

A REPORT BY THE HOOVER INSTITUTION

# INNOVATIVE ALABAMA

Prepared for the Alabama Innovation Commission



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# 1. The Role of Alabama Universities in Fostering Innovation and Growth

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## EXECUTIVE SUMMARY

Universities play a vital role in the development of their local economies and in the innovative ecosystem. Although the direct share of universities in patenting is relatively low, there is no denying that technologies developed within universities, as well as start-ups founded by university faculty and alumni, have been revolutionary.<sup>1</sup> The innovative activity of universities also plays an important role in local economic development. In the short run, university students of course provide economic boosts to their local economies. In the long run, universities can provide skilled, ambitious human capital to local economies that can become the leaders of these areas for years to come—if they succeed in both producing this talent and providing a framework that retains talent created.

In preparing this study, we conducted analysis on innovative activities of universities in Alabama and interviewed numerous stakeholders in both academia and private industry. Our work led us to the following recommendations:

1. Invest in amenities that promote strong quality of life in cities and surrounding areas around universities to create an environment in which potential faculty and alumni entrepreneurs will remain and locate their innovative activities.
2. Develop an entity similar to the Wisconsin Alumni Research Foundation (WARF) that promotes investment into innovative start-ups at universities in Alabama.
3. Encourage universities in Alabama to adopt best practices with respect to technology transfer ensuring optimal incentive structures.



4. Create new programs at current universities in Alabama that focus on entrepreneurship within MBA programs and use these programs to connect students with successful entrepreneurs and improve entrepreneurial quality and impact.

## Introduction

Universities have historically been viewed as institutions of knowledge, readying students for both life and career challenges. However, recently universities have taken on an additional role by contributing to the economic development within their respective regions by facilitating and supporting knowledge spillovers through innovation. Specifically, leading universities in particular are expanding their role from simply a knowledge hub to both a knowledge and an innovation center, acting as broker, liaison, and mediator facilitating and supporting technology transfer between the university and the community.<sup>2</sup>

Technology transfer offices at universities are the intermediary between the university, industry, and government organizations. Existing literature indicates that regions are more successful with technology transfers when they partner with other research universities within their respective states or regions, government laboratories, nonprofit research organizations, or private-sector research and development (R&D) units.

Entrepreneurship and technological innovation at universities are also factors of firm location. Juan Alcácer and Wilbur Chung find that firm location decisions depend on the level of academic knowledge and innovative activity as well as potential knowledge spillovers.<sup>3</sup> Furthermore, there are several benefits of attracting innovative firms and facilitating a relationship between the firm and the university. First, Shawn Kantor and Alexander Whalley measure a positive and significant effect for university research activities and productivity gains in local firms.<sup>4</sup> Second, Anna Valero and John Van Reenen find that the relationship between the number of universities and GDP growth depends on increased human capital and innovation.<sup>5</sup> Third, Nicholas Bloom et al. find that disruptive technologies have long-lasting returns for the area where the technology originated; these returns occur in areas with a strong local education, research institutions, and universities.<sup>6</sup>

Alabama, like many states, is fertile ground for the creation of a similar type of innovative environment between its universities and firms. In this report, we examine the current state of innovation in Alabama with respect to universities and compare Alabama's progress to neighboring states. Additionally, we aim to provide an exhaustive list of ideas and considerations from individuals within both academic and private spheres who have the necessary skill sets and knowledge bases to provide useful insight into making Alabama a center of innovation that attracts the best and brightest to the state.

We aim to achieve this by providing specifics about the current status of innovation in Alabama through an analysis of the state's patent production relative to its neighbors.

We then delve into a literature review that provides better context surrounding the necessary conditions in attracting entrepreneurial human capital and developing a culture of innovation within the state. Finally, we provide four specific takeaways and recommendations for the Alabama Innovation Commission (AIC) to consider as initial action items.

## The Current Landscape for Universities and Innovation in Alabama

Research institutions such as the Milken Institute and the Brookings Institution have compiled rankings and indexes that evaluate types of innovation in the United States. We report their findings along with data from the United States Patent and Trademark Office in an attempt to evaluate the current landscape for innovation produced by universities in Alabama.

A popular measure of innovation is the number of patents and patent citations produced.<sup>7</sup> For the past ten years, Alabama has ranked between 34th and 37th in the United States for total patents and utility patents according to the United States Patent and Trademark Office. Total patents include utility, design, and plant patents. Of these, utility patents are deemed the most innovative, and most patents produced in all states, including Alabama, are utility patents.

Universities in Alabama as well as universities in other states are not the top producers of patents relative to other entities. From 2011 to 2019, universities in Alabama produced 602 of the 2,841 patents, or approximately 21.19 percent of the patents produced in the state.<sup>8</sup>

In 2017, the Milken Institute ranked the best universities for technology transfer using the Technology Transfer and Commercialization Index. This index weights patents issued at 15 percent, licenses issued at 15 percent, licensing income at 35 percent, and start-ups formed at 35 percent. Using data from 2012 to 2015, the index ranked 225 universities in the United States. Of the 225, the University of Alabama ranked 135th, the University of Alabama in Huntsville (UAH) ranked 137th, Auburn University ranked 141st, the UAB (University of Alabama at Birmingham) Research Foundation ranked 155th, and the University of South Alabama ranked 161st. Each of the five universities ranked in Alabama were strongest in licensing income. The University of Alabama and the University of Alabama in Huntsville received the least weight from licenses issued. Auburn University and the UAB Research Foundation received the least weight for start-ups formed. Finally, the University of South Alabama received the least weight for patents issued.<sup>9</sup>

In a 2019 analysis, the Brookings Institution's *Information Technology and Innovation Foundation* report selected thirty-five metropolitan areas that have the potential to become one of the nation's growth centers. Birmingham, Alabama, was one of the thirty-five selected for its strengths in innovation and workforce development. The areas chosen were required to meet a population and innovation sector job growth benchmark. Second, the Brookings Institution created an Eligibility Index that highlights the potential



for innovation and workforce development. The factors for the index included STEM (science, technology, engineering, and mathematics) R&D spending, patent activity, and the availability of skill-based labor. Of these criteria, Birmingham was in the top half for university STEM R&D spending and was in the bottom half for patent activity and the share of the labor force with a bachelor's degree and STEM doctoral degrees. Birmingham, Alabama's Eligibility Index score was comparable to that of Knoxville, Tennessee, and Dayton, Ohio.<sup>10</sup>

In addition, the Brookings Institution's *State of the Heartland: Factbook 2018* reported on entrepreneurship and innovation. Brookings estimated the share of jobs from new firms as a measure of entrepreneurship in the Heartland. In 2016, 9.8 percent of jobs in Alabama were from new firms created in the last five years. This statistic decreased slightly from 11 percent in 2010.<sup>11</sup> The share of jobs formed from new firms is comparable to others in the Heartland region including Alabama's neighboring states, yet Alabama's share is less than those not in the Heartland. As for innovation, the report refers to the Milken Institute's *State Technology and Science Index*.

The *State Technology and Science Index* is reported biannually. It uses five indicators to evaluate a "state's capacity for achieving prosperity through scientific discovery and technological innovation."<sup>12</sup> These subindexes include research and development, risk capital and entrepreneurial infrastructure, human capital investment, technology and science workforce, and technology concentration and dynamism.

Overall, this index ranked Alabama 32nd in the nation in three of the last four reports (2014, 2018, and 2020) and 37th in 2016. In 2020, Alabama's overall rank bested Florida (33rd), Mississippi (50th), and Tennessee (40th), while falling short of Georgia (22nd). Looking at the five subindexes gives a clear picture of Alabama's strengths and weaknesses relative to neighboring states.

The first subindex uses data on research and development inputs to account for technology transfer from universities into the private sector. The Milken Institute forms research and development scores using federal, industry, and academic R&D funding as well as National Science Foundation funding and higher education spending in STEM fields. When it comes to funding, the Walton Family Foundation report, *The American Heartland's Position in the Innovation Economy*, states that at least 60 percent of research and development funding comes from industry where the remainder comes from university funding and federal government funding.<sup>13</sup>

In 2020, Alabama ranked 23rd for research and development. Alabama performed well relative to its neighboring states, surpassing Georgia (32nd), Mississippi (45th), Florida (39th), and Tennessee (35th). Additionally, Alabama's rank was up from 24th in 2018 and 28th in 2016 but down slightly from 2014 when the state ranked 22nd.

The second subindex is risk capital and entrepreneurial infrastructure. The Walton Family Foundation report emphasizes start-ups including those at universities that need crowdfunding, angel investing, and venture capital. Specifically, this subindex examines venture capital investment and growth, small business investment company (SBIC) funding, patents issued, start-ups created, IPO investment, and venture capital investment in specific technologies: nano, clean, and bio.

In 2020, Alabama performed poorly, ranking 46th for risk capital and entrepreneurial infrastructure. Alabama ranked behind Tennessee (26th), Florida (16th), and Georgia (20th) but slightly above Mississippi (48th). Additionally, it is important to mention that Alabama's ranking in this area has been moving in the wrong direction, as this was the state's worst performance in the last four reports (i.e., 39th in 2018, 38th in 2016, and 45th in 2014).

The third subindex is human capital, which was coined as the most important for intellectual property by the Walton Family Foundation. The authors of the report emphasize the rate of return for investing in education. This subindex accounts for the proportion of a state's population that has obtained a higher degree, student aid spending, ACT scores, appropriations for higher education, percentage of population with a doctorate in science or engineering, PhDs awarded and number of graduate students in science, engineering, and health, recent higher education degree awards for science and engineering, and percentage of households with computers and access to broadband.

In 2020, Alabama ranked 36th for human capital investment. Alabama, again, was able to best Mississippi (46th), Tennessee (40th), and Florida (42nd) but fell short of Georgia (26th). Alabama's ranking was slightly better than its rankings in 2016 and 2018 when it ranked 42nd and 38th, respectively; however, this improvement was simply a return to its ranking from 2014 when Alabama also ranked 36th.

The fourth subindex relates to technology and science in the workforce. The Walton report states clustering STEM workers leads to knowledge spillovers, which significantly increases productivity. It also states that skilled technicians without advanced degrees aid in economic growth as well as in research and development. Milken's technology and science workforce subindex examines the proportion of workers specializing in computer and information science, engineering, and life and physical sciences.

In 2020, Alabama ranked in the middle of the pack at 24th for technology and science in the workforce. This rank proved exceptional for the region, as the state outranked Mississippi (48th), Tennessee (45th), Georgia (30th), and Florida (47th). Alabama's ranking in this area improved greatly in 2020 relative to the last few reports where the state was ranked 33rd (2018) and 34th (2016 and 2014).



The fifth and final subindex is technology concentration and dynamism, which are included to measure high-tech business activity. Furthermore, this measure indicates whether public policy implemented leads to successful innovation outcomes. The technology concentration and dynamism subindex by Milken examines the concentration, employment, salaries, and growth associated with high-tech industries.

In 2020, Alabama, again, ranked in the middle of the pack—28th for technology concentration and dynamism. Alabama’s ranking was above Mississippi’s (50th) and Tennessee’s (33rd) but was significantly below Georgia’s (9th) and Florida’s (16th). While falling short of a couple of states, Alabama’s ranking still was up from 29th in 2018, 35th in 2016, and 39th in 2014.

Throughout these different indicators and rankings of innovative practices and behavior, Alabama fairly consistently finds itself in the middle to bottom third of the country. With this in mind, there is a great deal of room for improvement in developing curricula and academic environments within Alabama universities that will attract and keep talented students who are focused on innovation.

### **Analytic Findings**

Through discussions with stakeholders at twelve prominent universities (Auburn, Alabama A&M, University of Alabama in Huntsville, University of Alabama at Birmingham, Troy University, University of Alabama, University of North Alabama, University of North Carolina, Tuskegee, Stanford University, University of Virginia, and University of Texas–Austin) along with five ecosystem partners (Venture For America, Heartland Forward, Innovation Depot, Alabama Futures Fund, and Birmingham Bound) and reform organizations that include the Cicero Institute, we conducted an analysis and literature review designed to better understand how universities can assist in making Alabama more competitive relative to other states by bringing more businesses and entrepreneurship to Alabama.<sup>14</sup>

Through these conversations with the aforementioned relevant stakeholders, and through our own analysis of existing university-related patent data, we examine the impact of universities’ innovation and compare it to surrounding state universities (i.e., universities in Georgia, Florida, Mississippi, and Tennessee). We then discuss environmental factors that can lay the necessary groundwork in attracting the best talent to create a culture of innovation within Alabama.

### ***Patent Data Findings and Summary***

Wharton Research Data Services (WRDS) was used in preparing this analysis on universities in Alabama.<sup>15</sup> These data were directly parsed from the United States Patent and Trademark

**Table 1. Summary of patent data by state**

<i>State</i>	<i>Total patents from universities</i>	<i>Total patents within the state including those from universities</i>	<i>Percentage of patents from universities</i>
Alabama	602	2,841	21.19%
Georgia	3,477	26,499	13.12%
Florida	987	31,766	3.11%
Mississippi	119	586	20.31%
Tennessee	1,538	8,394	18.32%

Office, and the data sets consist of patents and citations in Alabama, Georgia, Florida, Mississippi, and Tennessee. For the purposes of this analysis, the dates for collected data range from 2011 through 2019. It is important to note that patents are not the only measure of innovative output. For example, software is an innovative output that does not always seek patentability. Therefore, it is important to take into account some of the limitations in the subsequent analysis.

From 2011 to 2019, universities within Alabama and its neighboring states produced 6,273 patents (see table 1). Combining the Wharton Research Data Services with Google Patents' data allowed for an investigation into total citations, patent citation, and nonpatent citations. Citations for patents are a measure of patent quality and productivity.

On average, patents produced by universities in Alabama have 57.51 total citations. A comparison of total citations of universities within Alabama to those of universities within neighboring states shows that universities in Alabama produce approximately the same number of total citations per patent as universities in Georgia and Tennessee. On the other hand, universities in Alabama produce significantly more citations per patent than universities in Florida and Mississippi.

Patent citations are a measure of how innovation leads to further patent innovation. On average, patents produced by universities in Alabama have 20.67 patent citations. A comparison of patent citations of universities within Alabama to those of universities within neighboring states reveals that Alabama's patents lead to a similar number of patent citations as Georgia's. Additionally, Alabama produces significantly more patent citations than Florida, marginally significantly more than Mississippi, and significantly less than Tennessee.

Nonpatent citations are a measure of how innovation leads to further research such as literature that is not patented. On average, patents produced by universities in Alabama have





**Table 2. Summary of patent data by university**

<i>University</i>	<i>Percentage of total university patents</i>
Auburn University	24.25%
University of Alabama at Birmingham	41.36%
University of Alabama in Huntsville	8.31%
University of South Alabama	4.65%
Alabama State University	0.50%
University of Alabama	19.27%
Tuskegee University	1.66%

**Table 3. Summary of growth rates per state (2011–2019)**

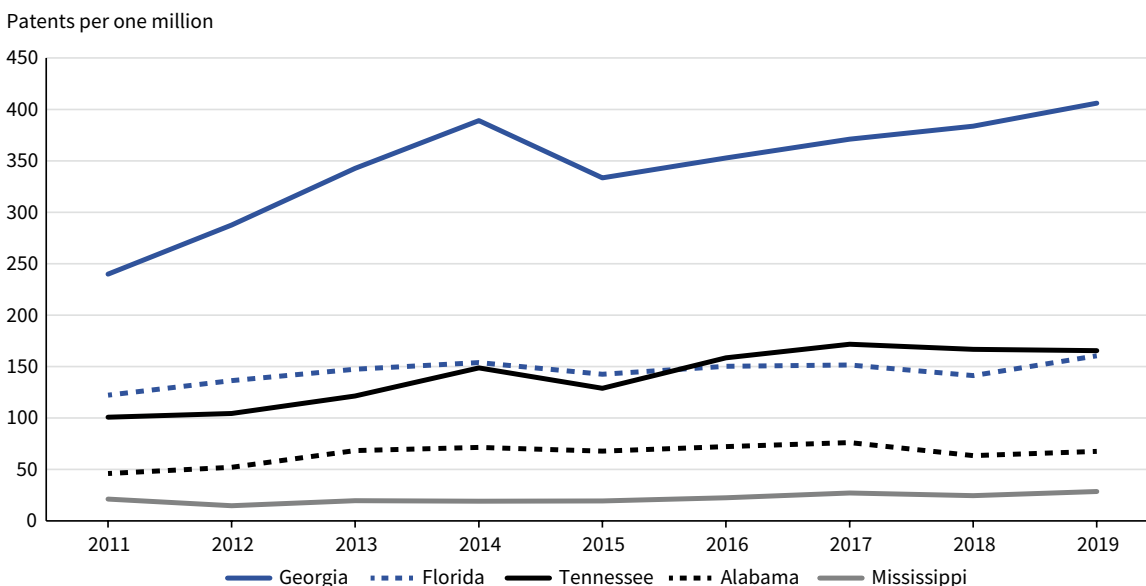
<i>State</i>	<i>Patents per capita growth rate</i>
Alabama	0.47
Florida	0.31
Georgia	0.69
Mississippi	0.35
Tennessee	0.64

36.85 nonpatent citations. In a comparison of nonpatent citations of universities within Alabama to those of universities within neighboring states, Alabama's patents are shown to lead to significantly more nonpatent citations per patent than patents in Florida, Mississippi, and Tennessee. On the other hand, patents produced by universities in Alabama lead to marginally significantly less nonpatent citations than those in Georgia.

Auburn University, the University of Alabama, the University of Alabama at Birmingham, and the University of South Alabama produce the most cited patents. These four universities also have significantly more nonpatent citations compared to other universities in Alabama. Additionally, the four universities along with the University of Alabama in Huntsville have significantly more patent citations compared to other universities within Alabama (see table 2).

Patents per capita are one way to measure statewide innovation. Although Alabama has the highest percentage of patents coming from universities compared to its neighboring states, Alabama does not fare as well for overall patents per capita as evidenced by figure 1; Alabama falls behind Florida, Georgia, and Tennessee in patents per capita. Moreover, Alabama's patent per capita growth rate across the nine years is larger than the growth rate in Florida and Mississippi but less than that in Georgia and Tennessee (see table 3).

**Figure 1. Patents per one million by state, 2011–2019**



**Sources:** US Census Bureau; Wharton Research Data Services.

All in all, since 2011, Alabama comes second to last in producing patents (see figure 1). Although Alabama produces fewer patents than its neighbors, universities in Alabama contribute more to total patents than universities in neighboring states. Patents produced by universities within Alabama are competitive for patent citations and nonpatent citations. Therefore, universities within the state are producing competitively innovative patents that advance the literature and lead to further innovation. To remain competitive with neighboring states, Alabama should focus on increasing total patent production while maintaining its current quality of those patents produced.

### ***Attracting Talent***

Research from Glaeser, Kerr, and Ponzetto suggests that areas with higher levels of firm birth have lower fixed costs and a greater supply of entrepreneurs.<sup>16</sup> The challenges related to fixed costs are addressed in the chapter on taxation policy. However, regarding the question surrounding the human capital problem related to new firm growth, this report highlights the geographic characteristics that are most important to attract and retain highly skilled talent.

Over the last twenty years, Nashville, Tennessee, has become a destination for technology, culture, and business investment. In 2020, Inc.com rated Nashville as one of the best places to start your business, claiming that “the musical city is finding its voice as an emerging tech and fashion hub.”<sup>17</sup>



Since 1990, Nashville has growth at ~3 percent year-over-year (YoY).<sup>18</sup> Today, greater Nashville is home to 1.96 million people, generates \$140 billion in gross domestic product, and has extremely competitive income and employment numbers (\$64,000 median household income paired with 2.6 percent unemployment pre-COVID). Countless larger technology companies, small entrepreneurs, and investors have targeted Nashville for relocation.

Yet, in 1990, the population of Nashville was 577,000, while the population of Birmingham was 623,000, and both had been experiencing 1–2 percent YoY growth. Nashville's trajectory separated itself from Birmingham and other southern cities around this time through a confluence of events. For one, the city was able to obtain two major professional sports teams—the Tennessee Titans and the Nashville Predators. Couple these changes in entertainment with effective tax policy (i.e., low taxation only on income from interest and dividends), and the city thrived. A clear success that resulted from these changes was the United Auto Workers' decision to remain in Nashville without any guaranteed incentives due to the fact that union members wanted to continue living in Nashville because of the sports teams the city had secured a year earlier.

A review of the broader literature largely supports Nashville's approach to taxation and quality of life. According to Richard Florida, areas that are energetic and vibrant are much more attractive to highly educated, talented people.<sup>19</sup> These characteristics are at such a premium that these individuals are willing to spend more money on housing and general living expenses to ensure that they acquire this standard of living. Further, he concludes that attracting and retaining a highly skilled talent pool is a key intermediate variable in ultimately attracting high-technology industries and generating higher regional incomes.

These results are largely consistent with a wider body of literature surrounding regional development that includes the work of Jane Jacobs and Robert E. Lucas Jr., the empirical findings of Edward L. Glaeser, and the writings of others.<sup>20</sup> These writers suggest that talent is *the* primary factor in jump-starting regional development. They further suggest that talent is not necessarily a geographical given but rather a consequence of certain geographical conditions and local initiatives. Therefore, policy makers should focus their attention on instituting policies that foster environments that attract such talent.

## **Recommendations and Ideas for Implementation**

Having reviewed the ideas and findings from the stakeholders as well as assessing the current standing of Alabama universities, this report presents the following recommendations for Alabama universities in fostering an innovative ecosystem within Alabama. The recommendations are as follows:

### *Investments in Entertainment and Quality of Life*

According to the stakeholders interviewed, a key area to consider when making Alabama a sought destination is investment in entertainment, restaurants, and other such quality-of-life-focused areas. This perspective is backed by recent research. The American Institute for Economic Research (AIER) shows millennials do not just move for a job. Instead, around 70 percent of young college graduates decide where to relocate based on quality-of-life factors such as a robust restaurant scene and good mass transit.<sup>21</sup> These survey data are further bolstered by the wider aforementioned academic literature, which suggests that culture is a necessary condition in fostering a growing innovative tech sector.

With this in mind, cities in Alabama should emphasize and develop their appeal as a cultural destination for tourists and residents alike. We highlight three specific endeavors that Alabama should consider in attracting talent:

First, Alabama could consider hosting or supporting a milestone event. For example, Austin, Texas, attributes much of its growth and reputation as a thriving tech city to South by Southwest (SXSW) and Austin City Limits (ACL). The city provides incentives such as free real estate and free support services that allow the event to be successful. In turn, SXSW in particular has allowed Austin to make a name for itself as a knowledge center. Together, SXSW and ACL bring those from outside Texas into the state, to see and experience what it might be like to reside there. Alabama could benefit from bringing people into the state through a cultural event, as it would allow the state to rebrand and show off its thriving culture and Birmingham metropolis. The Economic Development Partnership of Alabama's Innovation and Entrepreneurship conference would be a great place to launch a milestone event.

Second, Alabama should work to attract arts and entertainment to the state. As we mentioned earlier, Nashville secured a GM manufacturing plant, for free—without offering any incentives—purely because the United Auto Workers intervened. Its members wanted to live in Nashville because of the sports teams it had secured in years prior. For Alabama, arts and culture could similarly be a major professional sports team, a musical identity, or even a historical attraction given its rich civil rights history.

Last, Alabama should invest in hallmark infrastructure. Atlanta's beltline, much like the iconic central or golden gate parks, serves as passive space for city dwellers to think, wander, and generally improve their quality of life. Building out infrastructure in the big cities will similarly attract people to the city and inspire the freedom to innovate.<sup>22</sup>

In sum, Alabama has the potential to benefit from investments and initiatives focused on enhancing quality of life outside the workplace. Therefore, we strongly recommend that



the AIC consider the aforementioned ways to enhance the social lives of new innovators entering the state.

### ***Create Investment Entity That Invests in Start-Ups at Alabama Universities***

In addition to providing a more entrepreneurship-focused academic curriculum to potential innovators coming to Alabama for school, providing financial support for innovation should be another area of focus for the Alabama Innovation Corporation. A challenge with having universities directly involved in potential funding decisions for projects within the university is the potential for conflict of interests existing between the university and the professors involved with the project. To avoid such an arrangement, Alabama should consider establishing a new separate entity that focuses specifically on new ventures within Alabama universities.

Established in May 2021, the Alabama Innovation Corporation could achieve these goals.<sup>23</sup> A model for this arrangement exists in Wisconsin with the Wisconsin Alumni Research Foundation (WARF). WARF is an independent, nonprofit corporation run by alumni trustees of the University of Wisconsin that manages the university's patented technologies and invests the revenue to support future university research.<sup>24</sup> Although WARF receives a substantial amount of funds through investment returns, the bulk of its revenues is derived from contributions.<sup>25</sup>

In the century of WARF's existence, the organization has given \$3.4 billion in the form of direct grants to University of Wisconsin–Madison and the Morgridge Institute for Research, \$210 million to faculty inventors, and \$300 million in in-kind support over the last fifteen years alone (all figures adjusted for inflation). These funds also ensure that top talent remains at the university. Of the current \$100.3 million WARF grant to the university and the Morgridge Institute, \$12 million is earmarked for faculty recruitment and retention alone.<sup>26</sup>

Grant decisions are made by WARF's board of trustees, as they are entrusted to guide the organization's priorities each year.<sup>27</sup> Some of the key funding areas the board decides on are related to graduate fellowships, recruitment and retention, and biochemistry innovation among others.<sup>28</sup> The board of trustees making these decisions consists of professionals from a variety of fields. Almost all of them have completed a degree at the University of Wisconsin–Madison.<sup>29</sup>

An entity that operates like WARF would dovetail well with a program focused on entrepreneurship, as there would be ways to fund ideas conceived in the classroom and through working with potential entrepreneurs in residence. With this in mind, we highly recommend that the newly established Alabama Innovation Corporation uses WARF's approach as a framework for investing and assisting new ventures at universities.

### *Adopting Best Practices with Respect to Technology Transfer at Alabama Universities*

In addition to creating an entity that provides financial support for innovation, a university benefits from having an office of technology licensing (OTL) with the following purposes: to foster a culture of innovation, to assist in the commercialization of technology developed at the university, and to ensure that some returns from the innovations developed using university resources and grants accrue to the university directly. This requires the technology transfer office to understand the long-term processes and potential benefits from innovation such as philanthropy.

Jan Youtie and Philip Shapira discuss the development of the technology transfer office and universities' role as a knowledge and innovation hub.<sup>30</sup> They view universities' technology transfer office as a transfer specialist that acts as a broker to see which results are patentable or of high innovative value. After the technology transfer office determines the potential patentability, it presents the discoveries to industry. Therefore, the technology transfer office balances intellectual property management as well as incentives and barriers for faculty and industry participation.

Universities hope for high returns from innovation, yet according to Josh Lerner, university commercialization strategies do not yield returns quickly and most do not yield high returns but rather yield moderate returns.<sup>31</sup> Therefore, the key role of the universities is to focus on development strategies that do not limit licensing.

One strategy Lerner speaks to is venture capital-backed spin-outs and adding staff at a university's OTL to assist professors with establishing new firms. Furthermore, Alabama universities' OTL should follow leading universities' OTL to "reduce the uncertainty of academic entrepreneurs about the spin-out process and ease outside investors and strategic partners' doubts about the new venture." The first point coincides with informing academic entrepreneurs about management and funding in an attempt to avoid costly mistakes. The second point refers to OTL being a trusted intermediate that develops relationships with venture capitalists and corporations. The OTL then proposes and facilitates academic spin-outs utilizing these relationships. The key to successfully employing these two points is securing an experienced staff at the university's OTL.<sup>32</sup>

Depending on the specifics of the start-up, universities can often be essential in the development of a start-up's product. One key example of how a university played an integral role in the development of a start-up's product can be seen in the company SafeStamp Inc. in Austin, Texas. During his time overseas in the military, CEO Matt McGuire discovered that a major issue within pharmaceuticals was the distribution of fake, often dangerous drugs under benign packaging. Through research, he developed a concept of a nanotech indicator to seal medicine packaging that would verify its authenticity to consumers.<sup>33</sup>



The issue for McGuire was that he himself was not a scientist in this field, and he therefore began reaching out to universities with appropriate labs to help him develop the product. After reaching a deal with the university, master's and PhD scientists at Texas A&M developed technology that would glow orange with breath and blue with touch. This ultimately made it impossible to counterfeit drugs using the technology.<sup>34</sup>

In a conversation with McGuire, he explained that without universities his product simply could not have been made. Had he attempted to do this completely on his own, his up-front costs would have been too excessive, as he was not able to raise enough money on the concept of the business alone to contract out a private lab. Further, if he had been able to contract a private lab, he would have found that these labs often do not have the necessary heavy equipment to effectively develop these sorts of technologies. Therefore, for his R&D-intensive project, universities were a cost-effective choice and an absolute necessity in bringing his product to market.<sup>35</sup>

In Matt McGuire's case, Texas A&M had the essential labs to help develop his product. However, other universities may have other facilities that provide entrepreneurs competitive advantages in developing their products and services. The key for universities is leveraging these resources on their respective campuses in attracting new entrepreneurs.

The idiosyncrasies of these contractual arrangements vary significantly by academic institution. In an interview with a venture capital firm familiar with the technology transfer policies at universities across the United States, the following practices emerged as one example of a structure that preserved incentives for faculty innovation in one industry. To start, to enable VC investment, the university must in principle provide a path for the creation of start-up companies into which the know-how to use technology is endowed. Universities that provide strong incentives for innovation generally have an equity investment structure where they take a relatively modest amount of common stock (e.g., 1–2 percent), with some antidilution rights to preserve this, but perhaps through only one or two additional rounds of financing. The university can also have some preemptive rights to purchase into future rounds with additional investments. The university may collect some patent fees, sublicense fees, maintenance fees, and milestones fees (particularly in phased clinical trials in biopharmaceuticals), and may also have a modest royalty of 1 percent of sales. While practices vary across types of innovation, such as software versus biotech, the common theme is the importance of preserving the incentives of entrepreneurs to innovate and creating a path to spin out a company in which the university has some economic interest but not one that gives the university a strong or controlling stake in the business.

- *Equity Structure:* 1.3 percent in common stock (aggregate over two licenses) with antidilution rights to maintain that percentage through the next equity financing of at least \$1 million (but this right expires after one equity financing).

- *Preemptive Rights:* Right to purchase up to 10 percent of our round, and pro rata rights in future equity financings.
- *Patent Fees:* \$15,000 annually to offset.
- *Sublicense Fees:* 15–25 percent on certain milestones.
- *Maintenance Fees:* \$10,000–\$55,000 on certain milestones.
- *Dosing Milestones Fee:* \$75,000 at first dosing in phase II with licensed product; then \$250,000 at first dosing in phase III with licensed product.
- *Change of Control Fee:* In aggregate across two licenses, the university receives \$25,000 in cash and 1.25 percent of the topline acquisition amount capped at \$1.25 million.
- *Royalties:* 0.75 percent of net sales and \$15,000 onetime signing royalty.

According to the representatives in the field, a university would be making a severe mistake in attempting to make large sums of money, using its academic personnel as employees whose intellectual property the university would largely own. Rather, the university should aim to facilitate the commercialization and hope to receive money “on the back end” through philanthropy.

Having a technology transfer office at a university that encompasses the aforementioned purposes would be the best approach to incentivize innovation, attract innovative faculty, and build a local entrepreneurial ecosystem.

### ***Developing Entrepreneurship-Focused Programs within Alabama Universities***

At many of the major Alabama universities’ MBA programs, there is little focus on entrepreneurship relative to other more conventional areas of business such as finance and real estate. For example, at the University of Alabama’s Culverhouse College of Business, none of the specialized master’s programs are related to entrepreneurship specifically.<sup>36</sup>

This is much different from other competitive MBA programs where entrepreneurship is front and center. At MIT’s Sloan School of Management, for example, the Martin Trust Center for MIT Entrepreneurship offers the Entrepreneurship & Innovation (E&I) Track. This MBA track connects students with key faculty at MIT and provides a tailored curriculum that exposes students to strategies of bringing an idea to market.<sup>37</sup> MIT’s program also hires a new class of faculty called Entrepreneurs in Residence who are lecturers at the university, providing important insight into how they were able to succeed in building innovative





companies.<sup>38</sup> A recent study of Stanford’s entrepreneurship programs by Charles E. Eesley and Yong Suk Lee concludes that these programs decreased the probability of start-ups’ failure and increased firm revenue, specifically affecting the quality of entrepreneurship.<sup>39</sup>

The University of Alabama has The EDGE, which acts as an incubator and accelerator for new ideas, and the Alabama Entrepreneurship Institute (AEI), which aims to be a magnet program for the university.<sup>40</sup> We recommend extending The EDGE and AEI’s influence within the business school, using a model closely resembling MIT’s approach through the E&I MBA track.

This type of program would be incredibly attractive to aspiring innovators, as it would provide access to real-world successful entrepreneurs; these entrepreneurs could give invaluable insight in addition to the case studies and business fundamentals students are learning in the classroom. That said, this type of program could prove costly and inefficient if the necessary preconditions are not in place. More specifically, we recommend that the AIC focus on creating an environment in which entrepreneurs and innovators are attracted to Alabama and, once the surrounding geographic characteristics are satisfied, then focus on developing an MBA-focused program that complements the environment.

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## APPENDIX: ADDITIONAL RECOMMENDATIONS

Stanford GSB students in the Spring 2021 Policy Lab on Alabama Innovation developed a longer list of more specific ideas, not all of which could be assessed in detail given the scope of this report. These are as follows.

### Students

1. *Hold start-up competitions with cash prizes.* Almost every Alabama university with which we spoke has some variation of a start-up competition, and most have expanded them over the past five years. These start-up competitions must be paired with mentorship post-victory, as well as with feedback to all participants. Start-up competitions should be opened for entry across universities and not used to gatekeep—a Troy start-up may have a better fit with a start-up competition at Auburn, for example. The prominence of these events, across institutions, could attract national attention.
2. *Create a university-wide entrepreneurship minor.* This is another area where many Alabama universities have already succeeded, ensuring that an achievable university-wide minor exists in entrepreneurship and that the courses cover key topics such as fundraising, hiring, business plan creation, and so on.
3. *Create a business accelerator platform (DealBox) with resources for start-ups.* Invest in technology and service credits provided free to potential entrepreneurs. Examples include no code software, web server credit, business banking deals, remote team software, cloud software, HR and legal services, and so on.
4. *Provide broad access to entrepreneurship resources such as incubators.* Creating a culture of entrepreneurship means that acknowledging entrepreneurs operate atypically. Providing open access to entrepreneurship resources like incubators, maker spaces, and coworking labs is critical to allow entrepreneurship to thrive anytime.
5. *Give students hands-on experience through experiential classes.* Intellectual curiosity is vital for any entrepreneur to get out in the world and solve its most intractable problems. In need-finding classes such as Solving, students begin considering entrepreneurship through the lens of solving other problems, rather than form-fitting a solution to a problem. Similar classes that are successful include Stanford University classes such as Hacking for Defense, Design for Extreme Affordability, Lean LaunchPad, and Startup Garage.



## Technology Transfer

1. *Invest in technology transfer offices enough to build a customer service model.* Tech transfer offices must be easy to access for outside stakeholders and unbureaucratic. There are great examples in our interviews of tech transfer offices within the state, such as UAH's, moving quickly to meet a start-up's needs. Different tech transfer offices can have different operating structures, but other universities have found success in dividing processes into routine (e.g., pharmaceuticals) and nonroutine (e.g., physical sciences). Above all, investing enough to move with speed and even a customer service approach is vital to ensure that the pipeline is constantly moving.
2. *Conduct a commercialization review for each new piece of research.* Tech transfer offices can evaluate research as it is published from various parts of the university for commercialization. Depending on the scale of research at a university, this should be a formalized process with expertise developed in specific individuals among the tech transfer office staff.
3. *Provide public-facing commercialization templates.* Universities should have a public-facing commercialization template (term sheet) and sample processes documents. While acknowledging that these can be customizable by deal, providing a template of what to expect can help alleviate confusion and fear, especially from first-time entrepreneurs. These also serve to educate faculty on what to expect when starting on entrepreneurship.
4. *Adopt best practices with respect to technology transfer.* Having spoken with many players in venture capital, we have found that there is an optimal structure that can be adopted that best incentivizes innovation, attracts innovative faculty, and builds a local entrepreneurial ecosystem (see full list of terms above, in "Adopting Best Practices with Respect to Technology Transfer at Alabama Universities").

## General Entrepreneurship at Universities

1. *Tie funding to output.* Alabama should adopt a modified funding structure for its universities, similar to one just adopted by Missouri, but including a focus on entrepreneurship. Currently, universities are rewarded for inputs (number of students, hours of classroom time, etc.) rather than outputs (graduate employment rates, entrepreneurial output, etc.). Alabama should tie funding for its public universities to demonstrated excellence among faculty and students and to entrepreneurial output that facilitates economic growth in Alabama.
2. *Recruit entrepreneurs-in-residence.* Universities should establish funding for two-plus entrepreneurs-in-residence for multiyear appointments. These entrepreneurs-in-residence can provide valuable mentorship and expertise to first-time entrepreneurs (both students and faculty).

3. *Create new angel networks based on university ties.* Alabama is in desperate need of more capital for start-up funding. Building off intense loyalty to universities, each university should create an angel network within its alumni network. Plans are under way at the University of Alabama, but each university has an opportunity to better embed with its alumni and create capital flows back to its students through angel networks. These networks should provide alumni with training on how to invest properly in start-ups, a knowledge many investors lack.
4. *Invest in additional wet lab space.* Wet lab space is in particularly short supply, especially in medical-focused communities like Birmingham. Restrictions on the use of wet labs at universities for commercial activities are a large hindrance to private sector start-ups in the biohealth space. Two potential solutions are to open these wet labs on university property to more commercial activities or to subsidize more wet lab space in private institutions such as the Innovation Depot or other coworking spaces.
5. *Provide legal expertise at accessible rates.* The legal structure is one of the most important decisions a start-up can make. Providing monthly or quarterly drop-ins with lawyers trained in venture capital law and regulatory compliance is vital to ensure the sustainability of legal frameworks of new companies. This is also important to ensure that equity and other founder agreements are built properly at the onset, rather than trying to rework these agreements down the line of a company's life cycle.
6. *Build a culture of entrepreneurship (acceptance, failure, risk).* The language and environment that build a successful start-up culture are unique. Alabama universities need to create a better culture supporting entrepreneurship through celebration of failure, greater risk tolerance, and accepting entrepreneurship as a valued career choice. This can be done through marketing campaigns, art installations, awards, and general public relations.



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