 US issued (0 foreign)
  • 1 US use patent
  • Trademarks
Likarda Story

- Market Need
- Competition
- The Cost of Starting
- The First Almost-Investor
- Conflict of Interest
Likarda Story

- Employees
- Equipment
- Space
- Procedures (GLP)
- FDA/patent Submissions
Likarda Story

- Marketing
- Sales
- Revenues

The concept of microcultured organoids is not a new one to science, however Likarda's patented microplates can produce and test more than 300,000 cell clusters in the same amount of space that competitors use to create a maximum of 384 clusters.

THE LIKARDA MICROPLATE

Our approach is more efficient and allows the cell clusters to be maintained for a longer period of time. Our 3D cluster technology can be incorporated within standard 96-well formats to offer a solution that can integrate with industry standard automated equipment. This efficiency gives Likarda an advantage over all other companies by truly offering a scalable solution with vast applicability. Our microplates can also be combined with currently available assays.

Benefits of Engineered Cell Clusters from Microplate

- The benefits of using Likarda's microplates include:
  - Clusters can be formed from different tissues and populations
  - Age, sex, species- or breed-specific testing
  - Low diffusion barrier ensures total diffusion exchange

The Leader in Regenerative Medicine

Likarda utilizes a proprietary cell culture system to create three-dimensional cell clusters, or miniaturized organs, having applications in markets from drug discovery and development to cell-based therapies.
Likarda Story

- Tough Times
- Real Investor
Likarda Story

- The Kanslet (Doglet) Product
- Manufacturing
- Regulatory (FDA)
Different Question: Is my product or service viable?

• How do you know?
  – NSF I-Corps approach
  – Customer Discovery on both the need and the proposed solution

• Understand how your market segment works
  – How do large or small companies in the space of your product/service generally operate?
  – Can a small company really take the medical product all the way to market, or is acquisition by a large company required or preferable?
The Business Model Canvas

1. Value Propositions
2. Customer Segments
3. Customer Relationships
4. Revenue Streams
5. Key Resources
6. Key Activities
7. Key Partners
8. Cost Structure
9. Market Fit

Product

Fit
Planning and Hypothesis Testing should come before final product design and forming the company

= CUSTOMER DISCOVERY
The Business Model Canvas:
Your initial ideas are just guesses (or hypotheses)
Step 1: Validation of the Problem
• “Are we addressing a problem lots of people want to be solved?”

Step 2: Validation of the Proposed Solution
• “Does the proposed solution solve the problem in a compelling, unique way?”
Write down your hypothesized **Value Propositions** and experimentally test them without bias with **potential customers**.

*Treat validating the need for a product like testing your research hypothesis.*
First Step of Translation: Need Validation

What we are discussing today

IDEA

Project → Research Grant → Papers

“Papers are products too!”

Product

Service

Combo

Validate Need

Yes → Build Team

No: Pivot

2nd Session
Exercise

• Team Formation
• As a team
  • Decide on potential value propositions for your product concept
  • Generate an initial list of potential customer segments
Homework before next session

• Review the website https://steveblank.com/tag/customer-discovery/ to learn more about Customer Discovery techniques.
• Form questions to ask potential customers about validation of the need.
• Each team member should talk with at least two potential customers about the need only:
  • Start a log of who each team member spoke with and what that customer said in response to the questions.