

**Economic development by the Indiana University
Pervasive Technology Institute, Pervasive Technology
Labs, and the Research Technologies Division of
University Information Technology Services during FY
2011/2012**

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Executive summary

The Pervasive Technology Institute is one of many subunits of Indiana University with a strong focus on engagement in the state of Indiana and a particular focus on enhancing the Indiana economy. PTI and its forerunners have, either themselves or in collaboration with other Indiana University units, secured a combined \$91.3M of external funding since inception (excluding in this tally monies from the Lilly Endowment itself). These monies have fueled innovation and created high quality jobs in central and south-central Indiana. This report focuses on four specific areas of economic development activity over the past twelve years: inventions, patents, and licenses; investments made by the PTI Capital Investment Fund; direct aid to Indiana business; and job creation.

Inventions, patents, and licenses

- The Pervasive Technology Labs, Pervasive Technology Institute, and the Research Technologies Division of University Information Technology Services have collectively disclosed a total of nearly a hundred inventions to IURTC since 1999. Of these, more than 40 are currently being released in the form of open source software products. IU has received several hardware grants-in-kind since 1999, with an aggregate value to IU of more than \$6M as a direct result of releasing open source software. Open source software has been used within the state of Indiana and the US generally in the private and public sector, aiding innovation, health care, education, business management, and cybersecurity.

Investments made by PTI Capital Investment Fund and companies created with some relationship to PTI

- Two investments made by the PTI Capital Investment Fund have supported two companies growing and improving quality of life in the US. Precise Path Robotics (<http://www.precisepath.com/>) is based in Indiana, building autonomous robotic mowing equipment. Chartlogic (<http://www.chartlogic.com/>) is creating new tools and systems for management of electronic medical records.

Direct aid to Indiana business

- PTI and its collaborators have provided direct aid to and collaborated with Indiana businesses. The Indiana Initiative for Economic Development was a two-year partnership among IBM, Indiana University, Purdue University, and the Indiana Economic Development Corporation. IU assisted four Indiana companies through this program. IU continues to collaborate with one of those companies (Cummins, Inc.) through the FutureGrid project. PTI and UITS are aiding Cummins' research to improve diesel engine fuel efficiency and decrease production of nitrogen compounds in the exhaust. This work could have significant impact on Cummins (a major employer in Indiana) and the world rate of oil use.

Job Creation

- PTI has aided south-central Indiana by winning grant awards that bring money into the area and create jobs.
- As of June 30, 2012, there are 35 staff members employed in PTI whose positions are funded by grants and contracts. More than 1,269 FTE years of employment in Indiana

(that is, years of full time equivalents of employment) have been created as a direct result of grant and contract awards to PTI.

- Another view of job creation can be had through use of the economic models that include direct and indirect expenditures of grant monies within Indiana. An economic model recommended by the Indiana Business Research Center, used carefully and conservatively, suggests that grants awarded to or enabled by PTI and its collaborators have facilitated the creation of 1,269 full time job-years of employment in the state of Indiana.

The bottom line

Since the start of IPCRES in 1999, the Pervasive Technology Labs, Pervasive Technology Institute, and their collaborators, aided by and working with IURTC and the Indiana government, have contributed substantially and meaningfully to economic growth and job creation in Indiana. The Indiana economy is now faring better, relative to the US as a whole, than it was in 1999 when the Lilly Endowment made a tremendous investment in IU, informatics, and information technology. This improvement in the relative standing of the economy of Indiana is at least in part a direct outcome of IU's engagement in Indiana and efforts to help build a 21st century knowledge economy in the state.

Introduction

In 1999 the Lilly Endowment made an historic investment in Indiana University and the state of Indiana by awarding a major grant to fund the Indiana Pervasive Computing Research Initiative (IPCRES). From IPCRES grew the Pervasive Technology Labs (PTL), which for many years collaborated with the Research Technologies Division of University Information Technology Services. In 2008, PTL, Research Technologies, and additional units of IU were brought into more formal collaboration as part of the Pervasive Technology Institute (PTI). PTI reports administratively to the Office of the Vice President for Information Technology at Indiana University. IPCRES, the School of Informatics and Computing, and the Pervasive Technology Institute have enabled important developments in research discovery, educational delivery, economic development, and technology transfer by Indiana University, and this in turn has had profound impact on the state of Indiana.

A prior report summarized the combined economic development activities of the Pervasive Technology Institute and its forerunners was published in 2011:

Stewart, C.A. and T. Miller. *Economic development by the Indiana University Pervasive Technology Institute, Pervasive Technology Labs, and the Research Technologies Division of University Information Technology Services September 1999 – June 2011: a public report.* Indiana University, Bloomington, IN. 2011.
<http://hdl.handle.net/2022/13559>

The Pervasive Technology Institute and its forerunners have, either themselves or in collaboration with other Indiana University units, have as of 30 June 2012 secured a combined \$91.3Mf external funding since inception (excluding in this tally monies from the Lilly Endowment itself). Of this, \$11.5M was brought in during FY 2011/2012. These monies brought into the state fuel innovation and create high quality jobs in central and south-central Indiana.

PTI and its forerunners and collaborators have engaged in four very specific and targeted areas of technology transfer and economic development:

- The creation of inventions that were licensed or released as open source software products
- Direct involvement in the private sector of Indiana through investments made by the PTI (formerly PTL) Capital Investment Fund and the creation of startup companies as spinoffs of PTI-related activities
- Delivery of direct assistance to the Indiana private sector
- Creation of new jobs at PTI through acquisition of federal grant and contract funds and the indirect effects of so doing

This report summarizes the impact and current status of these economic development efforts. For the sake of simplicity, the PTI Capital Investment Fund is referred to throughout by its current name even when referring to events that took place prior to this fund having that name. PTI refers to the collective achievements of the current Pervasive Technology Institute, the Pervasive Technology Labs, and the Research Technologies Division of UITS since the advent of the IPCRES award from the Lilly Endowment, Inc.

I. Inventions, patents, and licenses

I.a. Inventions

The Pervasive Technology Labs, Pervasive Technology Institute, and the Research Technologies Division of University Information Technology Services have collectively disclosed nearly 100 inventions to IURTC since the start of the Pervasive Technology Labs. Of these, more than 40 are currently being released as open source software products.

I.b. Patents & Licenses

There was no new activity as regards patents or licenses of intellectual property during FY 11/12.

II. Investments made by the PTI Capital Investment Fund and companies created with some relationship to PTI

The Indiana University Research Technology Corporation holds an equity stake in two companies on behalf of the PTI Capital Investment Fund as of the end of FY 2011/2012. These are Chartlogic (<http://www.chartlogic.com/>) and Precise Path Robotics (<http://www.precisepath.com/>). Chartlogic creates tools and systems for management of medical records. As this company has evolved it has been consolidated and no longer has employees in the State of Indiana. Precise Path Robotics creates autonomous lawn mowers. IU holds a small stake in Precise Path Robotics via its stake in IndyRobotics LLC, which in turn owns part of Precise Path Robotics. Precise Path Robotics is headquartered in Indiana, with 24 full time employees in Indiana and 4 in Florida. Precise Path Robotics has just undergone a new round of venture capital fundraising, and seems well on its way. In the case of both companies the investments of money and/or expertise from IU and PTI has been critical to business success and thus job creation.

III. Support for private industries in the State of Indiana

PTI continues to work closely in support of Cummins, Inc. on piston design. We have entered a new phase in our relationship, in which piston design work that is part of ongoing Cummins product development is being done on IU supercomputers, through an extension of the IU Economic Development Initiative started in 2007 in partnership with IBM, Inc. This is quite a significant turn of events: IU is now helping Cummins, Inc. on significant aspects of diesel engine design as part of Cummins efforts to improve the fuel mileage and decrease emissions of Cummins diesel engines.

IV. New public private partnerships

Perhaps the most dramatic economic development news during the current reporting period is the establishment of a public / private partnership between IU and Penguin Computing, Inc. to establish a 'cloud' computing facility at IU. This partnership is perhaps best explained by quoting at length from the press release announcing this

relationship (<http://www.penguincomputing.com/resources/press-releases/IU-partner-secure-cloud-computing-service>):

Indiana University and Penguin Computing, today announced a partnership to offer US researchers access to powerful shared computing resources in a secure environment. This type of service — also known as on-demand or cloud computing — lets individuals and organizations share the resources of large computing systems without individually purchasing and maintaining the costly equipment.

One downside of traditional cloud services is that users often do not know where or how shared equipment is kept, which may create security and grant compliance concerns. The new service provided by IU and Penguin mitigates these concerns by providing access to a group of computers owned by Penguin and housed on US soil in IU's highly secure state-of-the-art data center. "This public/private collaboration demonstrates how technology companies are working together with academia to foster cost-effective innovation and provide access to world-class systems," said Charles Wuischpard, president and CEO of Penguin Computing. "The systems we provide are set up for ease-of-use with the same configurations as existing government supercomputers and helps address the challenge of providing the science and research community with easy cost-effective access to needed compute resources. We believe this specialized cloud computing model will help accelerate needed research to enable U.S competitiveness in science and engineering."

The agreement between IU and Penguin also has the support of a group of founding user-partners including the University of Virginia; the University of California, Berkeley; and the University of Michigan. Along with IU, these partners will be the initial users of the new service. Thereafter, researchers at US institutions of higher education and federally funded research centers can purchase computing time from Penguin, and receive access via high-speed national research networks operated by IU.

"This is a great example of a community cloud service," said Brad Wheeler, vice president for information technology and CIO at Indiana University. "By working together in a productive private-public partnership, we can achieve cost savings through larger scale while also ensuring security and managing the terms of service in the interests of researchers."

Security and technical expertise provided by IU are critical to the collaboration. The cluster will be located in the IU Data Center, an energy-efficient facility built to withstand a category 5 tornado, with around-the-clock security provided by the IU GlobalNOC.

"This partnership is being executed in ways that aid IU's mission of engagement in the state and nation, offering our researchers secure access to on-demand computing and protecting valuable intellectual property," said Craig Stewart, associate dean of research technologies and executive director of the IU Pervasive Technology Institute.

V. Job Creation

Indiana University is a strong contributor to the economy of central and south-central Indiana. PTL, PTI, and the Research Technologies Division of UIITS have grown steadily through securing grants and contracts, and have created new jobs as a result.

Figure 3 shows growth in FTE funded by grants and contracts and employed by PTI (and its forerunners). As of the end of the reporting period (30 June 2012) there are 120 staff members working for PTI (including the Research Technologies Division of UIITS) whose jobs are funded by grants and contracts. Those jobs are attracting and retaining highly skilled knowledge workers in central and south-central Indiana. The salaries paid to these staff contribute to the Indiana tax base and the growth of the Indiana economy. Over the 13 years since the inception of PTL, a total of 585.71 FTE-years of employment have been created in central Indiana directly through funding jobs from grant awards to PTI, PTL, and Research Technologies.

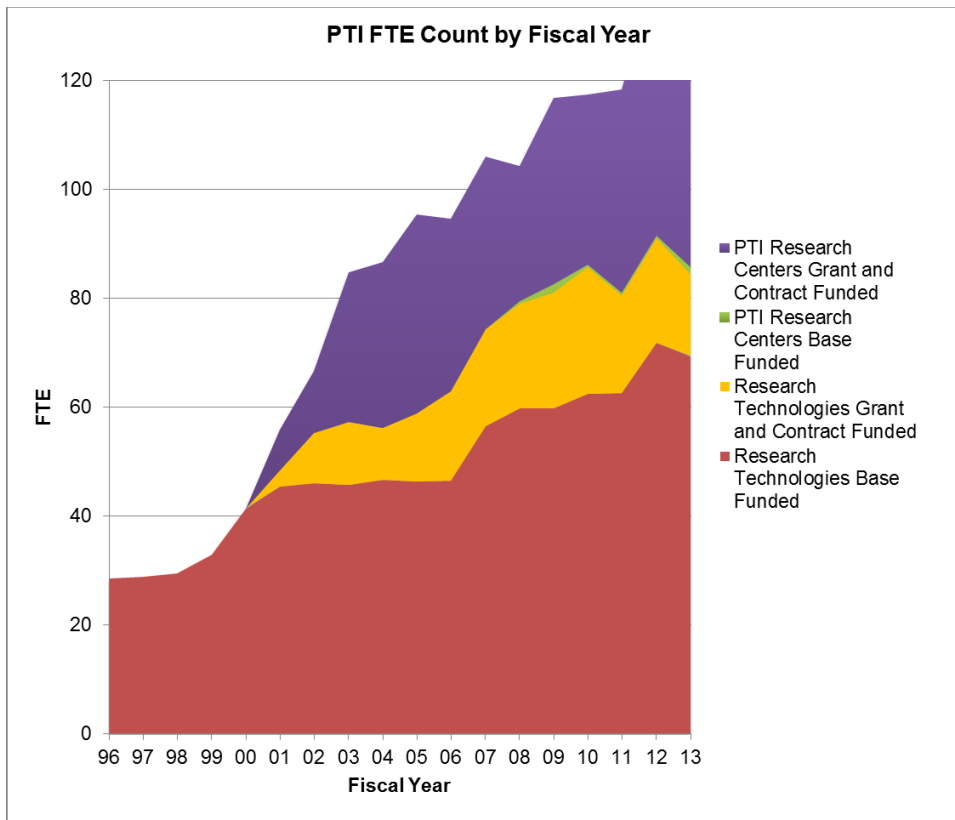


Figure 1 Graph of FTEs by subunit of PTI and funding source. Sources are subdivided into Research Technologies base funded positions, Research Technologies contract and grant (C&G) funded positions, PTI base funded positions, and PTI contract and grant funded positions.

The combined indirect and direct economic impact of PTL/PTI and the Research Technologies Division of UIITS can be had through use multipliers that relate expenditures of grant monies to creation of jobs. With the advice of the Indiana Business

Research Center, we are now using IMPLAN® (Impact analysis for PLANning)¹ to estimate the direct and indirect economic impact of contract and grant expenditures. This system suggests that the annual expenditure of \$1,000,000 by a postsecondary institution of higher education generates a total of 15.4 job-years of employment. Since the inception of PTL, IU has received a total of \$91.3M in grants directly to PTL, PTI, and RT or to those groups in collaboration with some other part of IU. Of these grants, a total of \$8.8M went out of the state of Indiana either through subcontracts to other universities or purchases of very large computer systems from outside the state, leaving \$82.4M as the amount of grant money that we might conservatively use as the basis for estimating job creation with the IMPLAN® multipliers. Taking this conservative approach, we can estimate that PTI, PTL, and Research Technologies have facilitated the creation of 1,269 full time job-years of employment in the state of Indiana since the start of PTL in 1999.

VI. Acknowledgments

Indiana University thanks the Lilly Endowment for its foresight, its belief in the value of information technology and informatics innovations created by Indiana University, and its dedication to IU and Indiana. This dedication is tangibly evident in the generous award of two grants to Indiana University to create the Pervasive Technology Labs and support PTL's evolution into the Pervasive Technology Institute. We also thank the faculty, staff, and students of the Pervasive Technology Institute who work with insight and diligence to ensure that their creations matter in practice to humankind, particularly the residents of the state of Indiana.

¹ http://implan.com/V4/index.php?option=com_multicategories&view=article&id=628:628&Itemid=14 ,
http://implan.com/V4/index.php?option=com_docman&task=cat_view&gid=145&Itemid=7&limitstart=5