Strategic Research Opportunities at Technology Readiness Level 4-7 for Purdue

by:

Ragu Athinarayanan
Arden Bement
Ed Morrison

Strategic Research Opportunities at TRL 4-7 for Purdue

As with many research Universities, Purdue has built an extensive infrastructure to support discovery activities linked with fundamental and early applied research (Technology Readiness Level TRL 1-2). Purdue also possesses the infrastructure to commercialize innovation; the Research Foundation, the Research Park and the Foundry move technology and innovation to market. This scenario is quite typical at many major research universities in the United States where there is a heavy investment in basic and early applied research for generating discoveries and new knowledge (TRL 1-2). On a national scale research universities contribute to sustaining a national ecosystem for a "Research Economy," with contributions predominantly from faculty members and researchers who determine the research agenda.

On the other end of the spectrum sits the "Market Economy" for spurring innovation and growth in the commercial marketplace. Industry R&D linked to these activities, specifically applied research and technology development (TRL 4-7), lies in the region after basic research has been conducted and prior to product development and commercialization. Because of lower risk and shorter time-horizon needed to take a technology to market, industry concentrate their R&D investments in later stage technology development and product development projects (TRL 8-9). These projects dominate all industry funded R&D, and in 2009 industry funded 78% of all such projects in the United States. Figure 1 provides a comprehensive look at this development process. It illustrates the various stages of development process of a technology, based on TRLs, as well as the organizations performing and funding these activities.

As Figure 1 illustrates, between the "Research Economy" and the "Market Economy" sits the so-called Valley of Death, also known as the "innovation gap"(TRL 4-7). Here many potential innovations die for lack of the resources needed to develop them to a stage where industry or investors can recognize and exploit their commercial potential. Purdue, like other research universities, faces challenges in bridging this gap. There is evidence the Valley of Death is getting wider, because industry is increasingly focusing its investments on shorter-term R&D projects (12-18 month time horizon), due to increased global competition and market volatility. Over the past two decades and especially since 2009, the nature of R&D funded by industry has shifted dramatically resulting in a proportionate decline of industry R&D investment in basic research. As a result, U.S. research universities are today performing not only their traditional role in basic research, but also an increasing role in translational (TRL 3) research and applied R&D (TRL 4-7) necessary to transfer research discoveries to industry.

With industry dominating the total U.S. investment in R&D, this development presents an opportunity. Research universities that design new infrastructures around market facing applied R&D, will likely attract new industry investment to support their research enterprise. Finding new ways to bridge the Valley of Death should become a priority for Purdue. There is a strong case that could be made for supporting this priority. Purdue has historically taken a national leadership role in designing new approaches to industry collaborations. For example, the Bayh-Dole Act, a keystone of our national innovation system, was largely written on our campus. Purdue now has the opportunity to strategically position itself to take advantage of this shift in trend in industry R&D funding, and bring its research closer to the marketplace than ever before.
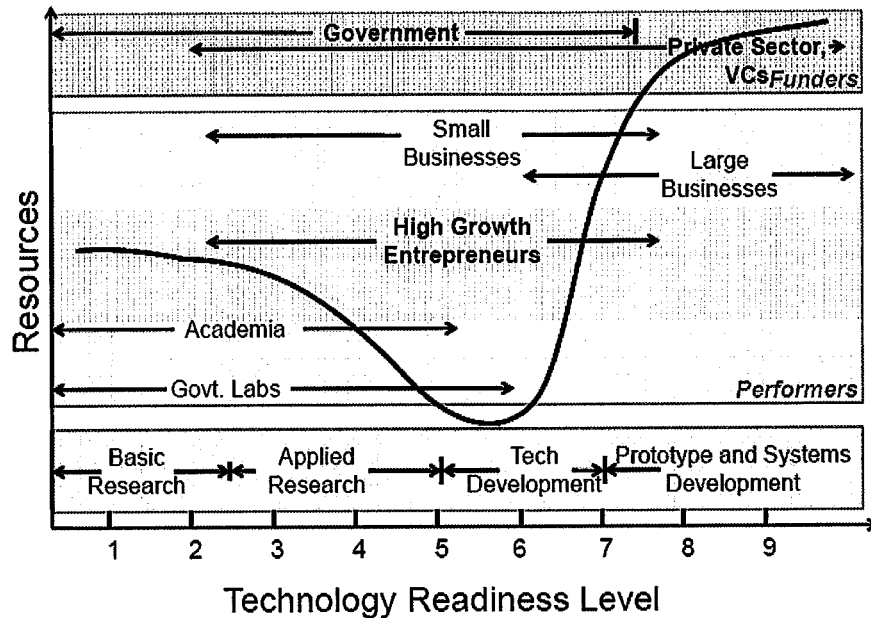
Elements of the Valley of Death

Figure 1 (Source: National Defense Industrial Association, Presentation by Philip Coyle, "The Missing Middle")

Our Proposal

With the PPI Innovation Accelerator initiative, we outline a framework to bridge the Valley of Death by focusing on Technology Readiness Levels (TRL 4-7). The design of the PPI Innovation Accelerator will have a strong focus on a 3-way collaboration between Purdue, industry, and partnership with two applied research organizations of choice (Battelle and Fraunhofer Society), to accelerate innovation. The PPI Innovation Accelerator will be uniquely positioned to "align, promote, and adapt" Purdue technologies to new market opportunities. At the same time, the accelerator initiative will open new opportunities for industries to "pull" technologies from Purdue toward market applications. Finally, the PPI Innovation Accelerator will provide flexible, custom designed platforms to accelerate the development of existing and new industry clusters. In sum, the PPI Innovation Acceleration will take a balanced, integrated approach organized around three key priorities:

a. *Technology Accelerated Adaptation to Market (extending existing knowledge and IP at Purdue toward new market opportunities),*
b. *Technology Accelerated Market Pull (creating new innovation Labs or i-Labs established with a market-facing, industry-defined agenda on campus), and*
c. *Cluster Development (supporting regional clusters through custom-designed i-Labs that leverage existing Purdue Research Labs and Centers).*

The PPI Innovation Acceleration will take the form of a flexible, adaptive network of innovation labs (i-Labs), anchored by a i-Core Lab. The i-Lab network will involve no new construction, but will leverage existing facilities on the Purdue campus. The i-Core Lab will operate much like a core lab in a biomedical

research facility. It will assemble and share technology and innovation assets from Purdue and its partners. These assets, consisting of tested frameworks, tools, and training in technology and innovation management, will provide a new applied research platform (TRL 4-7) to accelerate innovation on the Purdue campus in collaboration with our research partners (Battelle and Fraunhofer Society) and industry.

Our Technology Accelerated Adaptation to Market Agenda

The Technology Adaptation to Market agenda will develop a translational-applied research platform equipped with appropriate strategic innovation management tools (supported through the i-Core Lab) for helping researchers accelerate and adapt their innovations to market. This platform is similar to the Proof-of Concept Centers (PoCCs) pioneered by MIT (MITs Deshpande's Center) and University of California San Diego (von Liebig Center). Currently there are 32 such PoCCs across the United States to transfer technology and innovation to industry.

The Purdue PoCCs will develop an active relationship with associated Innovation and Entrepreneurship activities on campus through partnerships with industry and external research agencies, such as Battelle and the Fraunhofer Society. This agenda will assess technologies for their "market-readiness" and promote investment in the most promising candidates. In doing this it will consider all four possibilities outlined below for such adaptations:
   i.   existing technologies for existing markets (lowest potential returns but lower technology and market risks)
   ii.   existing technologies for new markets (higher potential returns but lower technology and higher market risks)
   iii. new technologies for existing markets (higher potential returns but higher technology and lower market risks)
   iv.   new technologies for new markets (highest potential returns but higher technology and market risks)

Employing proven strategies of technology and innovation management, the PPI Innovation Accelerator will evaluate potential technology adaptation candidates on a "return versus risk" grid and proceed to engage in strategies for changing the ratio of return to risk through risk reduction and return enhancement strategies. Strategy development associated with concepts such as risk management (entrepreneurship) and opportunity creation (innovation) is where innovative industrial firms, Battelle and Fraunhofer Society excel. Purdue researchers engaged as partners can make valuable contributions by identifying technological alternatives to bridge, circumvent or reduce apparent technical barriers (passing through the "Valley of Death"). They can guide technologies through TRL 4-7 with research activities such as such as modeling, analysis, testing, and fast prototyping.

The Technology Accelerated Adaption to Market agenda will be staged around the following priorities:
   i.   Finding profitable applications in the marketplace for existing Purdue IP/Innovation using tools such as the Market Explorer, Technology Radar, or other semantic search platforms, developed by Fraunhofer Society. Also identify adjacent market opportunities for specific technologies.
   ii.   Providing a translational research platform to support activities associated with technology assessments, innovation management, strategy development, technology/product development, analytical modeling, simulation, testing, and also prototyping.

iii. Providing Industry and Alumni Mentorship programs to facilitate interaction between researchers and industry to reduce technology and market risk; and this could include alumni, advisory mentors, and industry catalysts.

iv. Providing IP management (invention disclosure to ultimate licensing) and strategic innovation management support for related endeavors. This would look beyond the standard intellectual property management protocols that are common to most university-based research centers focused on basic research (e.g., invention disclosure submission, vetting for patenting, marketing for licensing or spinoff, technology licensing)

v. Expanding student training in innovation and entrepreneurship arising from applied research activities, such as technology assessments, technology development, testing, and prototyping. Industry members could work with students on project teams, act as mentors, provide in-situ internships, serve on thesis committees, and provide financial support for students with internships and assistantships.

vi. Providing support in connecting with Federal government programs such as the I-CORPS, Engineering Research Centers (ERC), Grant Opportunities for Academic Liaison with Industry (GOALI), Industry/University Cooperative Research Centers (I/UCRC), Partnerships for Innovation (PFI), Small Business Technology Transfer (STTR), Small Business Innovation Research (SBIR), Emerging Frontiers of Research and Innovation (EFRI), etc. Figure 2 below shows the different federal grant programs applicable at the various stages of the translation research lifecycle.
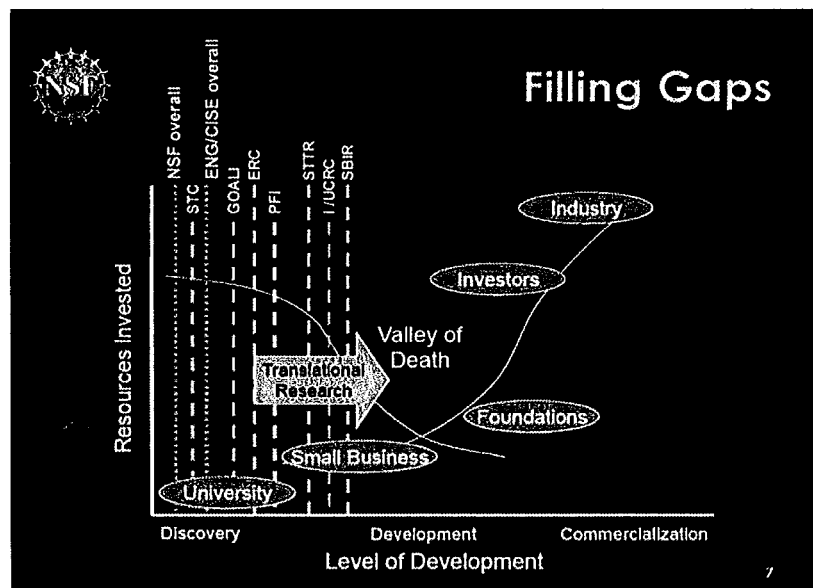

Figure 2 (Source: National Science Foundation, Presentation by Thomas Peterson, "Creating an Innovation Ecosystem")

Our Technology Accelerated Market Pull Agenda

The Technology Pull agenda in the PPI Innovation Accelerator will strategically align Purdue with industry R&D with emphasis on market facing applied research, particularly projects with a shorter time horizon for completion (TRL 4-7). The Pull Agenda will forge a 3-way collaboration between Purdue, industry, and Battelle & Fraunhofer Society, for engaging in industry funded R&D projects that generate rapid innovations (on an industry "time-scale") for industry and for transferring market facing research discoveries to industry. The choice of both Battelle and the Fraunhofer Society research enterprises is strategic to the overall mission of the PPI Innovation Accelerator.

We envision the establishment of a network of agile innovation Labs (i-Labs) around a particular cluster of applied research areas on the Purdue campus. The proposed i-Lab research program at Purdue will be designed to provide research support (TRL 4-7) for industry, whose operations are supported predominantly through contract research and industry memberships. We also plan to seek unrestricted industrial grants and gifts for establishment of the i-Labs. Although these i-Labs by design could collaborate with any size company, special emphasis could be placed on attracting small and medium-sized enterprises as they are also more likely to absorb new technologies and grow faster. Operationally the i-Labs at Purdue will be staffed by a combination of full-time staff researchers, faculty researchers, and also students. We will supplement the talent and expertise in the network of i-labs at Purdue with the expertise of staff researchers at Battelle and the Fraunhofer Society. Collectively this will provide us with a broader talent pool and expertise in the i-Labs which we could leverage and increase the diversity of activities that we can engage in

The Fraunhofer Society is an independent non-governmental network of applied research institutes in Germany. Their strength is for providing high-quality, short-term, affordable applied research that small and medium-size firms could not otherwise afford. One key advantage to leveraging the collaboration with the Fraunhofer Society is the PPI's access to its scale; it operates more than 67 research institutes with more than 250 focus areas and with 23,000 employees. The PPI's Innovation Accelerator mission is strongly aligned with the Fraunhofer Society's, which focuses on applied research with practical industrial value. Also they see themselves as a link between the knowledge that resides at universities and generating innovations for industry. In the process, they also generate a great deal of new knowledge alongside the universities with whom they are linked with.

Each of the 67 Fraunhofer institutes is associated with a specific applied research cluster and their operations are directly paired with a university in Germany with similar research interests. They place high emphasis on education combining academic studies with industry apprenticeships, employing master's and Ph.D. students who acquire practical experience while simultaneously pursuing their studies. This arrangement ensures a ready supply of well-trained researchers with hands-on experience in critical industrial technologies. This engagement model is a highly successful public-private partnership we could emulate or modify for operationalizing the network of i-Labs at Purdue.

Battelle is a U.S. based nonprofit R&D organization with over 22,000 employees at more than 60 locations globally. They are an international science and technology corporation that explores emerging areas of science and engineering, develops and commercializes technology, and manage some of the world leading national laboratories. They also have a large pool of scientists, engineers, and technologists and are considered to be a leader in the field of technology based economic development in the U.S. Their Technology Partnership Practice (TPP) program is highly renowned for bringing together government, universities, and private industry for fostering economic growth. Battelle also

excels in some of the core technology areas such as bioscience, agbioscience, biotechnology, and nanotechnology for which Fraunhofer Institutes does not have strong relative footprint. Their expertise with services such as technology roadmaps, technology workforce development, and design of programs and services that involves public-private partnerships would be of value to the PPI Accelerator for forging collaborations.

The Fraunhofer Institutes and Battelle connections would be organized through the Core Lab that would anchor the i-Lab network on the Purdue campus. This linkage will make possible three-way partnerships with Purdue to develop i-Lab's with the following features:

i. Each i-Labs will have a customized, lean, and agile innovation infrastructure to rapidly meet industry research agendas.

ii. Access to powerful innovation tools on demand. Each i-Lab will have a portfolio of the latest innovation tools, frameworks and training supported through the Core Lab. This includes two semantic search platforms which operate with an associated, disciplined protocol of identifying adjacent market opportunities for a given technology (MarketExplorer), as well as technology surveillance to spot technology development trends that can disrupt a given product market (TechnologyRadar).

iii. Access to full-time Purdue researchers, faculty and students on demand (collectively more than 40,000 researchers across the Purdue, Fraunhofer, and Battelle innovation ecosystem).

iv. Bring coherence, speed, and new opportunities to expand industrial investment in Purdue's market-facing industry research agenda.

v. Create new multi-disciplinary learning opportunities for Purdue students locally and globally. This includes training students in innovation stages through exposure to "real-world" problems, and engaging faculty in pondering the enigmas that are often encountered by industry in solving these problems. Also student engagement provides "fresh-eyes" that can lead to barrier reduction in bridging the "valley of death."

The services of the i-Lab should not be confused with the services provided by Purdue's Technical Assistance Program (TAP). Services of the i-Lab are further upstream on the TRL level, while TAP is focused on the diffusion (TRL 9) of existing knowledge for improving systems and processes, no longer considered to be research by this point. Consistent to the TRL 9 levels, the time horizon for their projects lasts anywhere from 3-6 months. The research of the i-Lab are in the TRL range of 4-7, spanning anywhere from translational research, applied research, technology development, TRL and also market assessments. In contrast to TAP, services of the i-Lab could be viewed as generating innovations and transferring research/knowledge to industry. These projects also have a longer time horizon (shorter than basic research) and span anywhere from 12-24 months.

Our Cluster Development Agenda

Pooling resources and linking skills creates new opportunities for small and mid-sized enterprises (SMEs) to compete globally. Knowledge-based markets often develop successfully in regional innovation clusters in which networks of university researchers, investors, and business firms accelerate the development of new business ideas. Regional innovation clusters represent geographic concentrations of interconnected industries and institutions serving closely connected markets and are typically defined as having the following four characteristics: (1) a geographically bounded concentration of similar, related, or complementary industries and institutions; (2) active channels for transactions and communications among these industries; (3) shared and specialized infrastructure, labor markets, and

services; and (4) common competitive opportunities and threats. There is growing interest in approaches to innovation development that are rooted in regional clusters and the role universities can play in facilitating the innovation. Ideally, universities like Purdue could anchor these clusters.

Regional innovation clusters can span a variety of markets such as renewable energy, advanced manufacturing, agribusiness and food processing, defense and aerospace, and so on. The Purdue Center for Regional Development has developed nationally accepted cluster definitions that start to define these relationships. PCRD is also nationally recognized for its work in cluster development. Professionals in the Center have been instrumental in developing the water cluster in Milwaukee, the IT cluster in Charleston, and the clean energy cluster in Florida. Supporting the development of regional innovation clusters represents another approach in which Purdue can leverage its strengths to bridge the Valley of Death.

The i-Core Lab established on Purdue's main campus will provide a foundation to accelerate growth in regional clusters. The i-Core Lab, can, in turn, support numerous custom designed i-Labs to serve different types of regional clusters. For example, in Indiana an i-Lab could be established to help a motor sports firm commercialize a sensor technology, developed in motorsports, to a medical equipment market. Alternatively, an i-Lab could assist a group of food processing firms exploit the use of sensor technology to improve food security.

The primary advantage of i-Labs is their flexibility. By linking and leveraging University assets quickly to address an innovation opportunity, i-Labs can accelerate the development of clusters. The deployment of technology solutions through an i-Lab will include moving skilled students and graduates into firms.
  i.   Clusters will include partnerships with and between business firms, other academic institutions, economic development organizations, entrepreneurial education programs, and training/workforce development initiatives
  ii. The clusters will connect and enhance Purdue's innovation assets, so that small and medium sized businesses can effectively leverage them to commercialize new technologies and expand into new markets.
  iii. Each cluster initiative provides the small and medium businesses in the cluster with matchmaking opportunities, business training, counseling, and mentoring.

The PPI Innovation Acceleration initiative has already attracted the attention of other institutions. We are currently working with the New Jersey Institute of Technology on their new Innovation Institute, launched in April. The Institute's first initiative involves cluster development in defense and aerospace, and both Purdue and Fraunhofer will be working as a partner in the design and implementation of this work. Similarly, we are already working with other universities (University of Wisconsin, Kansas State University, and North Carolina State University, etc) interested in partnering with Purdue to create a national network of Innovation Accelerators.

References:

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2. National Research Council, "Research Universities and the Future of America," 2012, download.nap.edu/catalog.php?record_id=13299

3. "PCAST Report to the President on Ensuring American Leadership in Advanced Manufacturing," June 2011
4. http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-advanced-manufacturing-june2011.pdf

5. "PCAST Report to the President on Transformation and Opportunity: The Future of US Research Enterprise," November 2012: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_future_research_enterprise_20121130.pdf

6. Kauffman Foundation, "Proof of Concept Centers: Accelerating the Commercialization of University Innovation,"
7. 2008, at sites.kauffman.org/pdf/poc_centers_01242008.pdf

8. "Proof of Concept Centers in the United States: an exploratory look," S. Bradley, C. hayter, and A. Link, Journal of Technology Transformation, Vol 38, pp 349-381, (2013)

Project Next Steps

Key Accomplishments Planned for 2014-2015

1. Establish an advisory and/or advocacy board group to outline a framework to support applied research activities for the PPI, aligned with Technology Readiness Levels (TRL) 4 through 7.
2. Facilitate interaction with Purdue Discovery Park, Foundry, and Research Park with the goal of integrating the Innovation Accelerator initiative as part of the broader Research agenda at Purdue.
3. Establish relationships within Purdue administration and faculty and communicate the value of the Center to the Purdue research ecosystem.
4. Pursue the participation of Fraunhofer Institute in Germany and Battelle to jointly establish the i-Core Lab at Purdue to provide.
   i. R&D and "pre" implementation support for projects
   ii. Innovation strategies, frameworks and tools.
   iii. Scalable and customizable infrastructures to accelerate projects.
5. Launch the i-Core Lab
6. Scope potential candidates for i-Labs aligning with strategic interest of Purdue and industry R&D needs.
7. Develop a funding model for industry engagement in i-Labs, and Purdue engagement with Battelle and Fraunhofer.
8. Leverage i-Labs to accelerate development of industry clusters.
9. Develop a plan for developing strategic relationship with industry and alliances with other universities.
10. Seek State and Federal Funding to support PCIA initiatives.

Key Accomplishments Planned for 2015-2016

1. Work with Purdue Discovery Park and Purdue Center for Regional Development (PCRD) to recruit a network of universities (NJIT, University of Wisconsin, Kansas State Univ, North Carolina State University, etc) to develop a National Innovation Accelerator Ecosystem.
2. Develop an IP management plan for working with all constituents in the ecosystem.
3. Work with Purdue Center for Regional Development (PCRD) to build a HUB platform to support activities of industry partners and university alliance members.
4. Formally launch i-Lab/s in collaboration with industry partners, Battelle, and Purdue.
5. Develop formal plans for integrating research and education at Purdue in the i-Core and i-Lab's.

CENTERS/INSTITUTES

Requirements to become a Center

Center Name: Purdue Center for Innovation Acceleration

Acronym: PCIA

Center Mission/Description (25- 50 words):

The center is a partnership between Purdue, industry, external research organizations and university partners. Its mission is to serve as a translational-applied research platform to design, guide, and deploy leading edge approaches in technology and innovation management to accelerate the adaptation of research discoveries, knowledge and technologies to the market. *(see attached White Paper)*

URL: www.purdue.edu/PCIA (TBD)

Center Director(s) Name: Carrie Berger, PhD*
Office Address: Knoy Hall 441
Phone: 42552
Email: TBD

Administrative Assistant or Managing Director (can't be same as director): Janet Ebershoff
Office Address: Knoy Hall 469
Phone: 42552
Email: jebershoff@purdue.edu

Colleges/Schools involved with the center:
College of Technology (Dean Gary Bertoline)
Tech Leadership & Innovation Dept. (Dr. R. Athinarayanan, Dr. A. Bement, Dr. C. Bozic)
Purdue Discovery Park (Dr. J. Pekny)
Purdue Center for Regional Development (Dr. Bo Beaulieu)
Purdue Technical Assistance Program (Dave McKinnis)
Research Center for Open Digital Innovation – RCODI (Dr. Sabine Brunswicker)
Biotechnology Innovation and Regulatory Science Center (BIRSC)
Fraunhofer IAO, Stuttgart, Germany (Dr. Joachim Warschat, Dr. Antonino Ardilio)
New Jersey Institute of Technology (NJIT)

Director Reports to (governance plan):
The PCIA will organizationally fall under the College of Technology and the Polytechnic Institute. The Director will operationally report to Dr. Gary Bertoline, Dean College of Technology.

How will the Center be funded:
The Center will receive funds totaling $100,000 from the College of Technology Polytechnic initiative for the first year, for initial startup and launch of the Center. For years 2-5, the Center will receive and additional $240K per year in base funding. Beyond this time, the Center will receive 30% of its base funding and is expected the remaining amount be supplemented through revenues generated from industry memberships, contract research, and short-term non-credit certificate programs offered to industry.

Expenditures:

From <u>external sources</u> such as contracts, grants, and gifts solicited by the center

Total Dollar Amount: $225,000
Sources: New Jersey Institute of Technology

From <u>internal sources</u> such as general funds, faculty release time, cost share, PRF awards, gift funds to the University that were distributed to the center (e.g., Lilly Endowment funds)

Year 1 - $100K (Travel - $60K; Post-Doc - $30K; Design Workshop - $6K; Misc - $4K)
Years 2 – 5 - $240K (details below*)
Year 6 - 30% base funding (70% supplemented through revenues)

i-Core Lab Annual Budget - $240K
i-Core Lab Director - $70K
Admin Assistant - $40K
Funding for 2 x PhD - $48K (or a combination of PhD, MS student, and/or undergrad students)
Funding for a Post-Doc - $60K
General Operations Costs (Office Supplies, Hospitality; Marketing/Brochures) - $12K
Travel - $10K

Total Dollar Amount: $1.285M
Sources: College of Technology ($1.06M) & New Jersey Institute of Technology ($225K)

Total Number of Faculty directly Involved:
5

Names of Faculty:
Dr. Ragu Athinarayanan
Dr. Arden Bement
Dr. Christy Bozic
Dr. Steve Byrne
Dr. Kari Clase

Total Number of Staff directly Involved:
4

Names of Staff:

Mr. Ed Morrison
Mr. Scott Hutcheson
Dr. Carrie Berger (Director)
Mr. Matt McKillip

Key Accomplishments for 2014-2015 (bulleted list of up to ten of the most significant achievements of the center): when applicable

1. Establish an advisory and/or advocacy board group to outline a framework to support applied research activities for the PPI, aligned with Technology Readiness Levels (TRL) 4 through 7.
2. Facilitate interaction with Purdue Discovery Park, Foundry, and Research Park with the goal of integrating the Innovation Accelerator initiative as part of the broader Research agenda at Purdue.
3. Establish relationships within Purdue administration and faculty and communicate the value of the Center to the Purdue research ecosystem.
4. Pursue the participation of Fraunhofer Institute in Germany and Battelle to jointly establish the i-Core Lab at Purdue to provide.
   i. R&D and "pre" implementation support for projects
   ii. Innovation strategies, frameworks and tools.
   iii. Scalable and customizable infrastructures to accelerate projects.
5. Launch the i-Core Lab
6. Scope potential candidates for i-Labs aligning with strategic interest of Purdue and industry R&D needs.
7. Develop a funding model for industry engagement in i-Labs, and Purdue engagement with Battelle and Fraunhofer.
8. Leverage i-Labs to accelerate development of industry clusters.
9. Develop a plan for developing strategic relationship with industry and alliances with other universities.
10. Seek State and Federal Funding to support PCIA initiatives.

Goals for 2015-2016 (bulleted list of up to five of the most significant goals for the center in the coming year):

1. Formalize an Industry Partner and University Alliance Program.
2. Develop an IP management plan for working with all constituents in the ecosystem.
3. Work with Purdue Center for Regional Development (PCRD) to build a HUB platform to support activities of industry partners and university alliance members.
4. Formally launch i-Lab/s in collaboration with industry partners, Battelle, and Purdue.
5. Develop formal plans for integrating research and education at Purdue in the i-Core and i-Lab's.

Space:

Total area of space allocated to the activities of the center (only include space currently controlled by the center for its activities):

    Office for Center Director – Office located in Knoy 414
    Office for i-Core Lab Director – Office located in TBD
    Office for Admin Assistant/Support Staff – Office located in TBD
    Project Activity Room (for students and Post-Doc) – TBD

Briefly describe how the space allocated to the center is used:

    For launching the PCIA, we need three office spaces. One to accommodate the Director for the Center, who will provide Leadership and Strategic direction for the Center, manage relationships within the university, manage external linkages with Fraunhofer Institute, Battelle, industry partners, and with the alliance of Universities. An office space is also required for the i-Core Lab Director who function is to provide oversight, manage, and support all activities and functions in the i-Labs. A third office space is for a Support Staff whose function is to handle daily support functions for the Center Director and i-Core Lab Director.

Date of Establishment: September, 2014

Documentation of Approvals, e.g. letters or email from Associate Dean or appropriate Dean and Dept. Head(s):

Dept. Head _____ Date __8/1/14_____

Assoc. Dean _____ Date _____

Dean _____ Date _____