

The regional economic impacts of university research and science parks

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Abstract:

This paper focuses on the regional economic impacts of US university research and science parks. Motivating this focus is the fact that the landscape for private-sector research is changing, and future research might well emphasize America’s “new geography of innovation.” Thus, university research and science parks might face, if they are not already doing so, pressure to retain current tenants and competition for future tenants. We find that only 11 of 146 research and science parks in the USA have, in the spirit of public accountability, conducted an economic impact study. One reason for the paucity of such studies is that universities are unfamiliar about how to conduct as well as how to interpret the findings from such a study. We offer an economic impact method for park administrators to follow if they proceed to document the regional economic impact of their park.

Keywords: university research and science park | public accountability | public engagement | economic impact | higher education

Article:

Introduction

This paper focuses on the regional economic impacts of US university research and science parks. Motivating this focus is the fact that the landscape for private-sector research is changing, and future research might well emphasize America’s “new geography of innovation.”¹ Thus, university research and science parks might face, if they are not already doing so, pressure to retain current tenants and competition for future tenants.

The American Association of University Research Parks (AURP) defines a university research park as² follows:

a property-based venture, which: master plans property designed for research and commercialization; creates partnerships with universities and research institutions;

¹ See, Katz and Wagner (2014).

² See, <http://www.aurp.net/what-is-a-research-park>.

encourages the growth of new companies; translates technology; and drives technology-led economic development.

Figure 1 shows this population of parks by the year that they were established. Notable in Fig. 1 are several well-known parks: Stanford University Park (in CA) and Cornell Business and Technology Park (in NY) were founded in 1951, and Research Triangle Park (in NC) was founded in 1959.

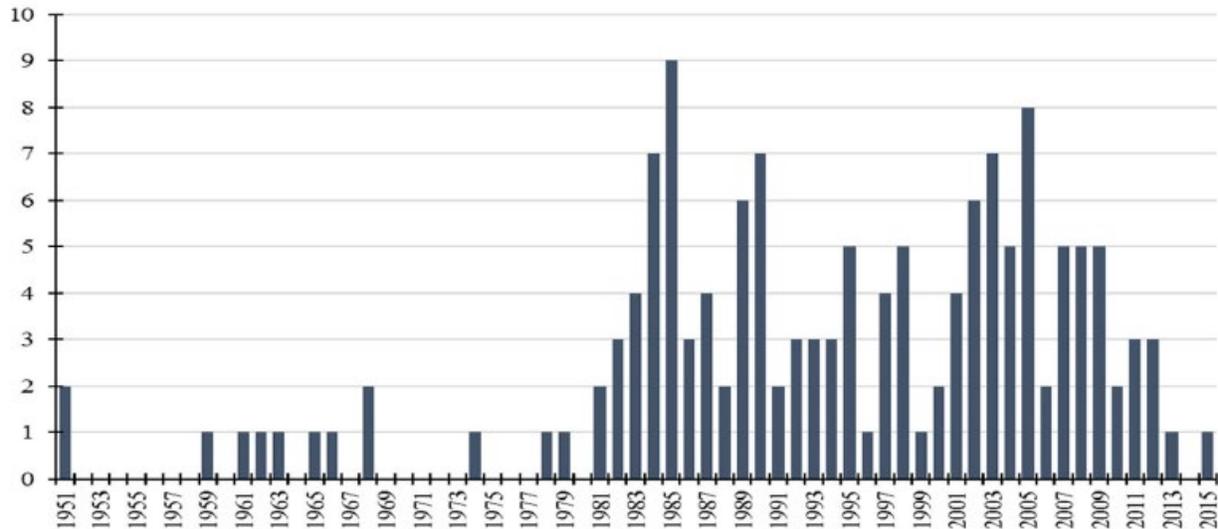


Fig. 1. U.S. University Research and Science Parks, by Year of Establishment

More recently established parks are associated with less research-active institutions, and these parks tend to be located off campus.³ As a result of their location, state universities in particular are increasingly relying on a combination of state support to purchase land and develop infrastructure and/or applying for developmental grants from governmental agencies.⁴

In 2007, Battelle Memorial Institute (Battelle) conducted a membership park survey under the sponsorship of the Association of University Research Parks (AURP). Several important issues were emphasized in their report, one of which was the financial challenges facing parks in the future. One such challenge is obtaining resources for future park development and expansion. At the time of the Battelle survey, nearly 30% of funding sources for park operations came from three sources: the university (and many members represent state universities), state and local governments, and the federal government. In addition to public support of park operations, park tenants themselves face capital challenges (Battelle 2007, p. 10):

³ Link and Scott (2006, 2007) and Hobbs et al. (2017) showed empirically that the closer (i.e., physical distance) the park is to the university's main campus the greater its annual rate of growth (i.e., growth in terms of park employment).

⁴ For example, STAR (Science, Technology and Advanced Research) Park at Texas State University, founded in 2011, is relying on the sale of US\$10 million of Texas State University System Revenue Financing System Bonds for future growth. The innovation park campus at the University of Delaware's advanced research campus is being developed through a US\$20 million award from the National Institutes of Health plus US\$5 million of support from the state.

Park directors responding to the survey indicated that helping tenants access capital will be a significant challenge during the next 5 to 10 years. As parks focus more on entrepreneurial start-up and emerging companies, the ability of these companies to access capital will greatly affect whether they are able to grow and expand in the park or in the community. Seventy-three percent of the respondents indicated that this was a significant or highly significant challenge facing their park in the future.

In 2012, Battelle conducted a follow-up survey in an effort to update its 2007 survey. Battelle reported, among other trends, that many parks are transforming their physical environment (2012, p. 25):

University research park directors indicated through the survey that the greatest challenge facing them would be obtaining capital for park development and renovation.

To illustrate this park emphasis on “development and renovation” through an example, Research Triangle Park (RTP) in North Carolina has adopted a new planning strategy to maintain itself and possibly grow in the future (Hardin 2013):

RTP faces challenges that could not be foreseen 50 years ago. The rapid pace of change in the research and global market make it critical that RTP plan for the next 50 years to remain a dynamic engine of growth for the region & state:

- Aging Building Stock
- Limited Amenities
- Use Restrictions
- Changing Work Styles
- Regional Congestion/Limited Transit
- Lack of Cohesive Identity
- Limited Available Sites/Leasable Space

One might infer from the above quotation from the Battelle report and from the RTP example that at least some parks are assuming that one major issue that they face now and in future decade(s) is the revival of their physical environment, that is, their space.

Perhaps, there are other issues and questions that parks might also want to consider. For example:

- Are university research and science parks having difficulty retaining tenants and attracting new tenants?
- If so, will developing and renovating the spaces of parks lessen competition from innovation districts or urban clusters of research firms for existing or potentially new tenants?

Regarding these two questions, which are beyond the scope of this paper, Katz and Wagner of the Brookings Institution (2014, p. 1) note⁵:

Innovation districts are the manifestation of mega-trends altering the location preferences of people and firms and, in the process, re-conceiving the very link between economy shaping, place making and social networking. In recent years, a rising number of innovative firms and talented workers are choosing to congregate and co-locate in compact, amenity-rich enclaves in the cores of central cities.

Another question which parks might also want to consider is as follows:

- Has the locational role of the university on park tenant research changed over time?

If one defines the information technology revolution beginning around 2000,⁶ and if one realizes from Fig. 1 that the majority of university research and science parks were established in a pre-information technology revolution era where tacit research knowledge from university scientists was most effectively exchanged face-to-face, then perhaps the importance of research firms being juxtaposed to university researchers, and the importance of a firm being located in a park, has changed over time.⁷

One might reasonably expect that many university parks have addressed, or are currently addressing, these three above mentioned questions especially if they are in a situation in which park tenants are either downsizing their presence in the park or are in fact leaving the park. Perhaps, such parks should therefore be increasingly involved in redefining their role and geographic benefits that they provide to existing and potential tenants, as well as to regional stakeholders. Anticipating the importance of regional stakeholders in parks relates directly to the purpose and theme of this paper.

Referring to the Battelle observation about parks “obtaining capital for park development and renovation,” which is within the scope of this paper, it may be the case that efforts to transform the physical environment of parks would involve public moneys.⁸ And, when the use of public moneys is involved, the issue of accountability of how public moneys have been used is an important issue to state policy-makers and to regional stakeholders in parks. This, meaning accountability, is a motivation for this paper. But, the issues raised in this paper should be

⁵ This is an observation that many entrepreneurial universities face or will face (see Trequattrini et al. 2018 for Italian universities examples).

⁶ Skype communications was founded in 2003.

⁷ Link and Scott (2003) provide some descriptive information related to the impact of research and science parks on internal university activities. Nearly one half of the 29 provosts surveyed reported that as a result of their involvement with organizations in a science park, overall publications and patents by faculty had increased. Their study did not address potential changes in the locational advantages to park tenants on being juxtaposed to the university (see also Hobbs et al. 2017).

⁸ RTP’s strategic plan for future growth is based, in part, on state support for more capacity in existing road networks as well as the development of mass transit, in order to remain attractive to those research firms already within the park and to potential tenants that might either be considering another park or even an urban cluster involved with related technologies.

viewed as only a first step, perhaps even an exploratory first step, toward addressing the current state and possibly the future state of university research and science parks in the USA.

The remainder of this paper describes our effort to obtain information about what US university research and science parks have done, or are doing, to document and quantify their regional economic impacts—one metric that state policy-makers and regional stakeholders in parks understand.⁹

Our methodology to accomplish this objective is described in Section II along with a description of our findings. We describe the nine publicly available economic impact studies (hereafter, studies) that were identified through an Internet search, and we describe the two studies that were identified through email requests to university provosts. In Section III, we summarize what we found to be the state-of-the-art method for quantifying economic impacts. Section IV concludes the paper with a discussion of our findings and their current relevance.

Methodology

Our methodology for collecting information about the regional economic impacts of university research and science parks was to explore both publicly available sources of information as well as proprietary sources of information. We adopted two methods. The first was to explore the Internet, for each of the 146 university research and science parks identified in Fig. 1, for studies related to a university parks' regional economic impacts. The second method was to contact the office of the provost at the other universities identified in Fig. 1 to obtain access to any proprietary studies.

Our methodology is based on the assumption that if a university conducted an economic impact study of its park, it would both acknowledge doing so and make it available to us with or without conditions about our use of it.¹⁰

Internet searches of websites associated with each of the 146 university research and science parks in Fig. 1 resulted in nine regional economic impact studies being identified. Not all of these studies were available in their entirety online, but those that were not were later graciously provided by the university or the park administration. Characteristics of the nine studies identified from our Internet searches are in Table 1; more detailed information about the findings from the economic impact studies is provided in the Appendix to this paper.

Regarding the characteristics of the studies listed in Table 1 are as follows:

- The nine identified studies were all completed within the last 10 years.

⁹ In a broad sense, our effort attempts to evaluation public engagement (Vargiu 2014).

¹⁰ Of course, it could be the case that a university conducted such a study but was displeased with its findings, and thus either denied doing so or was unresponsive to our inquires. Or, it could be the case that the park director conducted a study on his/her own, but the office of the provost was not aware of it. Our prior experience in collecting information about research parks from park directors, or even from AURP, was unsuccessful; thus, our focus in this study was on collecting information from the universities themselves.

- Listed in the table is the year the technology or science park was founded. Information was not available on when (or if) the university conducted its first study.
- Eight of the nine studies were conducted by state universities, but the ninth park had characteristics of being public.
- Two of the nine studies were conducted internally.

Table 1. Characteristics of studies identified from the internet

University(ies) (alphabetical)	Park	Year of study	Year park founded	State university	Internal/ external study
North Dakota State University	North Dakota State University Research & Technology Park	2010	2003	Yes	External
Purdue University	Purdue Research Park	2011	1961	Yes	External
University of Arkansas	Arkansas Research and Technology Park	2016	2003	Yes	Internal
University of Arizona	University of Arizona Tech Park	2015	1994	Yes	External
University of Illinois at Urbana-Champaign	Research Park at the University of Illinois Urbana-Champaign	2015	1998	Yes	External
University of Missouri	University of Missouri Research Parks	2009	1985	Yes	External
University of Nebraska	University of Nebraska Technology Park	2011	2008	Yes	Internal
University of Pennsylvania and Drexel University	University City Science Center	2016	1963	No	External
University of Wisconsin – Madison	University Research Park	2010	1984	Yes	External

North Dakota State University:

https://www.ndsu.edu/research/newsroom/feature_stories2011/report_shows_ndsu_research_tech_parks_economic_impact_on_region/

Purdue University: www.aurp.net/assets/executive%20summary.pdf

University of Arkansas: https://cber.uark.edu/files/Economic_Impact_of_the_ARTP_through_2014.pdf

University of Arizona: <https://techparks.arizona.edu/parks/ua-tech-park/economic-impact>

University of Illinois at Urbana-Champaign:

<http://www.researchpark.illinois.edu/sites/default/files/UI%20ResearchPark%20Impact%209-15.pdf> University of

Missouri: https://www.umsystem.edu/ums/red/umrpi/reports_and_statistics

University of Nebraska: https://cba.unl.edu/outreach/bureau-of-business-research/bureau-reports/documents/UNL_Tech_Park_Report.pdf

University of Pennsylvania and Drexel University: <https://www.sciencecenter.org/news/university-city-science-center-is-an-economic-catalyst-for-greater-philadelphia9>

University of Wisconsin – Madison:

http://universityresearchpark.org/wpcontent/uploads/2014/03/URP_Economic_Contribution_Report_2010.pdf

The universities associated with University City Science Center are private. However, the University City Science Center is also affiliated with the Children’s Hospital of Philadelphia (a charitable and non-profit hospital) and stakeholders include colleges, universities, and research institutions in Pennsylvania and nearby states.

An email request was sent to the provost of each of the 137 universities (146 minus 9 universities) with a technology or science park as defined by the data related to Fig. 1. Two additional studies were obtained from the 137 email surveys. Table 2 summarizes the responses and follow-up responses from the office of the provost. Characteristics of the two additional

studies are in Table 3. To our disappointment, we were unable to obtain sufficient information regarding the other questions on the email request.

Table 2. Email responses and follow-up email/phone responses from provosts to the request for a study

Number of Responses	Comments
2	Offices of the provost responded <i>yes</i> that a study had been done, and they emailed a copy of the most recent study without stipulations on how it can be referenced in our final report.
7	Offices of the provost responded <i>yes</i> that a study had been done, but they would not agree to make their study available
26	Offices of the provost responded that no study had been done
0	Of the remaining 102 (137–35) offices of the provost responded to a follow-up email
83	Of the 102 (137–35) offices of the provost responded to a follow-up phone call that no study had been done
17	Of the 19 (102–83) offices of the provost responded to a follow-up phone call that they were not sure about a study having been done, but 0 emailed any additional information
2	Of the 2 (19–17) offices of the provost responded that they do not respond to surveys

For consideration is the observation that the number of “no” responses or the number of universities that have not conducted an economic impact study might be related to the Battelle observation that parks are finding it difficult to acquire capital to develop their parks

Table 3. Characteristics of studies provided by provosts

University (alphabetical)	Park	Year of study	Year park founded	State university	Internal/external study
Arizona State University	Arizona State University Research Park	2016	1983	Yes	Internal
Virginia Commonwealth University	Virginia BioTechnology Research Park	2010	1992	Yes	External

Of the 11 studies, 10 were conducted at state universities and the other has elements of being “public” due to its many stakeholders. Perhaps, the fact that the studies we identified were conducted at state universities suggests that issues of public accountability are of greater importance at state universities.

Summary of Regional Economic Impact Studies

All of the economic impact studies that we identified are based on commercially available input/output models and various multipliers generated by those models. The estimated impacts summarized in these studies consist of direct impacts, indirect impacts, and induced impacts. Direct impacts represent the dollar value of the activities of park tenants, such as wages, operating expenditures, and capital expenditures. Indirect impacts are a multiple of direct impacts; they represent the dollar value of activities in firms that interact with park firms (e.g., suppliers). Finally, induced impacts represent the value of consumption expenditures of direct employees in the park and indirect employees in other firms on durable and non-durable items.

The purpose of this paper was to identify what has been done with respect to regional economic impact studies, not to conduct a critical assessment of each study’s methodology or methods for implementing the tools of the input/output model used (e.g., IMPLAN) or the use of the

associated multipliers. That said, it is perhaps worth noting that 5 of the 11 universities that conducted an economic impact study are Innovation and Economic Prosperity Universities. The Association of Public and Land Grant Universities' (APLU's) Commission on Innovation, Competitiveness and Economic Prosperity (CICEP)¹¹ states as follows:

... established the Innovation and Economic Prosperity (IEP) Universities Program to recognize and celebrate institutions for their commitment to regional economic development through their work in economic engagement. Economic engagement holistically refers to university efforts that promote innovation and entrepreneurship, excellence in technology transfer, leadership in talent and workforce development, establishing strong government-university-industry partnerships, and fostering community and “place” development through public service, engagement and outreach.

It is also perhaps worth noting that 3 of the 11 studies were done internally by university faculty.

From an analytical perspective, 126 of the 146 research and science parks in Fig. 1 are associated with a state university, and 10 of the 126 parks at state universities conducted an economic impact study. Table 4 provides some comparative characteristics on the 10 parks with and the 116 parks without an economic impact study.

One generalization from the characteristics in Table 4 is that state universities with parks closer to their campus, and with smaller parks in terms of acreage, are more likely to undertake a regional economic impact study, other factors not held constant. The other factors not held constant are the university's goals, rationale, and policy issues motivating the university to undertake an impact study. The survey to the offices of the provost did ask why an impact study was conducted and how the study was used, but that question was not answered.¹²

Table 4. Characteristics of parks associated with a state university with and without an economic impact study (mean statistics)

Characteristic of the park	10 parks with a study	116 parks without a study
Age of the park	21.2	21.5
Distance of the park from the university	1.76 mi	8.4 mi
Size of the park (as of 2016)	266.5 ac	402.7 ac

Age of the park for the ten parks with a study equals (year of study—year park founded). Age of the park for the 116 parks without a study equals (2016—year park founded)

Discussion and Concluding Remarks

Our findings should be interpreted in terms of the purpose of the paper. The purpose of the paper was to develop a taxonomy of approaches used by universities to assess and/or evaluate their research and science parks. The taxonomy of approaches has only one category, namely the use of input/output models to develop relevant multipliers to quantify the economic impact of parks. One should therefore exercise caution about generalizing from the findings presented herein.

¹¹ See, <http://www.aplu.org/projects-and-initiatives/economic-development-and-community-engagement/innovation-and-economic-prosperity-universities-designation-and-awards-program/index.html>

¹² The impact study of the Purdue Research Park states that it was done to commemorate the 50th anniversary of the park.

Specifically, one should exercise caution in generalizing from the number of universities that have conducted an economic impact study. In our opinion, an incorrect generalization from the fact that 11 of 146 universities have conducted a study would be that most universities do not see value in conducting an economic impact study. As we emphasized above, we did not have information on university's goals, rationale, and policy issues that might have motivated the university to undertake an impact study. Our objective in this paper was to document "what is," and not to critique "what is."

Caveats aside, this paper does raise the question of whether the conduct of an economic impact study has improved the university's management of its research or science park. The 103rd Congress stated in the August 3, 1993 Government Performance and Results Act (GPRA) legislation that it found, based on over a year of committee study, that, among other things:

Federal managers are seriously disadvantaged in their efforts to improve program efficiency and effectiveness because of insufficient articulation of program goals and inadequate information on program performance.

Accordingly, the purposes of GPRA are, among other things, to states as follows: "Improve Federal program effectiveness and public accountability ... and improve internal management ..." If program evaluations work to improve efficiency and effectiveness of publicly funded programs, would similar evaluations improve the efficiency and effectiveness of university research and science parks? Reflecting on the growth of innovation districts and the reality that changes are facing university research and science parks in the future, is the effort to undertake an economic impact study worth the effort?

Support of university research and science parks comes from myriad sources, including state and local moneys, university resources, and revenues received by park managers or directors through tenant leases.¹³ Accordingly, this study also raises the question about the extent to which universities feel accountable to state policy-makers and to regional stakeholders for the economic benefits that their park produces.

AURP conducts periodic surveys of its membership (and not all US university research and science parks are members of AURP). Perhaps AURP will introduce in future surveys questions to university officers as part of their membership surveys about the perceived usefulness of conducting an economic impact study and, relatedly, the usefulness of workshops on how best to conduct such studies.¹⁴

Finally, in light of the studies conducted by Battelle and by the Brookings Institution, the final question that universities and state policy-makers should consider is the economic future of university research and science parks. While our findings do document that the 11 extant studies do show positive local, regional, and/or state impacts, a question to consider relates to whether or not geographic and locality competition for existing as well as new research firms will maintain those benefits in the future.

¹³ To illustrate this trend for a new park, see Howard and Link (2017).

¹⁴ It is our understanding that previous AURP surveys were directed to park managers or directors and not to university administrators.

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Appendix: Summary of Economic Impact Studies

<p>North Dakota State University North Dakota State University Research & Technology Park “NDSU Research Technology Park, Inc., 2010 Annual Report” Economic Modeling Specialists Inc., 2010</p>	
Background information	<p>“The NDSU Research & Technology Park [RTP] operates to enhance the investments in North Dakota State University by the citizens of North Dakota. Through partnerships with international, national and regional centers of excellence, high technology-based businesses, and the research community at NDSU, the Research & Technology Park works to achieve successful technology-based development and broaden the economic base of North Dakota.”</p> <p>https://www.ndsu.edu/research/newsroom/feature_stories2011/report_shows_ndsu_research_tech_parks_economic_impact_on_region/</p>
Methodology	<p>While Economic Modeling Specialists Inc.’s report is not available on-line or through the Park, it appears that the analysis was one of quantifying jobs, salaries, property income, and revenue to the state and local governments over the 2007–2010 period.</p>
Impact estimates	<p>p. 4: “The 19 businesses located at the RTP account for 893 direct, on-site jobs and another 551 indirect, off-site jobs. ... RTP industries pay out nearly \$51 million in wages and account for another \$23 million in indirect off-site wages as a result of multiplier effects. ... RTP industries and offsite but linked businesses generate \$28.4 million in property income in North Dakota. ... RTP generates more than \$10.9 million for state and local governments.”</p>

The most recent online report can be found through a Google search for “2010 annual report: unity of purpose”

<p>Purdue University Purdue Research Park “Driving Today’s Economy: An Economic Impact Study of the Purdue Research Park Network” Thomas Miller and Associates, 2011</p>	
Background information	<p>p. 5: “The primary mission [of the Park] during the early years was to serve as an attractive site for companies seeking a location to leverage the resources of Purdue University.” Since the early 1990s, the mission of the park has changed and now it is involved in (p. 5): “promoting technology-based economic development [and becoming a] primary vehicle for focusing the University’s economic development activities (both as a physical location and with a dedicated staff).”</p>
Methodology	<p>Economic impact estimates came from the use of the Regional Input-Output Modeling System (RIMS II).</p>
Impact estimates	<p>p. i: The Park’s impact has been: “\$256 million investment in the Park facilities and infrastructure from 1999 to 2010; \$1.3 billion annual impact for State of Indiana; \$48 million contributed to State and local taxes; and \$49 million in Federal research and development grants for small businesses brought to the State since 1987.”</p>

The summary report is online at: www.aurp.net/assets/executive%20summary.pdf

The complete report came from Purdue Research Park. The above page numbers refer to the complete report

<p>University of Arkansas Arkansas Research and Technology Park “Economic Impact of the Arkansas Research and Technology Park” University of Arkansas Center for Business and Economic Research, 2016</p>	
Background information	<p>The Arkansas Research and Technology Park (ARTP) is operated by the University of Arkansas Technology Development Foundation. The mission of the foundation (p. 1): “is to stimulate the knowledge-based economy in Arkansas through partnerships that lead to new opportunities for learning and discovery, that build and retain a knowledge-based workforce and that spawns the development of new technologies to enrich the economic base in Arkansas.” The mission of the park is to assist (p. 1): “technology-based companies to be more efficient and have higher quality products by applying knowledge and techniques developed at the University.”</p>

University of Arkansas Arkansas Research and Technology Park “Economic Impact of the Arkansas Research and Technology Park” University of Arkansas Center for Business and Economic Research, 2016	
Methodology	Using park tenants’ annual business expenditures and construction expenditures, an IMPLAN model was used to estimate the economic impact on the state.
Impact estimates	The business expenditures of tenants and related construction expenditures exceeded US\$216.9 million since 2003. These economic activities (p. 11) “have had a combined economic output impact of \$575.9 on the state of Arkansas.”

The most recent online report is at: https://cber.uark.edu/files/Economic_Impact_of_the_ARTP_through_2014.pdf. The 2016 report was sent by email. The above page numbers refer to the 2016 report

University of Arizona University of Arizona Tech Park “The Economic Impact of the AU Tech Park” VP Research & Consulting, LLC, 2015	
Background information	p. v: The Park is built “upon the synergies among the faculty, administration, students and alumni; the tech parks; and the technology and business community to enhance the impact of UA research, intellectual property and technological innovation ... [and to promote] synergistic relationships between the University, industry and the community.”
Methodology	The IMPLAN model was used to calculate economic impacts at the county and state level.
Impact estimates	In 2015 the overall county impact, including construction was US\$1.5 billion. At the state level, the impact was US\$1.7 billion.

The impact estimates are in an executive summary online at: <https://techparks.arizona.edu/parks/ua-tech-park/economic-impact>. The full report was sent by email. The above page numbers refer to the complete report

University of Illinois at Urbana-Champaign Research Park at the University of Illinois Urbana-Champaign “An Economic Impact Report for the Research Park at the University of Illinois Urbana-Champaign” Champaign County Regional Planning Committee, 2015	
Background information	p. 1: “The Research Park at the University of Illinois provides an environment where technology-based businesses can work with faculty and students to take advantage of opportunities for collaborative research and easy access to University labs, equipment, and services. It was created by the University of Illinois in order to advance its economic development mission.”
Methodology	Economic impacts estimated at the regional level from the IMPLAN model.
Impact estimates	p. 7: In 2015, the “economic output from direct, indirect, and induced Research Park operations in East Central Illinois is \$319 million.”

The report is online at: <http://www.researchpark.illinois.edu/sites/default/files/UI%20ResearchPark%20Impact%209-15.pdf>

University of Missouri University of Missouri Research Parks “The Economic Impact of the University of Missouri’s Research Operations” The Hanover Council, 2009	
Background information	“The University of Missouri has a statewide network of 10 research parks and business incubators, each designed to help faculty, entrepreneurs and businesses collaborate to move innovative research to the marketplace.” The oldest and largest park is the Missouri Research Park (MRP). (https://www.umsystem.edu/ums/aa/umrpi/locations_list)
Methodology	Unclear. Impacts seem to come from the St. Louis Regional Chamber & Growth Association.
Impact estimates	p. 3: “MRP tenant operations are estimated to have a \$786 million total impact on the St. Louis area economy, including the direct or indirect support of 4450 jobs.”

The Hanover Report is referenced online at: https://www.umssystem.edu/ums/red/umrpi/reports_and_statistics. The report was sent by email. The above page numbers refer to the complete report

University of Nebraska University of Nebraska Technology Park The Annual Economic Impact of Firms Located at the University of Nebraska Technology Park” Bureau of Business Research at the University of Nebraska, 2011	
Background information	p. 1: “The mission of the University of Nebraska Technology Park is to enhance the transfer of technology from the University to the marketplace, foster interaction among technology-based businesses and with the University, provide an environment which fosters applied research and development of new technology-driven products or services and promotes technology-focused economic development in Nebraska.”
Methodology	Direct impacts were estimated from (p. 2) “employment, salaries, and gross revenue from firms located at the Technology Park, and of graduates of the Technology Development Center.” Indirect impacts were calculated at the county level using multipliers from the IMPLAN model.
Impact estimates	The total impact from Park businesses in 2010 was US\$589 million.

The report is online at: https://cba.unl.edu/outreach/bureau-of-business-research/bureau-reports/documents/UNL_Tech_Park_Report.pdf

University of Pennsylvania and Drexel University University City Science Center “University City Science Center: An Economic Catalyst for Greater Philadelphia” Economy League of Greater Philadelphia and Econsult Solutions, Inc., 2016	
Background information	The City Science Center’s mission statement is: “Our mission is to inspire and lead a diverse and inclusive community of innovation and entrepreneurship that nurtures and scales economic development through technology commercialization, business growth and civic engagement.” (https://www.sciencecenter.org/about-us)
Methodology	IMPLAN model was used to estimate indirect impacts (e.g., spending on materials, equipment, and professional services) and induced impacts (e.g., spending that is supported by labor income paid to workers as a result of direct and indirect employment in industries, such as food, entertainment, housing, retail, and transportation).
Impact estimates	p. 9: “Science Center incubated firms in greater Philadelphia drive \$12.9 billion in annual economic activity.”

The report is online at: <https://www.sciencecenter.org/news/university-city-science-center-is-an-economic-catalyst-for-greater-philadelphia9>

University of Wisconsin—Madison University Research Park “The Economic Contribution of the University Research Park” NorthStar Economics, Inc., 2010	
Background information	The Park’s mission is “to encourage technology development and commercialization that advances the economy and benefits research and related education programs at the University of Wisconsin – Madison.” (Strategic Plan at: http://universityresearchpark.org/about/strategic-plan/)
Methodology	The report does not mention the IMPLAN model, but the impact estimates are based on direct and indirect effects from the use of multipliers.
Impact estimates	Park activity generated in 2010 over US\$826 million in economic activity statewide; in Dane County, it was US\$588 million and in the rest of the state it was US\$238 million.

The report is online at: http://universityresearchpark.org/wp-content/uploads/2014/03/URP_Economic_Contribution_Report_2010.pdf

Arizona State University Arizona State Research Park “The Economic Impact of the Arizona State University Research Park, 2016” Center for Competitiveness and Prosperity Research at Arizona State University, 2016	
Background information	“ASU Research Park’s mission is to strengthen ties between Arizona State University and industry, and to contribute to the Valley’s economic development.” https://cfo.asu.edu/article/20160406-asu-research-park-board-directors-welcomes-three-new-members
Methodology	Economic estimates were made using the IMPLAN model
Impact estimates	The total economic impact in 2016 was US\$1.4 billion

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Virginia Commonwealth University Virginia BioTechnology Research Park “The Estimated Cumulative Benefit of the Virginia Biotechnology Research Park” Virginia Economic Development Partnership, 2010	
Background information	The mission of The Virginia Biotechnology Research Park is to be “a technology center dedicated to fostering development of Virginia’s biosciences industry through technology transfer, new business formation, expansion of existing businesses and business attraction.” https://www.biospace.com/employer/506781/virginia-biotechnology-research-park/
Methodology	IMPLAN model used.
Impact estimates	The Park’s economic impact on the City of Richmond was US\$598 million; and for the Greater Richmond area was US\$846 million.

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