

**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**

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Executive summary

In September of 1999 the Lilly Endowment awarded IU a major grant to fund the Indiana Pervasive Computing Research Initiative (IPCRES)¹. From IPCRES grew the Pervasive Technology Labs (PTL) and then the Pervasive Technology Institute (PTI). This report summarizes the economic development activities of PTL, PTI, and the Research Technologies Division of University Information Technology Services (which long collaborated with PTL and is now one of the several components of PTI). These units report administratively to the Office of the Vice President for Information Technology. This report summarizes activities from the IPCRES award in 1999 to 1 June 2011.

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 \$173,016,092 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 88 inventions to IURTC since 1999. Of these, 58 have been released as open source software products. IU has received several hardware grants-in-kind since 1999, with an aggregate value to IU of \$6,012,958, 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.
- PTL and PTI faculty and staff have initiated proceedings to patent four inventions. One of these has resulted in a patent award, and one other is expected to result in a patent award.
- IURTC licensed a design for a 3D visualization system called a John-E-Box to CAE-net, an Indianapolis company, and received modest income (\$18,078).

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

- The PTI (formerly PTL) Capital Investment Fund had an initial balance of \$1,750,000, obtained via income received on the IPCRES grant funds between time of receipt by IU and time of use to support PTL. The Fund made targeted investments in firms with a strong information technology focus and with operations in the state of Indiana. The current value of the PTI Capital Investment Fund is \$899,276. Some companies in which IU made investments have become insolvent and ceased

¹ <http://www.indiana.edu/~uits/cpo/ipcres/index.html>

operations. The value of IU holdings in two companies operating in Indiana has increased while the value of one has held steady.

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 1, 2011, there are 54 staff members employed in PTI whose positions are funded by grants and contracts. More than 437 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 2,705 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. Direct engagement in the private sector carries risks and benefits. Action and engagement offer the opportunity to aid, influence, and possibly succeed in economic development. Inaction holds only the guarantee of failure. IU has contributed directly to the Indiana economy as a result of support by the Lilly Endowment and innovation by IU researchers. 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. The Pervasive Technology Institute and its forerunners have, either themselves or in collaboration with other Indiana University units, have as of 1 June 2011 secured a combined \$173,016,092 of external funding since inception (excluding in this tally monies from the Lilly Endowment itself). 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 88 inventions to IURTC since the start of the Pervasive Technology Labs. Of these, 58 have been released as open source software products. As a direct result of these open source software releases, IU received several hardware grants-in-kind with an aggregate value of \$6,012,958. In addition, open source software products developed and released by IU have been used by IU, by academia in general, and in some cases by

private sector entities in Indiana. The release of software as open source has benefitted IU, Indiana businesses, and the US generally. Areas in which open source software has been used to benefit the public and private sectors of the state and the nation include health care, education, civil safety, business management, and cybersecurity.

I.b. Patents

PTL and PTI faculty and staff have initiated investigation of patents on four inventions. One of these has resulted in a patent award, and a patent seems likely for another.

I.c. Technology licenses

IURTC licensed a design for a 3D visualization system called a John-E-Box to a company called CAE-net located in Indianapolis. IU received a total income of \$18,078 from this license. In retrospect there was probably too much emphasis in this particular case on finding an Indiana company as a purchaser of a license. The result was a less than ideal match between the technology licensed and the interests of the company. This technology might have had more impact, and IU might have received more income, had it been licensed to a company out of state. There were other benefits to IU, however. IU was able to purchase professionally manufactured devices back from the company at a lower cost than we could build them ourselves. These devices remain in use within IU and at the Indianapolis Museum of Art. As a result of the license to CAE-net John-E-Boxes were manufactured in less time and at lower cost for university use than would otherwise have been possible. Figure 1 shows a John-E-Box installed at the Indianapolis Museum of Art, displaying 3-D artwork of PTI affiliate and IU faculty member Margaret Dolinsky.

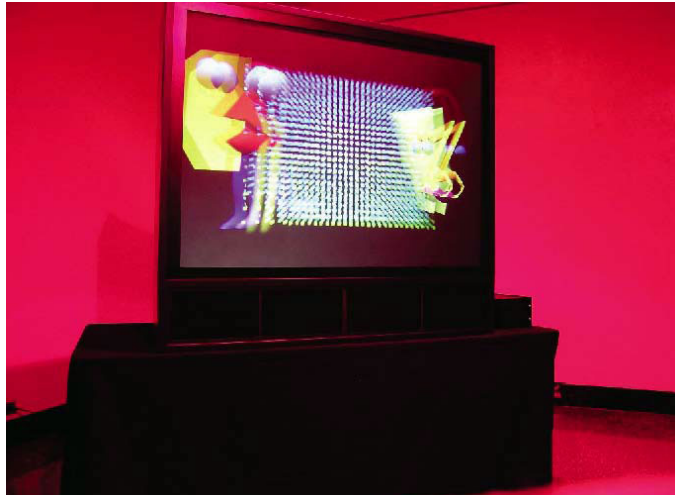


Figure 1. The John-E-Box, as manufactured by CAE-net, installed at the Indianapolis Museum of Art and displaying 3D virtual reality artworks by PTI affiliate and IU faculty member Margaret Dolinsky.

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

The PTI Capital Investment Fund had an initial balance of \$1,750,000, obtained via income received on the IPCRES grant funds between time of receipt by IU and time of use to support PTL. (This fund does not contain any monies that came directly from the Lilly Endowment, and no taxpayer monies were used to support this fund.) The PTI Capital Investment Fund made targeted investments in and loans to firms with a strong information technology focus and with operations in the state of Indiana. In addition, there were a number of companies created with a relationship to PTI by virtue of being started by personnel who worked in or had some other relationship to PTI.

Table 1 summarizes PTI’s relationship with companies in which the PTI Capital Investment Fund made investments or which have some other relationship to PTI and which remain active and in operation.

Asset	Date of Initial investment	Current status
Dynomed/Chartlogic	2004	Active (but now based in Utah)
Precise Path Robotics	2005	Active, growing, based in Indiana
Anabas, Inc.	2003	Remains active, but based in California. Subcontracts to IU active

Table 1. Companies in which the PTI Capital Investment invested and which remain active as of 30 June 2011.

There are other ways in which PTL and PTI have aided the Indiana Economy. For example, two former students of School of Library and Information Sciences Professor and former Pervasive Technology Labs fellow Dr. Katy Boerner founded the Chalklabs.com. Chalklabs.com has thus only an indirect relationship to PTI, but it is a relationship that has been mutually beneficial. The founders of Chalklabs.com were trained in a lab supported in part by PTL funds. PTI has hired Chalklabs.com to do contract work that it was not able to do in house, and thus also aided the development of this company. Chalklabs.com and its relationship to IU and PTI provide a good example of the value to the university, private sector, and state as a whole that comes from developing a high tech innovation ecosystem in central Indiana. Prior to the advent of PTL and PTI, such students might well have moved elsewhere – to Boston or Silicon Valley – to start up companies. (Topica.com is one example of this – started by a student employee of IU who moved to Boston to turn his ideas into a multi-million-dollar company).

III. Direct aid to Indiana business and the residents of Indiana

The Indiana Initiative for Economic Development (IIED) was an economic development program designed to foster technology development and job growth in the state of Indiana, active from 2007 to 2009. The IIED made available advanced computing technology and expertise to companies whose proposed projects advanced the Indiana economy, fostered job creation in high-tech jobs in Indiana, and showed promise in creating new technologies. The IIED was a partnership among IBM, Indiana University, Purdue University, and the Indiana Economic Development Corporation (IEDC). The computing resources dedicated to this Initiative were jointly owned by Purdue University and Indiana University, and housed on IU's Bloomington campus. Assistance was provided to four companies through the IIED. IU continues to work with one of the four – Cummins – as part of 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’s rate of oil use.

PTI has helped develop the local high-tech ecosystem in central and south-central Indiana. As mentioned above, PTI has had a mutually beneficial relationship with the local company Chalklabs.com – which was formed by students from a lab that received

support from PTI. PTI has had other impacts on the innovation economy of central and south-central Indiana as well. For example, PTI was one of the first entities to contract with Bloomington firm Cairril.com Design & Marketing Inc., when it was just a fledgling startup. Now an important element in the high-tech and creative economy of Bloomington, Cairril.com Design & Marketing Inc. was recently designated as a Woman Owned Business Enterprise (WBE) by the Indiana Division of Minority and Women's Business Enterprises. Similarly, PTI works with local educational organizations such as WonderLab, a 501(c)(3) educational nonprofit located in Bloomington, Indiana and focused on science education. PTI has in the past worked with the Indianapolis Museum of Art and the Indianapolis Children's Museum. In addition, PTI sometimes works beyond the borders of Indiana and the Midwest in hopes of bringing businesses to Indiana. While we were ultimately not successful in establishing a permanent IBM presence at IU, we did manage for three years to have IBM staff running a research lab in Indianapolis. It is possible that this initiative could be restarted someday. Mr. Bill Sherman (Research Technologies & PTI) has developed a collaboration with Idaho National Labs and the visualization company Kitware (www.kitware.com), which has offices in New York, North Carolina, and France. Through a systematic strategy of collaborative of NSF and DoE grant proposals, it is our intent to create sustainable jobs in Indiana via collaborations with Kitware and Idaho National Labs.

As mentioned above, many of the open source software tools developed and released by PTI are used by Indiana-based businesses. In addition, PTI produces data products of great value to residents of and businesses located in Indiana. The most important of the data products is the Indiana Spatial Data Portal (ISDP), which organizes Indiana geospatial data into a shared location (<http://gis.iu.edu>), connecting decision makers with the information they need when they need it. Most ISDP datasets are public domain and have no use restrictions. The ISDP promotes collaboration among agencies, businesses, and citizens; facilitates economic development; speeds up disaster response and recovery; and archives important Indiana data for the long term. The Portal currently archives and provides web mapping services to over 20 terabytes of Indiana geospatial data, primarily orthophotography. From January 2010, through June 2011, more than 7,434 different hosts downloaded 11.7 terabytes from the ISDP. Duke Energy, for example, uses ISDP resources for daily operations and responding to electrical outages. PTI staff will soon add new 2011 Indiana orthophotography, elevation, and LiDAR datasets to the Portal. Indiana is well ahead of most states in providing a trustworthy source of both current and historical geospatial data accessible to users via easy to use web tools. The ISDP is an investment in Indiana's modern information infrastructure.

These are just a few examples of the beneficial influence PTI has in the central Indiana economic and social ecosystem. Central Indiana is yet far from being Silicon Valley or the North Carolina Research Triangle. However, it was these same types of activities, started 25 to 50 years ago that made those now booming economic areas what they are today.

IV. Direct aid to the Midwest region

PTI has just executed a Memorandum of Understanding (MOU) with Avetec (the Advanced Virtual Engine Test Cell, Inc.) to participate in research, development, and

educational activities with Avetec and MSIs (Minority Serving Institutions) in the state of Ohio. Avetec is a not-for-profit public benefit research organization located in Springfield, Ohio. PTI's first project with Avetec will involve testing the performance of a variety of file system software on behalf of (and in partnership with) Clark State Technical College, an MSI also located in Springfield. In general, PTI strives to maintain a very "Indiana-centric" focus to its economic development and outreach activities. However, there are no four-year MSIs dealing with technology (or general professional or liberal arts) education in the state of Indiana. Working with a Midwest technical not-for-profit and a Midwest MSI should both provide new grant funding opportunities related to economic development and lead to more students matriculating from MSIs and pursuing graduate study at IU or pursuing technical careers in the Midwest. Both benefit the Midwest in general and the state of Indiana in particular (indirectly through a larger, better trained potential workforce and directly through increased grant income).

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 UITS have grown steadily through securing grants and contracts, and have created new jobs as a result. Figure 2 depicts a "virtuous positive feedback loop" of acquiring grant funding, building capability, and producing excellent results, which leads to more success in acquiring additional grant funding. IU VP for IT Brad Wheeler developed this graphic several years ago, part as an explanation of past IU activities in advanced information technology, part as a plan for growth of same.

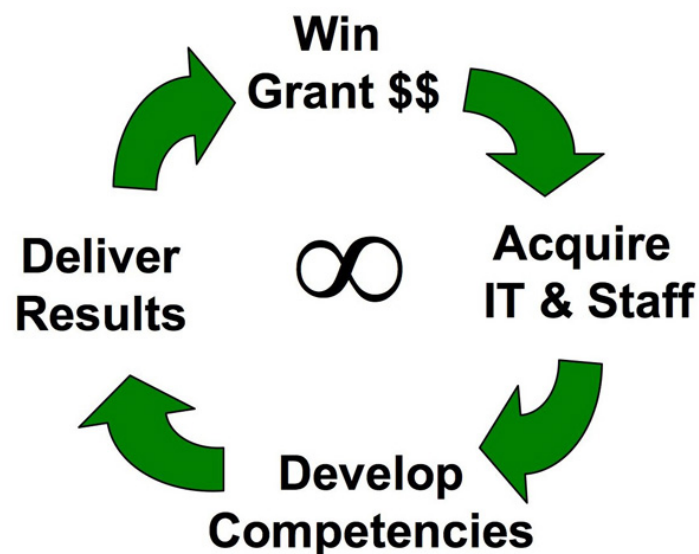


Figure 2. Diagram of positive feedback loop – winning grant awards, developing competencies, delivering results, winning more grant awards. Graphic by Bradley C. Wheeler. Used under Creative Commons 3.0 unported attribution license.

Figure 3 shows this virtuous cycle in action at IU through growth in FTE funded by grants and contracts and employed by PTI (and its forerunners). At present there are 54 staff members working for PTI (including the Research Technologies Division of UITS)

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 12 years since the inception of PTL, a total of 437 FTE-years of employment have been created in central Indiana directly through funding jobs from grant awards to PTI, PTL, and Research Technologies.

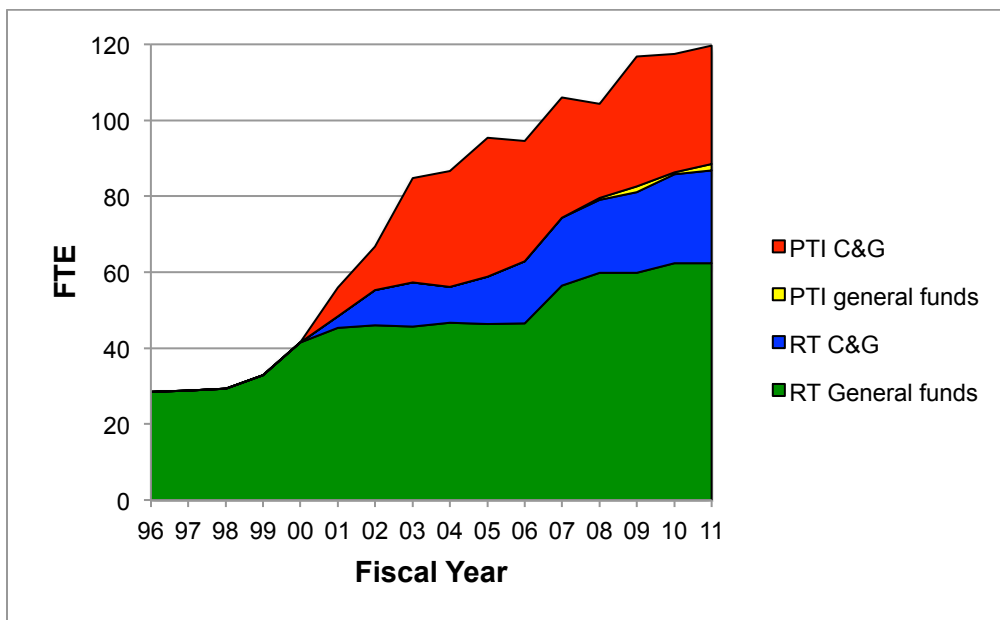


Figure 3 Graph of FTEs by subunit of PTI and funding source. Sources are subdivided into Research Technologies base funded positions, Research Technologies contract and grant (C&G) funded positions, PTI base funded positions, and PTI contract and grant funded positions.

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. In the past we have used the US Department of Commerce Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS II²). Unfortunately the RIMS II system gives a number of jobs created without any information on full time jobs vs. part time jobs, and so does not provide a clear estimate of the full time equivalent positions created by the direct and indirect effects of grant and contract expenditures. With the advice of the Indiana Business Research Center, we are now using IMPLAN® (Impact analysis for PLANning)³ to estimate the direct and indirect economic impact of contract and grant expenditures. This system suggests that the expenditure of \$1,000,000 by a postsecondary institution of higher education generates a total of 17 FTEs (both per year). Since the inception of PTL, IU has received a total of \$173,016,092 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 13,887,766 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

² <https://www.bea.gov/regional/rims/rimsii/>

³ 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

\$159,128,326 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 2,705 full time job-years of employment in the state of Indiana since the start of PTL in 1999.

These statistics, which show clear evidence of economic benefit from investment in advanced technology, are reinforced by a recent study of investment in advanced information technology⁴. This study involved a statistical analysis of publically available research data and information on ownership of high performance computers (HPC) in the list of the 500 fastest supercomputers in the world⁵. This study led to the following conclusions: “Appearance on the Top 500 list is associated with a contemporaneous increase in NSF [National Science Foundation] funding levels as well as a contemporaneous increase in the number of publications. . . . consistent investments in HPC at even modest levels are strongly correlated to research competitiveness.” A positive relationship between investment in high performance computers and aggregate funding from the National Science Foundation was also noted. IU invests in high performance computing in the fashion commended in these comments, and indeed we have long believed that such investments were of value intellectually and financially. High performance computing is just one aspect of the advanced information technology and informatics activities carried out by PTI. But this statistical analysis adds weight to the other data we have suggesting that PTI has contributed directly to the benefit to IU’s intellectual output and financial inputs from the NSF. A financial benefit to the university is of course a benefit to the state of Indiana, due to the direct and indirect effects of grant funding on the state economy.

There has been a change over time on the income that IU has derived from its technology transfer and economic development efforts. During the early portion of the reporting period, IU received millions of dollars worth of supercomputer hardware in the form of in-kind grants (awarded competitively by several vendors). The programs that supported these grants-in-kind no longer exist; however, in recent years we have experienced a significant increase in monies brought in through facilities and administration costs associated with grant awards and contracts relative to investment in match on grant proposals. What this means is that the net income to the university in the form of monies other than 'direct' (personnel, equipment, and travel funds) has increased. This represents an increase in IU's stature in the national cyberinfrastructure community, and the fact that we are now being invited to participate in grant proposals on the basis of our expertise – without any match or without significant match – because of our expertise and reputation for quality execution. Thus, while the nature of income has changed during the reporting period, there is every reason to believe that PTI and its components will continue to have a highly positive impact on the overall IU financial situation.

⁴ Apon, A., S. Ahalt, V. Dantuluri, C. Gurdgiev, M. Limayem, L. Ngo. 2010. High Performance Computing Instrumentation and Research Productivity in U.S. Universities. *Journal of Information Technology Impact* 10: 87-98

⁵ www.top500.org

VI. IU, PTI, and the Indiana economy

According to a new report by the US Science Coalition, “When public money is invested in university-based basic research there is tremendous return on investment. Research creates jobs directly for those involved and indirectly for many others, through innovations that lead to new technologies, new industries and new companies”⁶. This report cites institutions such as PTI that bring large sums of federal grants into the area as contributing positively to an area’s overall economy, and makes the following key points:

- *Universities conduct the majority of basic research in the United States— 55 percent in 2008. Business and industry conduct less than 20 percent of basic research in the United States.*
- *The federal government is the primary source of funding for basic research conducted in the United States, providing some 60 percent of funding. The second largest source of basic research funding is the academic institutions themselves.*
- *Basic research is conducted for the sake of knowledge and is essential to scientific discovery and understanding. Basic research is the first step in the innovation process.*
- *Innovations that flow from university-based basic research are at the root of countless companies. Companies spun out of research universities have a far greater success rate than other companies, creating good jobs and spurring economic activity.*
- *The US continues to lead in global research and development expenditures from all sources. However, China and other nations are investing aggressively in R&D in order to enhance their innovation capabilities.*
- *America’s global competitiveness and long-term economic health depends on significant and consistent investment in basic research.*

Several of these key points are evident from the current status of the Pervasive Technology Institute and IU’s role in the state, and thus the state’s economic position within the nation. Indiana has traditionally ranked poorly in rankings of state innovation economies. Influencing a state economy takes a long time, and even institutions the size of Indiana University can have impact only over the course of many years. The state of Indiana identified life sciences and information technology as two of its focus areas for economic development at the turn of the century, and PTI has contributed to IU’s overall efforts in economic development. The table below shows AeA CyberStates⁷ rankings for Indiana and every state that shares a border with Indiana. The Cyberstates rankings are very broad, and put significant weight on industries such as electrical engineering – not an area where Indiana University has much influence within the state. Indiana is consistently 23rd in the overall Cyberstates ranking – no improvement shown, but also no losses such as those shown for Michigan, Ohio, and Kentucky.

⁶ <http://www.sciencecoalition.org/successstories/index.cfm>

⁷ <http://www.ita.org/cyberstates>

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Indiana	23	23	23	23	23	24	23	N/A	23	23	23
Illinois	4	6	7	7	7	7	7	N/A	8	7	7
Kentucky	27	28	29	29	29	29	30	N/A	30	30	30
Michigan	10	10	10	11	10	10	11	N/A	10	11	12
Ohio	11	13	13	13	13	13	15	N/A	15	14	14

Table 2. AeA Cyberstates ranking – rankings of “high-tech industry.”

The table below shows Kauffman foundation rankings of state high-tech economies, which are defined more narrowly than the Cyberstates analyses and thus show somewhat more strongly the influence of information technology. In terms of the Kauffman rankings, the state of Indiana definitely shows the impact of economic hard times between 2007 and 2010. Indiana has not made as much progress in the Kauffman ratings that Ohio or Illinois have. At the same time, Indiana has had a net gain for the most recent figures as compared to 1999 – not a net loss as Kentucky has had.

	1999	2002	2007	2010
Indiana	37	32	31	35
Illinois	22	19	16	15
Kentucky	39	42	45	44
Michigan	34	22	19	17
Ohio	33	27	29	25

Table 3. Kauffman Foundation rankings of high-tech economies for Indiana and bordering states⁸

Perhaps the most positive recent news regarding the Indiana economy comes from the Milken Institute’s State Technology and Science Index. The index tracks and evaluates each state’s technology and science capabilities and its success in converting these assets into companies and high-paying jobs. Overall, Indiana moved to 28th place in the 2010 State Technology and Science Index, up from 33rd place two years ago and 30th in 2002. According to the "Biggest Gainers" section of the report, "Indiana University has grown more aggressive in supporting new firm birth, launching a venture capital fund to invest in technology start-ups and dedicating a new Innovation Center in late 2009." Much of the rankings increase had to do with investment in venture capital and business incubators. However, growth in technology inputs also contributed, and PTI is the largest tenant within the Innovation Center.

	2002	2004	2008	2010
Indiana	30	29	33	28
Illinois	19	21	21	20
Kentucky	46	48	47	47
Michigan	24	25	26	26
Ohio	27	24	36	29

Table 4. Milken Institute’s State Technology and Science Index for Indiana and bordering states⁹.

⁸ <http://www.kauffman.org/newsroom/2010-ranking-of-new-economy-states-highlights-leaders-and-laggards.aspx>

⁹ DeVol, R.C., K. Klowden, B. Yeo. 2011. State technology and science index 2010. Milken Institute. <http://www.milkeninstitute.org/publications/publications.taf?function=detail&ID=38801259&cat=resrep>

Innovations from PTI are filtering out to the Indiana economy and aiding it, and aiding the global competitiveness of the US in the process. PTI has aided the creation of an IT innovation economy in central and south-central Indiana. Direct engagement in the private sector carries risks and benefits. Action and engagement offer the opportunity to aid, influence, and possibly succeed in economic development. Inaction holds only the guarantee of failure. In the twelve years since the creation of the Pervasive Technology Labs, PTL, PTI, and the Research Technologies Division of UITS – with help and partnership from IURTC and the Indiana government – have contributed substantially and meaningfully to economic growth and job creation in Indiana.

VII. 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.