



**LSU'S INNOVATION ENGINE:
TECHNOLOGY TRANSFER AND COMMERCIALIZATION**



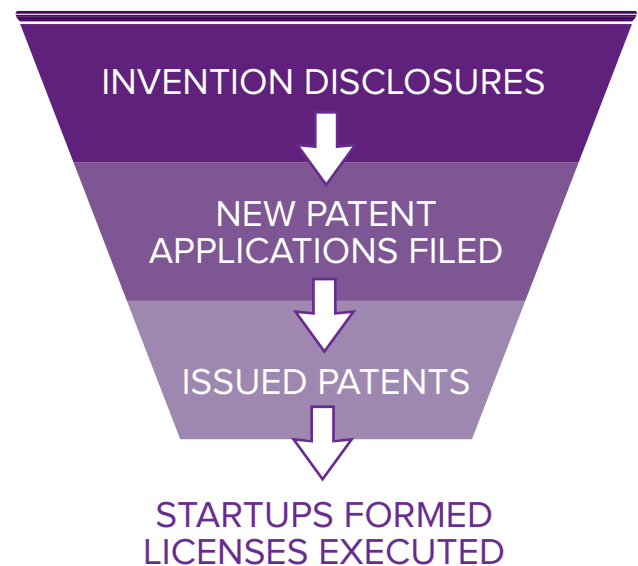
LSU'S INNOVATION ENGINE: TECHNOLOGY TRANSFER AND COMMERCIALIZATION

Louisiana State University (LSU), a Carnegie-designated R1 research university, is one of the Baton Rouge Area's most important assets for innovation and entrepreneurship. Research universities are powerful economic drivers, providing incalculable direct and indirect benefits to the regions in which they are located. Beyond educating talent, research universities enhance a region's technology-based economy, measured by such elements as an intellectual infrastructure, entrepreneurial culture, and capital.¹ LSU has embraced its role in economic development and established itself as a key player in regional innovation ecosystems, naming "fostering research and catalyzing economic development" as a core initiative in its Strategic Plan 2025.² Technology transfer and commercialization is one avenue through which research universities engage in economic development, and since 2012, LSU has taken major steps to improve technology transfer and commercialization activities at the university.

WHAT IS TECH TRANSFER?

Through technology transfer offices, universities commercialize innovation. The process begins with an invention disclosure submitted by a faculty member or student of the university detailing an innovation she has developed. The invention disclosure is then assessed by the office to determine the innovation's commercial potential. If it is determined that there is a potential to secure a patent, the office may file a patent application to the U.S. Patent and Trademark Office and foreign patent offices, if applicable. If an innovation demonstrates commercial potential, the office will market the innovation to companies, or will assist in forming a startup company to bring the innovation to market. Finally, once a company has expressed interest, a license agreement is negotiated for the company to further develop and commercialize the technology.³

A study by the Biotechnology Innovation Organization (BIO) and the Association of University Technology Managers (AUTM) sought to measure the economic impact of technology transfer activities nationally, estimating that between 1996 and 2015 academic-industry partnerships contributed \$1.33 trillion to U.S. industry gross output, \$591 billion to the gross domestic product, and supported over 4.2 million jobs.⁴ In 2016 alone, the 195 technology transfer offices that responded to AUTM's annual survey reported 1,024 new startups formed, 800 new products on the market, and 7,021 U.S. patents issued.⁵



Source: Office of Innovation & Technology Commercialization, Louisiana State University

In 1980, the passage of the Bayh-Dole Act transformed university technology transfer. The legislation made it possible for universities to retain ownership and management of the intellectual property of innovations arising from federally-funded research, providing increased incentive for universities to engage in technology transfer and commercialization.⁶

AUTM gathers annual performance information on institutions with technology transfer offices. BRAC used this information to compare LSU’s¹ performance to the average performance of the 13 other member universities of the Southeastern Conference (SEC) between 2012 and 2016, the most recent year of data available.² Each of these universities are classified by the Carnegie Classification of Institutions of Higher Education as R1 or R2 research universities with high levels of research activity, and five of these universities have been identified by LSU as peer research institutions.⁷ While LSU is typically ranked against SEC universities in athletics, competition also exists for talent and business. Additionally, since 2011, the SEC has augmented its academic focus and initiatives through the SECU. Data provided by AUTM in this report includes: invention disclosures received, new patent applications filed, issued U.S. patents, startups formed, licenses executed, total license income, total research expenditures, and industry-sponsored research expenditures.

LSU’s Peers

For purposes of this report, BRAC chose to compare LSU against its peers in the Southeastern Conference. However, LSU identifies its own set of peer research institutions⁸, which includes:

Colorado State University	University of Georgia
Iowa State University*	University of Illinois at Urbana-Champaign*
Mississippi State University	University of Maryland-College Park*
North Carolina State University at Raleigh	University of Nebraska at Lincoln*
Purdue University*	University of Tennessee
Texas A&M University*	Virginia Polytechnic Institute and State University
University of Arkansas	



*Association of American Universities (AAU) schools

LSU’s self-identified peers are all public land-grant universities with a Carnegie Research designation of Very High Research Activity. They do not have medical schools and are located in the Midwest or the South.

Potentially, BRAC could compare LSU only against members of the AAU, which are considered the leading research universities in the U.S. Such a comparison would illustrate the level of increased research activity needed for LSU to join that eminent group. As proponents of the positive economic impact that exceptional levels of university-based research and development has on a regional economy, BRAC hopes that LSU continues to move in a direction where it finds itself competitive against AAU schools.

1 The LSU System institutions reporting technology transfer activities include Louisiana State University and Agricultural and Mechanical College, Louisiana State University Agricultural Center, Louisiana State University Shreveport, LSU Health Sciences Center New Orleans, LSU Health Sciences Center Shreveport, and Pennington Biomedical Research Center.

2 To determine the “SEC Peer Average” for each metric, BRAC averaged the performance of all member institutions of the Southeastern Conference except LSU, which includes University of Alabama, University of Arkansas Fayetteville, Auburn University, University of Florida, University of Georgia, University of Kentucky Research Foundation, University of Mississippi, Mississippi State University, University of Missouri, University of South Carolina, University of Tennessee, Texas A&M University System, and Vanderbilt University.

FINDINGS

In 2012, LSU lagged behind the SEC Peer Average in almost every key technology transfer metric.

2012	LSU	SEC Peer Average
Invention Disclosures Received	88	123
New Patent Applications Filed	34	63
Issued U.S. Patents	14	23
Startups Formed	3	5
Licenses Executed	18	36
Total License Income	\$10,322,805	\$5,889,612
Total Research Expenditures	\$369,640,000	\$298,695,386
Industry Sponsored Research Expenditures	\$21,659,000	\$14,970,154

In four years, LSU doubled its number of invention disclosures received, surpassing the SEC average, and almost met the average of new patent applications filed and issued U.S. patents.

2016	LSU	SEC Peer Average
Invention Disclosures Received	173	122
New Patent Applications Filed	49	60
Issued U.S. Patents	32	38
Startups Formed	3	5
Licenses Executed	32	45
Total License Income	\$9,538,939	\$7,948,929
Total Research Expenditures	\$359,346,000	\$333,009,820
Industry Sponsored Research Expenditures	\$13,069,000	\$18,124,639

Between 2012 and 2016, LSU saw significant growth in key technology transfer metrics, including inventions disclosures received, new patent applications filed, issued U.S. patents, and licenses executed.

2012–2016	LSU Change	SEC Peer Average Change
Invention Disclosures Received	97%	-1%
New Patent Applications Filed	44%	-5%
Issued U.S. Patents	129%	65%
Startups Formed	0%	0%
Licenses Executed	78%	25%
Total License Income	-8%	36%
Total Research Expenditures	-3%	11%
Industry Sponsored Research Expenditures	-40%	21%

PERFORMANCE DATA

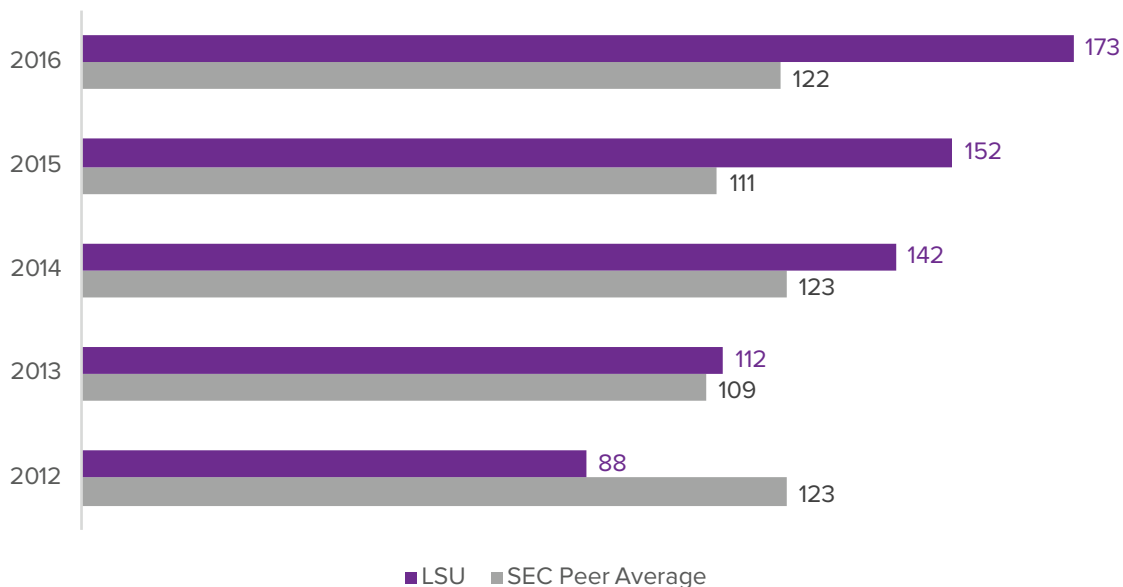
In the following section, BRAC reviews LSU's performance in each key technology transfer metric and compares it to the average performance of the 13 other member institutions of the SEC.

INVENTION DISCLOSURES

The number of invention disclosures received by LSU has consistently grown, up from 88 invention disclosures in 2012 to 173 in 2016, a 97 percent increase, and has remained above the SEC peer average since 2013. Of the 14 SEC schools, LSU ranked No. 5 in the number of invention disclosures received in 2016, up from No. 7 in 2012.

An invention disclosure is the first, and by some measures the most important, step in commercializing innovation. Disclosures are submitted to a technology transfer office by a university researcher detailing the specifics of an innovation. They are used by the office to determine the technology's commercial potential. A large pool of invention disclosures increases the possibility that a university will identify and commercialize a highly lucrative innovation. Additionally, the number of invention disclosures received by a technology transfer office is reflective of the innovation-mindedness of university researchers and their trust in the office. LSU's performance in invention disclosures received is the best evidence that the innovation culture at LSU is changing for the better and is particularly promising for the future of technology transfer at the university.

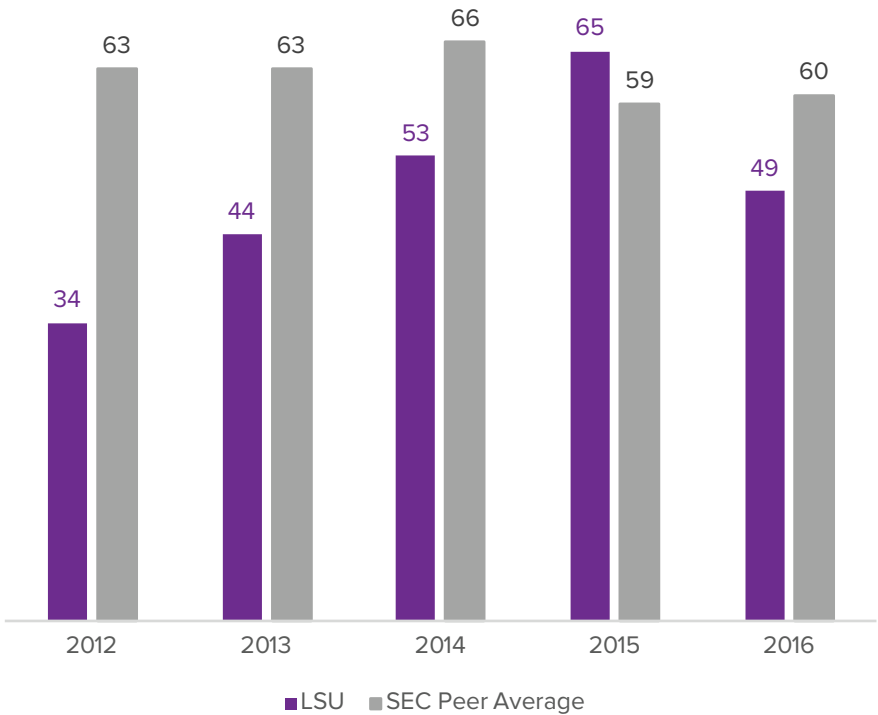
Invention Disclosures Received



PATENTS

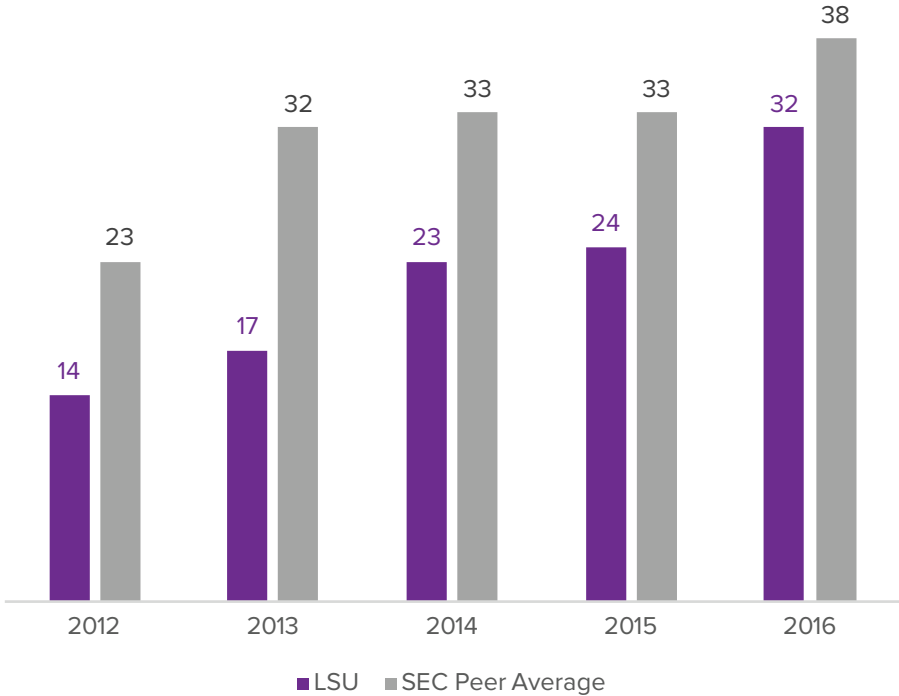
LSU increased its number of new patent applications filed from 34 in 2012 to 49 in 2016, a 44 percent increase. As a result of this growth, LSU moved up in the SEC rankings from No. 8 in 2012 to No. 5 in 2016. Between 2012 and 2015, LSU's new patent applications filed grew steadily, surpassing the SEC's average in 2015, when growth from LSU was combined with a significant drop in the SEC average. The number of new patent applications filed by LSU fell by 25 percent from 2015 to 2016, landing below the SEC peer's average.

New Patent Applications Filed



LSU’s issued U.S. patents have consistently grown, up from 14 in 2012 to 32 in 2016, a 129 percent increase. LSU’s consistent growth was poised to meet the SEC average, but while LSU’s one-year growth between 2015 and 2016 was significant, the SEC average recovered from its three-year stagnation and remained greater than LSU’s performance. Of the 14 SEC schools, LSU ranked No. 8 in issued U.S. patents in 2016, while it tied for No. 8 in 2012.

Issued U.S. Patents



Overall, LSU has shown significant improvement in the key indicators of new patent applications filed and issued U.S. patents, suggesting a more aggressive internal approach to discovering and protecting innovations at the university.

STARTUPS

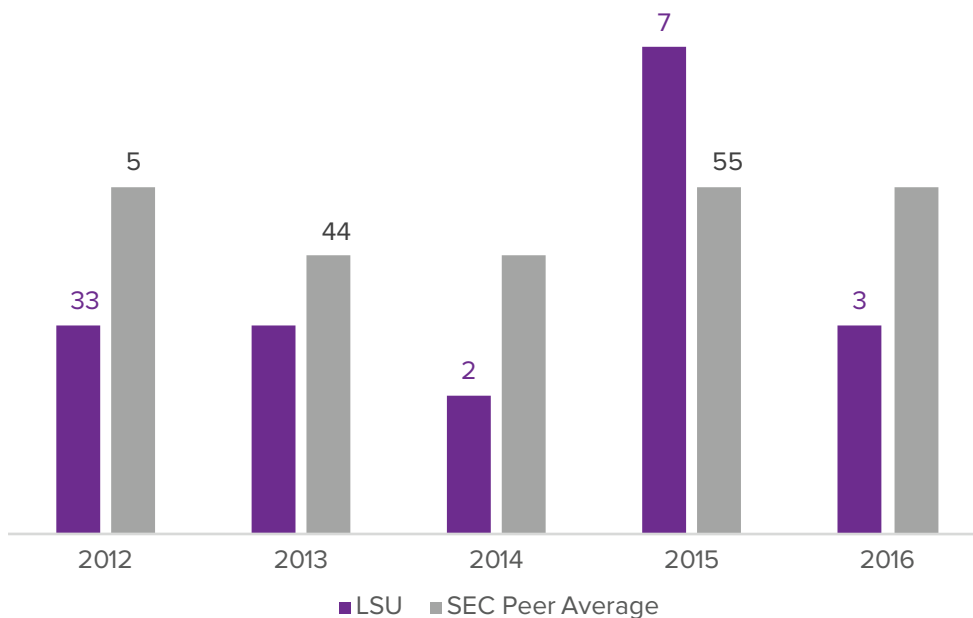
Between 2012 and 2016, 18 startups formed with the assistance of the technology transfer offices at LSU. Of the 14 SEC schools, LSU ranked No. 7 in startups formed in 2016, up from No. 8 in 2012.

In 2016, 1,024 new startups were formed nationally through technology transfer offices reporting to AUTM. Over 73 percent of those startups remained in the institution's home state, spurring local economic growth.⁹ The economic impacts of startups go beyond what the AUTM metrics capture, including factors like job creation, employee wages, and sales.¹⁰ Nationally, new firms account for almost all net new job creation.¹¹

Although LSU has lagged behind the SEC peer average number of startups formed since 2012, with the exception of 2015, it has made considerable progress in helping to cultivate an entrepreneurial culture. LSU has increased resources available to entrepreneurs at the university, particularly funding and training. In 2014, the LSU Board of Supervisors created the LSU LIFT² Fund, a competitive grant program for LSU System researchers, intended to "Leverage Innovation for Technology Transfer."¹² Grants of up to \$50,000 are awarded twice a year to help LSU researchers bring their innovations to market. Since 2014, the LSU LIFT² Fund has awarded over \$4 million in support of 108 research projects.¹³ In addition, the National Science Foundation selected LSU in 2016 to be an Innovation Corps Site (I-Corps Site)¹⁴ with the purpose of providing support for university faculty and students in commercializing their technologies through entrepreneurial training and resources.¹⁵ The number of startups formed will be particularly important to monitor in the coming years to determine the effectiveness of these programs and the impact on technology transfer and commercialization at the university, as well as the impact on the regional economy.

Since 2014, the LSU LIFT² Fund has awarded over \$4 million in support of 108 research projects.

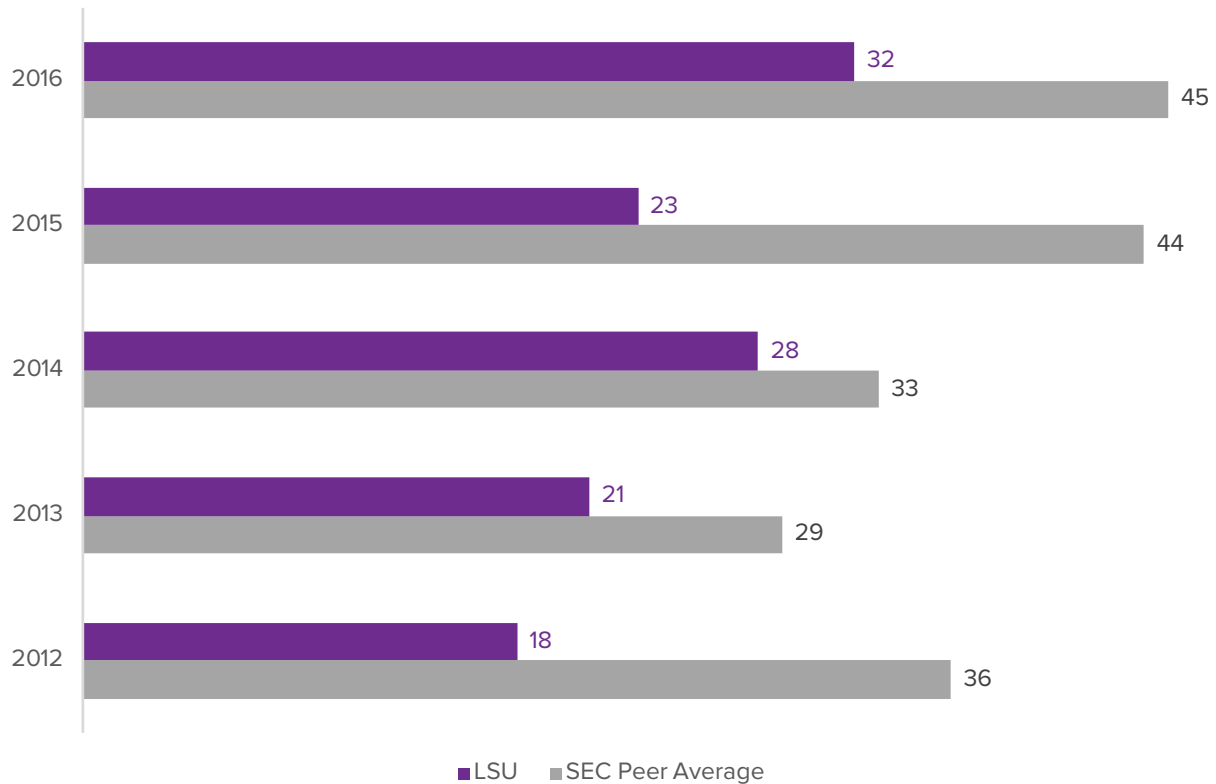
Startups Formed



LICENSES

LSU's number of licenses executed increased from 18 in 2012 to 32 in 2016, a 78 percent increase. However, LSU continues to fall below the SEC peer average and has not improved its ranking among SEC institutions. LSU ranked No. 7 in licenses executed in 2016 among SEC peers, and tied for No. 7 in 2012.

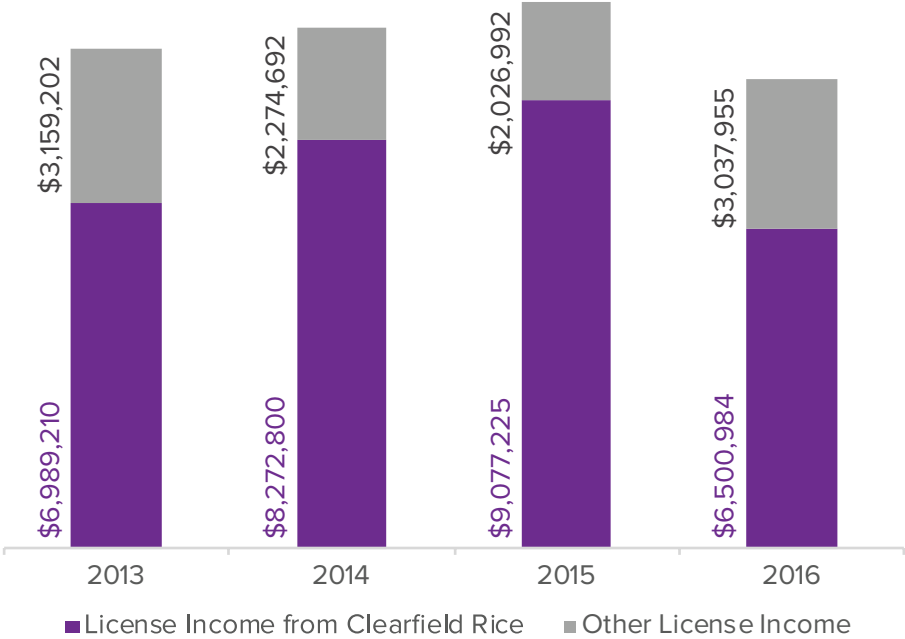
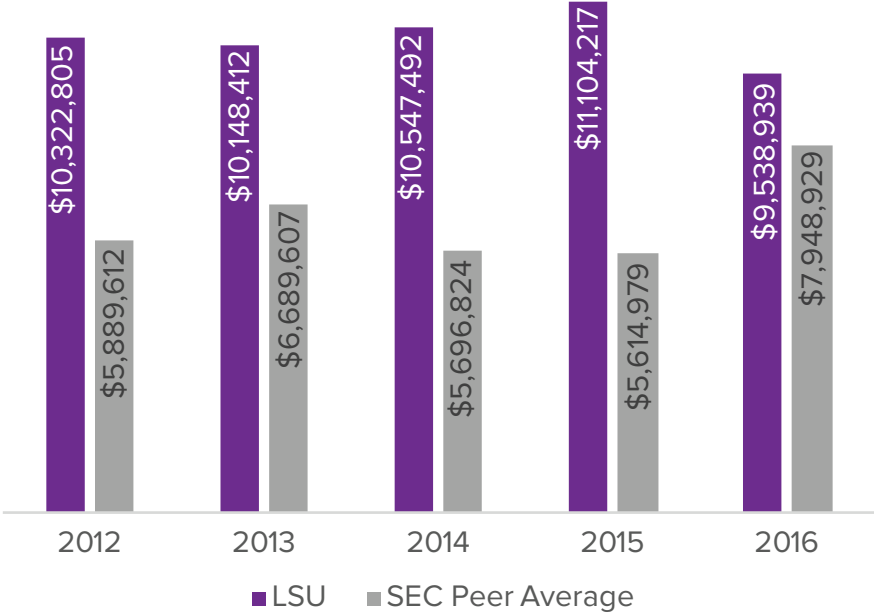
Licenses Executed



Of the 14 SEC schools, LSU ranked No. 4 in total license income in 2016, down slightly from No. 3 in 2012. Since 2012, LSU has consistently outperformed the SEC peer average in total license income, but this number is lower than it was in 2012. It is important to note how much of this income comes from a single license, Clearfield rice, held exclusively by BASF. In 2016, Clearfield rice's license income continued to account for the majority of LSU's total license income. However, LSU's number of licenses executed have increased since 2012. It is essential that LSU continues to diversify its portfolio with new licenses to reduce its reliance on this single source of license income.

↑ Between 2003 and 2012, Clearfield rice, a rice production technology developed by scientists at the LSU AgCenter and exclusively licensed to BASF, generated over \$20 million in revenue for the university. In 2012, Clearfield rice was grown on the majority of the rice acreage in the southern United States, as well as in other rice-growing nations.¹⁶

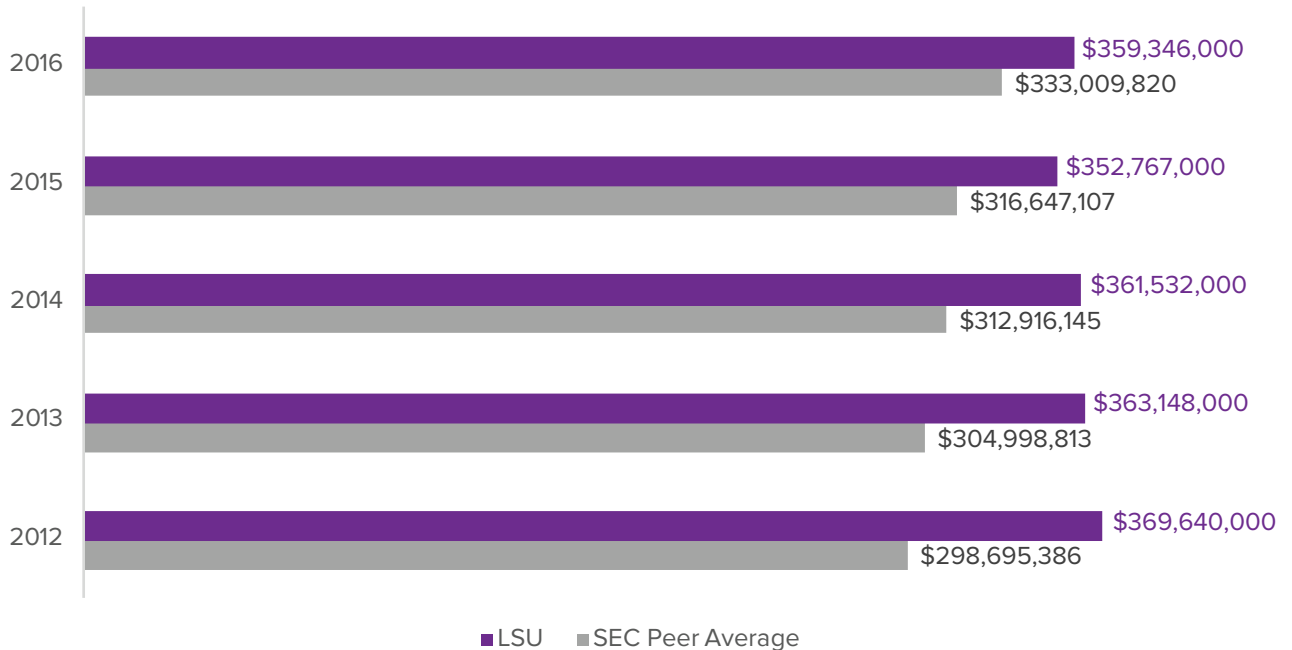
Total License Income



RESEARCH EXPENDITURES

LSU spent \$359 million on research expenditures in 2016, compared to \$369 million in 2012. As a result of the decline in spending, LSU's ranking in total research expenditures fell from No. 4 in 2012 to No. 5 in 2016. While LSU's total research expenditures are lower than what they were in 2012, they remain higher than the SEC peer average.

Total Research Expenditures



LSU's industry-sponsored research expenditures, the amount of research expenditures that come from industry partners, fell from \$21.7 million in 2012 to \$13 million in 2016, falling every year between 2012 and 2016. Of the 14 SEC schools, LSU ranked No. 7 in industry sponsored research expenditures in 2016, down from No. 4 in 2012.

This decline is concerning. Research by the Walton Family Foundation found a positive correlation between higher industry-sponsored research and commercialization outcomes.¹⁷ Increased engagement between industry and the university could result in increased industry-sponsored research, increased funding, a higher level of work, and greater economic benefit to the Capital Region.

CONCLUSION

LSU has made major improvements in innovation activity since 2012. Arguably, this growth is because of leadership at LSU making technology transfer and innovation a high priority internally, and President F. King Alexander, Vice Chancellor Kalliat Valsaraj and the LSU Board of Supervisors are to be commended. Based upon the data presented in this report, the university should continue to push forward its goals under the Strategic Plan 2025 related to innovation, research, and technology commercialization, including in the following ways:

- I. Keep innovation as a priority of the LSU Board of Supervisors and the President;
- II. Maintain the rate of improvement for invention disclosures received and ensure the performance gains are across all key colleges and campuses;
- III. Increase the rate of licenses executed and benchmark goals across LSU campuses, which will also drive increases in license income;
- IV. Grow research expenditures across LSU; and
- V. Drive entrepreneurship spinout activities more aggressively.

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ENDNOTES

- 1 Iryna Lendel. "The Impact of Research Universities on Regional Economies: The Concept of University Products," Economic Development Quarterly, August 2010 vol. 24
- 2 "LSU Strategic Plan 2025," Louisiana State University Office of Academic Affairs 2017, p. 5.
- 3 Office of Innovation & Technology Commercialization, Louisiana State University, <https://www.lsu.edu/innovation/faculty/techtransferprocess.php>
- 4 Lori Pressman, Mark Planting, Robert Yuskavage, Sumiye Okubo, Carol Moylan, Jennifer Bond. "The Economic Contribution of University/Nonprofit Inventions in the United States: 1996-2015," Associations of University Technology Mangers, 2017. <https://www.bio.org/sites/default/files/June%202017%20Update%20of%20I-O%20%20Economic%20Impact%20Model.pdf>
- 5 "AUTM U.S. Licensing Activity Survey FY 2016," Association of University Technology Managers, 2017. https://www.autm.net/AUTMMain/media/SurveyReportsPDF/AUTM_FY2016_US_Highlights_no_Appendix_WEB.pdf
- 6 "Landmark Law Helped Universities Lead the Way," AUTM.net 2018 <https://autm.net/about-tech-transfer/advocacy/legislation/bayh-dole-act>
- 7 LSU Flagship Peer Group https://www.lsu.edu/academicaffairs/institutional_effectiveness/Flagship2020/Peergroup.php
- 8 LSU Flagship Peer Group https://www.lsu.edu/academicaffairs/institutional_effectiveness/Flagship2020/Peergroup.php
- 9 "AUTM U.S. Licensing Activity Survey FY 2016," Association of University Technology Managers 2017. <https://www.autm.net/resources-surveys/research-reports-databases/licensing-surveys/fy2016-licensing-survey/>
- 10 Measuring Research University Contributions to Regional Economies, Walton Family Foundation
- 11 <https://www.kauffman.org/what-we-do/resources/entrepreneurship-policy-digest/the-importance-of-young-firms-for-economic-growth>
- 12 <https://www.lsurtf.com/lift-fund/>
- 13 https://www.lsu.edu/mediacenter/news/2018/06/25itc_lift2_june2018.php
- 14 https://www.nsf.gov/awardsearch/showAward?AWD_ID=1547932&HistoricalAwards=false
- 15 <https://www.lsu.edu/innovation/ICorps/main.php>
- 16 Linscombe, Steve. "Clearfield technology changes the rice industry." Vol. 55, No. 4, Fall 2012
- 17 Measuring Research University Contributions to Regional Economies, Walton Family Foundation, p. 10