

UNLV

University of Nevada, Las Vegas

The Path to Tier One

September 2014

Executive Summary

The University of Nevada, Las Vegas, experienced dramatic change over the last generation, including significant enrollment growth and entry into the second-highest tier of universities designated by the Carnegie Foundation as “Research University/High.” This year UNLV launches a concerted planning effort focused on its next goal: joining the top level of American higher education, which the university refers to as “Tier One” status and which involves becoming a Carnegie Research/Very High university. This working document examines the benefits of achieving that goal, the challenges that UNLV faces in accomplishing these changes, and concludes by posing a set of questions intended to guide discussions of this initiative across the university and throughout Nevada.

Tier One refers to the most prestigious group of universities in the country, where extensive, rigorous research and innovations can stimulate entrepreneurship, job creation, and economic vitality throughout the surrounding region. These higher education institutions attract and retain the best professors and students, as well as large amounts of competitive research grant funding from the federal government and other sources. They also create more value for the communities in which they reside. The Carnegie Foundation for the Advancement of Teaching produces a classification that categorizes every college and university in the country based on their missions, the students that they serve, the research that they conduct, and a wide variety of other measures. Under the leadership of President Carol C. Harter, UNLV entered the second highest tier of universities in the 2000 Carnegie classification through the strength of its research and the scope of academic programs. The *Path to Tier One* focuses on moving the university into the highest category in this classification: “Research University/Very High,” or “RU/VH,” indicating the most extensive level of research activity. The 108 universities in this RU/VH classification represent the highest level of American higher education—often referred to as Tier One universities.

Almost every large, economically robust metropolitan region in the United States is home to a Tier One university—with the exception of Las Vegas. When a host city and its local Tier One university collaborate effectively, they leverage the learning and discovery on the campus as a source of economic development. Inventions and discoveries made in university laboratories turn into new businesses—particularly in high technology fields—and these knowledge spillovers also stimulate growth in existing enterprises. Highly-productive universities also attract, train, and graduate skilled workers who tend to remain in the region after graduation. Students benefit from learning alongside other well-qualified degree candidates who challenge each other to meet the rigorous expectations of their faculty and themselves. Students also benefit from strong job placement and graduate school opportunities associated with Tier One universities and the valuable degrees they confer.

UNLV’s Tier One goal is ambitious. Comparisons between UNLV and aspirant institutions on the Research University/Very High list show both the extent of the challenge ahead and the feasibility of reaching the target level of research productivity in the coming years. To achieve the Tier One goal, UNLV must significantly increase the level of competitively funded research it conducts as well as the number of research doctorates it confers each year.

This working document concludes with a series of questions for consideration by everyone in the UNLV community and in communities throughout Nevada. How does the Tier One vision relate to the other important work underway at UNLV? What kinds of success metrics, goals and objectives, core strategies, and action plans will guide the Tier One initiative? What kind of organizational structure, people, and support structures will UNLV need? What will UNLV's report card include to enable the University to assess its progress toward implementing these changes? These questions will launch discussions on campus and around the state as UNLV charts the *Path to Tier One* in the coming year.

Why Does Las Vegas Need a Tier One University?

One of the hallmarks of a great community is a great university, and almost every dynamic city or region in America benefits from the vitality of one or more major research universities. Nevada, however, “is the only state of over 2 million people that is not home to a top-tier Carnegie-ranked research university,” where extensive research leads to discoveries and inventions that generate entrepreneurial activity and where highly esteemed programs attract and retain dynamic students. In fact, several less populous states (Delaware, Hawaii, Montana, and New Hampshire) are home to Tier One research universities and the economic dynamism that they promote.¹ According to a 2011 study by Brookings Mountain West and the non-profit research institute SRI International, Nevada enjoys many advantages that fuel its economic competitiveness, but these “assets are not likely to be sufficient to support the kind of growth and investment Nevadans desire given the increasingly determinative role of knowledge, technology, and workforce skill in today's global economy.”² The report concludes that “the state currently suffers from its lack of a top-tier Carnegie-ranked doctoral research university; its low overall levels of R&D activity; and its low per capita production of PhDs, scientific publications, and patents.”³

Why is this absence of a Tier One university a problem? A report commissioned by the State of Nevada “to inform the creation of a State Economic Development Plan” found that “most of Nevada's neighboring states (Arizona, California, Colorado, New Mexico, and Utah) all have at least one research university in the top-tier Carnegie ranking.”⁴ One consequence of the absence of a university at the highest level of research intensity is that “Nevada generally falls in the bottom ten of all states for the ability of its research universities to commercialize their research outputs.”⁵

Nevada, Clark County, and Las Vegas need to maximize their ability to attract and retain dynamic people as students, workers, and employers. Diversifying the economy and thus fully leveraging the region's strengths requires increased levels of entrepreneurial activity. A recent article published by the Las Vegas Chamber of Commerce on “why we need a tier 1 university, and how UNLV will get us there” argued that becoming a top-level research university would boost the regional economy by:

- Attracting new and emerging industries by providing research and educational support, as well as a valuable community partnership, to their employment and workforce needs.

- Producing a highly-qualified workforce, helping to attract new businesses to the area and providing them with employees that will fit their needs.
- Expanding the Las Vegas area's export economy.
- Bringing in large federal grants and private industry contracts.
- Creating patents and business startups.
- Drawing in highly competitive students from around the world.⁶

The economic impact of research-intensive universities is well documented and discussed in detail below.

Economic Benefits for Nevada, Clark County, and Las Vegas

Research universities play an integral role in dynamic, knowledge-based economies. Almost every metro area in the United States with high levels of technology-related business activity is also home to a Tier One research university.⁷ When highly-productive universities align with regional strengths, they can generate significant startup activities from their discoveries and inventions, as well as graduate highly-skilled people equipped to work in those enterprises. With a concerted effort that includes a broad range of constituencies—including state and local government, the business community, and the university—Tier One status at UNLV can stimulate economic growth throughout the region.

The research capacity of a Tier One university can stimulate entrepreneurship and business development in two critical ways. Most directly, the research products from the university may be commercialized into new businesses, and these businesses almost always locate in the same region as the university.⁸ In addition, as a study from the Massachusetts Institute of Technology has demonstrated, universities also help the local business community leverage discoveries made elsewhere by adapting knowledge to the local context and integrating “previously separate areas of technological activity” in the region. For example, a 2007 study found that the University of Rochester fostered increased entrepreneurial activity in the city by connecting existing companies and their technologies in new ways through a network of companies engaged with researchers at the university.⁹

One challenge that Las Vegas and the rest of Nevada now face is a low percentage of residents with college degrees, compared to the rest of the United States. Las Vegas has a lower percentage of the population with a Bachelor's degree than most other cities of similar size (or larger), and Nevada also suffers from “brain drain”—a net loss of students to higher education in other states (and those students are unlikely to return upon graduation).¹⁰ One recent study examining “smart cities,” or “metropolitan areas with a large share of the adult population with a college degree” found that these locales “are often centers of higher education” where students move to the region to attend a university and “stay in the city after completing their education.” The capacity of such cities to attract talent buoys their economic success and feeds on itself to produce growth because “the stock of human capital in a metropolitan area, measured as the share of the adult population with a college degree, is a strong predictor of future population growth.”¹¹ Even beyond increasing the number and skill level of workers, research-intensive universities foster activities in the local economy that raise the demand for more skilled labor.¹²

Much of the capital necessary to fund the research that generates these discoveries and attracts talented students comes from federal government agencies, such as the National Institutes of Health, the National Science Foundation, and the Department of Defense. The vast majority of these funds go to Tier One universities, and the benefits of this funding accrue to their surrounding communities. Federal research data from 1991 to 2009 shows that, while federal research expenditures grew by approximately 70% during that period, the top universities consistently dominate, controlling around 90% of the share of federal dollars. Increasing a university's level of federally sponsored research is central both to increasing its standing as a research university and to bringing the benefit of those funds to the region.¹³ Once the funding is at the university, the research activity has a tangible effect on the local economy. A 2014 study of the effects of universities on wages showed that research activity generates persistent spillovers to local firms and workers. For example, a 10% increase in university expenditures increases local labor income by 0.8%. Spillover effects are as much as 10% to 100% larger when universities are more intensively focused on research and when research universities are technologically closer to local firms.¹⁴

Large-scale research activities of this nature also provide lasting benefits to the local economy. A recent study examined the long-term effects of university-based research activity over the phases of the latest business cycle. Findings suggest that the presence of research universities has a positive effect on local economies that goes beyond cyclical economic changes. This effect correlates to the scale of academic research expenditures; more prominent research universities have a stronger impact on their regional economies.¹⁵ One particularly encouraging set of findings for Las Vegas and UNLV is that the economic benefits of research-intensive universities are greatest in small and medium-sized communities.¹⁶ Unlike Los Angeles or New York where the impact of a Tier One university may be smaller relative to overall economy, the size of Las Vegas is well suited to fully leveraging the benefits of a highly research-intensive university.

One of the most sought-after benefits of having a Tier One university in a community is the high-tech startup activity associated with such intuitions. Silicon Valley, with its close link to Stanford University, is the most high-profile example of this synergy, but other noteworthy hubs of startup activity may be found in the Southern California "Biotech Corridor" (from Thousand Oaks to San Diego, building on activities at UCLA, USC, Caltech, UC Irvine, and UC San Diego), the "128 Tech Corridor" in Massachusetts (building on Harvard, MIT, and Brandeis), and the "Research Triangle" in North Carolina (based on activities at Duke University, North Carolina State University, and UNC-Chapel Hill). As these and other similar regions show, proximity to one or more research-intensive universities is a strong factor influencing the performance of young companies, particularly high-tech firms.¹⁷ A 2013 study examining the conditions that stimulate "high-productivity industries," particularly in technology-related fields, found that "an exogenous change in a region's research capacity (through the development of a university) boost[s] both patents and labor productivity."¹⁸ A different 2013 study focused on startups emerging from research universities found that 89 of 100 companies profiled remained in business after more than five years, which compares very favorably to a national average in the U.S. where only half of new businesses remain in business five years after opening.¹⁹

Successful research-intensive universities tend to develop specific areas of expertise, and this strategy of excellence in niche areas is most beneficial when aligned with local industries and resources. A 2014 study confirmed previous research that knowledge spillovers from universities tend to focus on specific local industries and that the “longer-term effects that universities have on their local economies may grow over time as the composition of local industries evolves to take advantage of ... knowledge spillovers.”²⁰ Nevada has a wealth of resources and strengths on which to build these kinds of research-based connections between industry and a Tier One university. For example, Brookings Mountain West identified seven “recommended industries and target opportunities for Nevada” developed through “an objective and systematic analysis of the state’s assets and industries ... carried out to assess the growth potential of dozens of Nevada’s industrial sectors and sub-clusters in the light of several key strategic needs for the state.” The study also sought to identify sectors of the economy that would “mitigate the extreme economic volatility of its consumption-oriented economy by diversifying toward an increasingly export-oriented” economy. The same list of key industries appeared in *Moving Nevada Forward: A Plan for Excellence in Economic Development*, a 2012 report produced by the Nevada Board of Economic Development.²¹ More recently, the Nevada Governor’s Office of Economic Development adapted that list into a set of nine “key industries” of focus for the state:

- Aerospace and Defense;
- Agriculture;
- Information Technology;
- Energy;
- Health Care;
- Logistics and Operations;
- Manufacturing;
- Mining; and
- Tourism, Gaming, and Hospitality.²²

This list provides one example of the range of industries that might benefit from links to a local Tier One university. Such linkages are also a vital means by which the local economy can connect with technologies and markets found outside the region. A 2013 study examined the role of research in growing Nevada’s economy and found that a research university would foster a larger regional economy supporting a greater breadth of products and services. The authors argued that a research university “may be the critical difference in attracting and maintaining economic muscle to compete in global markets.”²³

What does the *Path to Tier One* Mean for Students?

Beyond the impact on the state and local economy, the changes inherent in the *Path to Tier One* Initiative must benefit students while they attend UNLV and throughout their careers. Without careful attention and planning, an increased focus on research and graduate education could come at the expense of the undergraduate student experience. A key facet of the *Path to Tier One* must be to increase the overall academic excellence of the University. UNLV is fully committed to promoting student learning and success at all levels, and a focus on undergraduate

teaching and pedagogical innovation is a vital complement to the research excellence inherent in Tier One status.

For undergraduate students to benefit from the research activities of their faculty, UNLV must engage in a sustained, purposeful effort to become a leader in undergraduate education. The principal hallmark of highly esteemed research universities is a faculty with leading thinkers in their fields. The engagement of faculty in research can infuse their teaching with the most current knowledge and connect these scholars and their students to the latest thinking at universities and in industry. To ensure that these benefits accrue to students, rigorous standards of instructional quality will promote positive student learning outcomes and serve to increase the university's overall academic reputation.

With added rigor, students expect more from themselves and their peers—and they benefit from greater opportunities upon graduation. For example, a 2014 study found that the options available to graduates are closely linked to the status of the degree-granting college or university. Students' access to competitive graduate schools and earnings throughout their careers are closely linked to the institutional prestige of their undergraduate alma mater. Increasing academic prestige bolsters the long term earning potential of graduates.²⁴

A similar connection between institutional prestige and career outcomes may be seen on the graduate level. As the research profile of the university increases, so too will the professional prospects for graduate students. A 2013 study of 551 Ph.D. graduates found that the strongest predictor of employment was school rankings and department-level rankings, even while controlling for individual accomplishments such as publications and teaching experience.²⁵

The campus environment also plays a role in the *Path to Tier One*, where improvements to the atmosphere on campus should work in concert with the rising academic reputation of the institution. Part of making UNLV a world-class institution must include ensuring that the campus is literally *built for success*, where the facilities and co-curricular offerings attract and retain students. This issue is partly about physical infrastructure and partly about the ethos of the institution—and, in both cases, the goal is to create and sustain attributes that bring people to the university and create a lasting bond.

Competitive, successful intercollegiate athletics can play a role in this as well, as seen in the combined academic and athletic success of many Tier One research universities, such as Stanford, UC Berkeley, UCLA, USC, Arizona State University, and many, many others. One important role that athletics can play is in student recruitment. One recent study measured the impact of intercollegiate athletics on the quality and quantity of applications. Referred to as the “Flutie effect,” the findings suggest that overall athletic success has a significant effect on future applications in terms of both quantity and quality. The study also found that athletic success positively impacts applications even among academically stronger students.²⁶ Another study found that winning among sports teams at Division I universities reduced acceptance rates by increasing the overall number of applications.²⁷ The same study found a correlation between athletic success and increases in donations, academic reputation, in-state enrollment, and incoming SAT scores.²⁸ As noted above, increasing the academic preparation of students and

their expectations of themselves, their peers, and the university serve to enhance the atmosphere of the university and the learning it promotes.

Is Tier One Status Attainable?

Yes, but UNLV must first decide how to measure its success. The Carnegie Foundation for the Advancement of Teaching produces a classification of all colleges and universities in the United States, and the highest category in the ranking is for “Research Universities (very high research activity),” abbreviated as “RU/VH.”²⁹ This top tier—or Tier One—group of universities includes 108 institutions with the most robust academic research activities, as measured by levels of research funding, the number of researchers on staff, and the number of research-oriented doctorates that the university confers. UNLV currently ranks in the High rather than Very High classification. RU/H institutions are respected research universities, but they generally secure a smaller portion of competitive research funding, produce fewer actionable discoveries and inventions, and therefore create a smaller economic impact. Entry into the most productive group of research universities is UNLV’s goal, and the RU/VH designation is a critical measure of the scope of the University’s research activities. The precise methodology for producing the Carnegie Classification changes over time (most recently in 2005), and that index does not measure the full breadth of a university’s impact on its students and the communities it serves, so it cannot be the only factor in the Tier One initiative. Achieving overall academic excellence—such as the academic reputation of degree programs, the academic preparation of students, the graduation rate, and job placement outcomes after graduation—are also critically important for UNLV.

The hallmarks of a Tier One research university include prestigious faculty, well-prepared students with the potential to be the next generation of societal leaders, esteemed academic programs whose graduates are sought after in their respective fields, and research and creative activities that yield important discoveries and inventions.³⁰ These attributes develop over time through purposeful recruitment and retention of students, faculty, and staff, along with strategic investments in infrastructure and robust engagement with employers, community organizations, and benefactors. UNLV prides itself on recruiting faculty from a diverse range of institutions focused on excellence in teaching and research; and the vast majority of the University’s faculty members attended RU/VH universities steeped in the culture of excellence that characterizes those institutions. Thus, UNLV’s faculty is well-positioned to foster the necessary changes within the university as it increases its research profile and overall academic excellence.

As part of the *Path to Tier One*, UNLV has identified several benchmark institutions to serve as points of comparison. Several of these are large public universities in neighboring or nearby states, including Arizona State University and the universities of Colorado, Oregon, and Utah. Although each of those institutions has been a Tier One, Carnegie RU/VH university for decades, two other universities are more recent entrants to that top-tier list. The University of Houston was classified in the second tier of research universities in 1994 but emerged into the top tier by the next ranking in 2000. Houston provides an intriguing institutional comparison because of that city’s central role in the oil industry, which is akin to the role of Las Vegas as a hub for hospitality and gaming. Both the University of Houston and UNLV host academic

strengths aligned with those local industries.³¹ The University of Central Florida appeared in the Carnegie classification's second tier in 2000 and 2005, but moved to Tier One status in 2010.³² Like Houston, Central Florida is a useful comparator not only based on its recent entry into RU/VH status but also given its location. Like Las Vegas, Orlando is one of the country's other main tourism destinations. Moreover, the University of Central Florida established a medical school in 2006, just a few years before it gained a place in the top level of the Carnegie classification. The ascent of both institutions in a relatively short time demonstrates the viability of achieving the Tier One goal. One aspect of the Tier One initiative will be to gain a full understanding of the means by which these institutions successfully increased their research capacity and to determine the extent to which similar efforts would be suitable at UNLV.

The research-related successes at the University of Houston were examined in a 2013 study on the role of "research clusters" in improving research productivity and securing federal grant funding. The authors studied activities at the University of Houston from 2006 to 2010, where major research expenditures grew 74%. The "cluster-based approaches" examined in the study "focus on developing points of excellence that raise the stature" of research universities and "increase the capabilities of the surrounding community."³³ Houston began by identifying "existing or emerging strengths" in the regional economy and then used "a mapping process... to look for areas of synergy and concentrations of research activities across the university."³⁴ This analysis identified six "clusters" on which the university focused its research activities. Less than five years later, the University of Houston appeared on the Carnegie RU/VH list for the first time, and the study attributes much of the increase in research funding to the cluster strategy. The study also notes that a similar strategy is in place at Arizona State University and several other research-intensive institutions.

Each Tier One university is different, and there is a limited extent to which an institution can copy its way to success. Rather, UNLV must look to its own strengths and the assets in place in Las Vegas, Clark County, and Nevada. The *Path to Tier One* will be charted on that basis and for the benefit of the communities UNLV serves.

UNLV's strengths provide opportunities on which the University can build. The William F. Harrah College of Hotel Administration is world-renowned and well aligned with the "Tourism, Gaming, and Hospitality" area of focus identified by the Governor's Office of Economic Development. UNLV seeks to be the intellectual capital of global gaming and hospitality research and education—an ambition that complements regional economic strengths. The new UNLV School of Medicine will align with the "Health Care" industry focus for economic development, and UNLV already enjoys a strong foundation, with its School of Allied Health Sciences, School of Community Health Sciences, School of Dental Medicine, and School of Nursing. "Energy" is another focus industry for Nevada, and the second place finish by UNLV Engineering students in the 2013 U.S. Department of Energy Solar Decathlon serves as an indicator of the University's strengths in renewable energy. Similarly, the innovative work of Skyworks Aerial Systems, whose CEO and COO are both UNLV students with close ties to the Mechanical Engineering faculty, demonstrates the University's strengths in the "Aerospace and Defense" sector. During the Presidency of Robert C. Maxson, UNLV began to make reference to "watering the green spots" to underscore the benefits of building on existing strengths. This is precisely the ethos that must underpin the *Path to Tier One*, where the university can identify

areas of alignment between intellectual strengths on campus and industry needs in the region and thereby focus its way to success.

One of the greatest assets available to UNLV as it embarks on the Tier One Initiative is the economic vitality of Nevada, Clark County, and Las Vegas in particular. Despite the great adversity associated with the recent economic downturn, the region is host to a dynamic set of industries. As discussed above, the nexus between these industries and research activities at UNLV will be of critical importance going forward. One such partnership links UNLV to the Las Vegas-based super-scale technology solutions company, Switch. Led by Founder, CEO, and Chief Inventor Rob Roy, Switch is the developer of the groundbreaking SUPERNAP data center and Internet ecosystems. SUPERNAP has been acknowledged as the world's leading and highest rated co-location data center. Switch will connect UNLV via a high-speed fiber optic network to Intel's new Cherry Creek supercomputer, housed at the SUPERNAP. Intel will dedicate 60% of the supercomputer's computational capacity to UNLV. Access to high-performance computing of this nature enhances the efficiency of research output in a range of key fields.³⁵ A 2010 study showed that access to high performance computing is positively and significantly associated with increases in federal research funding and increases in publications at Carnegie "High" and "Very High" research institutions.³⁶ Accessing computational capacity of this magnitude typically necessitates a significant financial investment on the part of a university. Switch will cover the connection costs over a ten-year contract. This donation will result in dramatic savings to UNLV. The combination of this savings, the high-speed connectivity, and the Cherry Creek supercomputer represent an important competitive advantage.

The relationship between UNLV and Switch is doubly important, given the identification of "Information Technology" as one of nine high potential growth areas for the state of Nevada by the Governor's Office of Economic Development.³⁷ Southern Nevada is home to numerous other organizations with similar potential as partners for UNLV. For example, the Governor's Office of Economic Development also highlighted the defense sector as area of focus, and the Nevada National Security Site hosts numerous nuclear security initiatives for the federal government. In both the private sector and the public sector, the region around UNLV affords many opportunities for mutually-beneficial research collaborations.

Another potential advantage stems from UNLV's plans to develop a medical school. Nevada is unable to meet the current health care needs of its citizens, and Las Vegas is the largest urban area in the United States without a public medical school. The UNLV School of Medicine will be an innovative center for teaching that is built on areas of current strength within UNLV and around Clark County; including neuroscience, cardiology, and cancer research. For example, the UNLV School of Medicine will develop early research programs that will coordinate with the Cleveland Clinic/Lou Ruvo Center for Brain Health, whose focus is to care for patients with Parkinson's, Alzheimer's and multiple sclerosis and provide high-level clinical trials research. Two existing areas of strength within UNLV—radio-pharmacology and computational science with large databases—will be leveraged as the UNLV School of Medicine develops.

Many of the top-performing research universities have medical schools, and highly competitive research-oriented medical schools make significant contributions to the success of

many Tier One universities. Not all research-intensive universities have medical schools, and the research contribution that medical schools make to their universities also varies widely.³⁸ However, high-performing medical schools can make a very significant contribution to the research activity at a university, and this addition to UNLV holds great promise for enhancing the university's academic profile.

One other hallmark UNLV enjoys is its status as a Minority Serving Institution (MSI) and an emerging Hispanic Serving Institution (HSI), based on significant enrollments of students from diverse backgrounds. This level of diversity is very rare for a RU/VH university, with only four Tier One universities meeting these standards (the University of Houston, the University of New Mexico, and two University of California campuses: Santa Cruz and Riverside). MSI status provides preferential access to many federal grants and exemption from matching costs associated with some federal programs, both of which are beneficial to UNLV in a very competitive environment for funding.

Tier One status would situate UNLV amongst the top 2.3 percent of higher education institutions in the United States (as a Research University/High institution, UNLV is currently ranked in the top 4.5 percent). There are currently 75 public universities in the Tier One, Carnegie Research University/Very High category. When UNLV shares the attributes of these highly productive research universities economic benefits will accrue for the state and local economies. Similarly, increased academic rigor and an improved graduation rate will attract and retain the best students—and when they become alumni the value of their UNLV degrees will grow. For graduate students, increased sponsored research will improve levels of stipend support and grow the pool of world-class doctoral candidates. UNLV's goals for itself and its contributions to the community hold great promise and also pose a significant set of challenges for the coming years.

The Challenge Ahead

The Tier One goal is highly ambitious. It is also achievable, but it is important for the UNLV community and people throughout Nevada to understand the scope of the challenge ahead. Many criteria could be used to assess the distance between UNLV's profile in 2014 and the attributes that would garner Tier One status. However, the Carnegie Foundation's classification is the key indicator, and the criteria used to produce that index provide a good initial indication of the work to be done.

As noted above, the Carnegie classification methodology uses three main types of data in producing its classification: the number of research doctorates awarded per year, the "level of research activity" at the institution, and the number of researchers on staff.³⁹ Looking at how UNLV compares to Tier One institutions in each of these categories is illustrative. There are 108 RU/VH institutions, ranging from extremely large universities with massive research capacity to relatively small, specialized institutions. UNLV's Tier One benchmark institutions vary in size: from Arizona State University, with over 68,000 students, to the University of Oregon, with just over 22,000 students. Their research expenditures also vary, although student population is not necessarily a major factor. For example, Table 1 (see below) shows that Arizona State (ASU) and the University of Colorado at Boulder have nearly identical research expenditures, but ASU

is more than twice the size of Boulder. Similarly, Utah has the highest total R&D expenditures, but its student population is even smaller than Colorado (and nearly identical in size to UNLV).

Table 1: Research Expenditures⁴⁰

University	STEM R&D Expenditures	Non-STEM R&D Expenditures	Total R&D Expenditures
University of Utah	\$425,558,000	\$4,498,000	\$430,056,000
University of Colorado at Boulder	\$373,512,000	\$18,492,000	\$392,004,000
Arizona State University	\$344,611,000	\$41,348,000	\$385,959,000
University of Central Florida	\$107,324,000	\$14,329,000	\$121,653,000
University of Houston	\$105,844,000	\$10,444,000	\$116,288,000
University of Oregon	\$87,656,000	\$17,374,000	\$105,030,000
University of Nevada-Las Vegas	\$33,130,000	\$1,413,000	\$34,543,000

The data in Table 1 are from 2012 and are the most up-to-date available for comparisons among all seven universities. UNLV’s *Path to Tier One* benchmark institutions may be seen as two sub-sets in terms of the scope of their research activities. Arizona State, Colorado, and Utah have the highest level of research activity, with expenditures 11-12 times those of UNLV; whereas Central Florida, Houston, and Oregon have a relatively lower level of research activity; roughly three times that of UNLV. Prior to the recession that began in 2008, research expenditures at UNLV totaled over \$53million, compared to \$78million at Oregon—which was a less daunting gap.⁴¹ While UNLV suffered a decline its research profile during the recession, Oregon and the other benchmark institutions increased their funding. Research activity is now on the rise at UNLV. The number of competitive grants awarded increased 20% between FY2013 and FY2014, and the total grant funding increased by 12%. However, securing an increasing share of grant funding poses a particularly daunting challenge, because overall research funding is relatively static and existing RU/VH institutions are particularly well positioned to secure and retain those monies.

Building additional research capacity will require a significant investment in time to become competitive for grants in new fields, but research expenditures can grow significantly over a period of years. For example, the University of Houston increased its research expenditures by 74% between 2006 and 2010 through the “research cluster” strategy discussed above.⁴² Although the task of dramatically increasing funded research at UNLV is formidable, it is not unobtainable.

Another key criterion is the number of research doctorates awarded, and the benchmark institutions also range widely in this area (see Table 2 below). Given its very large size, Arizona State University awards by far the most doctorates in this group (more than six times as many as UNLV). However, Oregon and the University of Central Florida confer only about twice as many doctorates as UNLV. As with research expenditures, a university can greatly increase its productivity in this area, but growth of this nature requires a significant amount of time to accomplish. Existing Ph.D. programs need to grow, often requiring an investment in additional faculty members, and new programs need to be created and enroll students—and students take

several years to earn their degrees. The number and scale of doctoral programs are closely linked to the grant activity analyzed above, and the two generally grow in tandem.

Table 2: Research Doctorates Awarded⁴³

Arizona State University	580
University of Utah	311
University of Colorado at Boulder	299
University of Houston	222
University of Central Florida	192
University of Oregon	173
University of Nevada-Las Vegas	91
<i>Median for all RU/VH universities⁴⁴</i>	344

The third main factor in the Carnegie classification is non-faculty research staff. These Ph.D.s play key roles on research teams, either as research faculty or as postdoctoral fellows, and their numbers serve as another indicator of the scope of research activity at a university. As Table 3 shows, some institutions host vastly larger numbers of non-faculty researchers. For example, Utah has nearly ten times the number at UNLV. On the other hand, Oregon employs roughly 75% more research staff than UNLV. As with the number of doctoral degrees conferred, the size of the non-faculty research staff closely corresponds with grant-funded research and grows accordingly. But, these researchers can be recruited in a shorter timeframe and with a smaller initial investment than tenure-track faculty.

Table 3: Non-Faculty Research Staff (including Postdoctoral Fellows)⁴⁵

University of Utah	412
University of Colorado at Boulder	370
University of Houston	298
Arizona State University	210
University of Central Florida	112
University of Oregon	77
University of Nevada-Las Vegas	45
<i>Median for all RU/VH universities</i>	336

Although the size of the full-time faculty is not a factor in the Carnegie classification, it is a useful point of comparison alongside the data included above (see table 4 below). Not all full-time faculty members are research-active or seek competitive grant funding for their work, but the number of full-time faculty is a useful indicator of the long-term intellectual resources at a university. As Table 4 shows, UNLV's full-time faculty numbers roughly half the median faculty size found at RU/VH institutions. The size of the full-time faculty at UNLV is 88% of the faculty at Oregon and 80% of the Houston faculty—and thus is a manageable difference in scale. The student/faculty ratios at UNLV and Oregon vary greatly, with far more faculty at Oregon relative to the size of the student body. However, the student/faculty ratio at Houston is nearly identical to UNLV's, and Central Florida has a higher ratio. Overall, the student/faculty ratio at UNLV is twice that of the median for all RU/VH universities, and that variance highlights one of the key challenges ahead for UNLV as it expands its research profile, pursues overall academic excellence, and deepens its focus on undergraduate education.

Table 4: Full-Time Faculty, Total Enrollment, and Student-Faculty Ratios⁴⁶

University	Full-Time Faculty	Enrollment	Students/Faculty
Arizona State University	2510	68,064	27.1
University of Utah	2280	29,284	12.8
University of Colorado at Boulder	1868	33,010	17.7
University of Central Florida	1282	53,401	41.7
University of Houston	1126	37,000	32.9
University of Oregon	1019	22,335	21.9
University of Nevada-Las Vegas	897	29,080	32.4
<i>Median for all RU/VH universities</i>	<i>1760</i>	<i>26,198</i>	<i>15.4</i>

The benchmark institutions each serve as important points of comparison for various criteria in the *Path to Tier One*, and as the initiative proceeds detailed analysis of UNLV’s position vis-à-vis these institutions will need to occur. But the data above show that the University of Oregon serves as a particularly useful comparator for use in understanding the scale of the challenge ahead for UNLV. Unlike the many very large institutions on the Tier One list, Oregon is smaller than UNLV (with roughly 22,000 students versus the roughly 29,000 at UNLV) and has a faculty similar in size. Despite its smaller size, Oregon produces more doctoral students and hosts more faculty and non-faculty researchers than UNLV—and it therefore has roughly 50% more research activity. Oregon shows that scale is not necessarily a driving factor in achieving Tier One, and that although the *Path to Tier One* will require significantly increased research activity, that designation is attainable for an institution the size of UNLV.

The Carnegie Foundation RU/VH criteria are important, but there are many other attributes that UNLV must also develop to reach the broader academic excellence inherent in the Tier One goal (and to secure that designation regardless of subsequent changes to the Carnegie methodology). The final section below presents a set of questions designed to raise many of the critical issues that UNLV must examine as it embarks on the *Path to Tier One* status.

Questions to Consider

As Nevada, the greater Las Vegas area, and the UNLV community consider the *Path to Tier One*, these questions provide a starting point. These and other similar questions will guide discussions among the many stakeholders involved with the university as details of the Tier One Initiative takes shape.

1. How do the goals of the Tier One Project intersect with other critical UNLV priorities, such as student success, access and affordability, community engagement, and regional economic development?
2. Given finite resources, UNLV will likely need to focus on developing capacity in some number of specific areas of research. If so, how should we select these areas? In what disciplines does UNLV currently produce the most publications? What attributes are needed at the university and in the community to build and sustain research excellence in key areas?

For each area, what number of tenured and tenure-track, research faculty, and graduate students would be necessary to create the necessary research activity? What hiring, promotion, tenure, and reward systems need to be in place to support such efforts?

3. What facilities, organizational structures, and human resources need to be in place to enhance the faculty's ability to seek outside funding for their research and creative activity? Similarly, at what level will UNLV need to support graduate students to attract top-level doctoral candidates? What role should undergraduate research activity play in the Tier One process?
4. What constitutes high-quality research at UNLV? What units within the University have the most high-profile research presence? How can UNLV best leverage these areas of strength?
5. What can UNLV do to ensure that it is a leader in undergraduate education? How are master teachers rewarded, and how can their success be harnessed to improve teaching throughout the University?
6. To what extent will research excellence necessitate interdisciplinary work? To the extent that UNLV's capacity for interdisciplinary research needs to be bolstered, what hiring, promotion, tenure, and reward systems need to be in place to support such efforts?
7. To achieve the broader Tier One Goals, UNLV will have to develop a stronger organizational structure that includes an appropriate leadership structure, faculty governance system, a correct deployment of the people (faculty, staff, and leadership personnel) in the right positions, and critical resource and support systems, among others. What strategies need to be developed to achieve an overall organizational structure to support the Tier One agenda?
8. How can the university maximize its ability to recruit and retain diverse students, faculty, and staff, and how does it maintain a campus that is open to a diversity of experience, beliefs, and viewpoints, expressed in a civil manner?
9. Various research metrics are essential to achieving Carnegie RU/VH status, including the number of research doctorates awarded and research productivity. What specific metrics should the university track in its pursuit of Tier One status, and what goals should UNLV seek to attain for each metric? How can UNLV develop sustainable ways of compiling and maintaining the necessary data on itself and on peer institutions?
10. What is the relationship between obtaining Tier One status and the development of the medical school, and how critical is the establishment of the medical school to achieving Tier One status?
11. Achieving Tier One Status, including a RU/VH classification, will require significant additional funds from public and other sources. What strategies should UNLV use to obtain these resources?

12. Achieving Tier One Status, including a RU/VH classification, depends on support from the local, regional, and state community. How can we become the university of choice in terms of providing solutions to problems facing the community?
13. What role will intercollegiate athletics play in the *Path to Tier One*? How can the University foster success on its fields and courts and leverage that visibility in service of academic excellence?
14. What are the foreseeable barriers to UNLV achieving (and maintaining) Tier One status?

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- ³ *Ibid.*, 107.
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- ⁵ *Ibid.*, 36.
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- ⁷ Ross C. DeVol, "America's high-tech economy: growth, development, and risks for metropolitan areas" (Milken Institute, Research Report, 1999).
- ⁸ *Sparking Economic Growth 2.0: Companies Created from Federally Funding University Research, Fueling American Innovation and Economic Growth* (The Science Coalition, 2013), 17; *Unify, regionalize, diversify*, 109.
- ⁹ Richard K. Lester, "Universities, innovation, and the competitiveness of local economies: An overview" *Innovation, universities, and the competitiveness of regions* 214, no. 2007 (2007): 155-188.
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- ¹¹ John V. Winters, "Why are smart cities growing? Who moves and who stays?" *Journal of Regional Science* 51, no. 2, (2011): 253-54.
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- ¹⁷ Note: This phenomenon is international in nature and may be seen in many countries. For example, one recent study examined this same connection in Germany. See: David B. Audretsch, Marcel Hülsbeck, and Erik E. Lehmann. "Regional competitiveness, university spillovers, and entrepreneurial activity." *Small Business Economics* 39, no. 3 (2012): 587-601.
- ¹⁸ Jonathan T. Rothwell, Jose Lobo, and Deborah Strumsky, "The Role of Invention in US Metropolitan Productivity," *Available at SSRN 2175310* (2013) 6.
- ¹⁹ *Sparking Economic Growth 2.0*, 6.
- ²⁰ Kantor and Whalley, "Knowledge spillovers from research universities," 171-188.
- ²¹ *Unify, regionalize, diversify*, 7, 28-61; and *Moving Nevada Forward: A Plan for Excellence in Economic Development* (Nevada Board of Economic Development, 2012) 32-33.
- ²² Nevada Governor's Office of Economic Development, <http://www.diversifynevada.com/key-industries>
- ²³ Alan Schlottmann, Marcus Conklin, and John Restrepo, *Leaving a Legacy of a Research University to Enhance Nevada's Future* (Unpublished report, 2013) 4.
- ²⁴ Joni Hersch, "Catching Up is Hard to Do: Undergraduate Prestige, Elite Graduate Programs, and the Earnings Premium." *Vanderbilt Law and Economics Research Paper* 14-23 (2014).
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³² See: <http://classifications.carnegiefoundation.org/resources/>

³³ Donald Birx, Elizabeth Anderson-Fletcher, and Elizabeth Whitney, "Growing an emerging research university." *Journal of Research Administration* 44, no. 1 (2013): 12.

³⁴ *Ibid.*, 19.

³⁵ Amy Apon, Linh Ngo, Michael Payne, and Paul Wilson, "Assessing the effect of high performance computing capabilities on academic research output," *Empirical Economics*, June 2014.

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³⁸ John Lombardi, Elizabeth Capaldi, Denise Mirka, and Craig Abbey, *Deconstructing university rankings: Medicine and engineering, and single campus research competitiveness, 2005*. (Gainesville, FL: The Lombardi Program on Measuring University Performance, 2005).

³⁹ To be specific, an institution must confer "at least 20 research doctorates" in a specific set of disciplines in the humanities, the social sciences, and STEM fields (Science, Technology, Engineering and Mathematics). Professional doctoral "degrees such as M.D., J.D., Pharm.D.," and others are excluding from this metric. Research expenditures are another key factor, as they give an indication of the overall research activity and vast majority of that funding comes from competitive grants. The classification tracks research expenditures in the sciences and Engineering in one category and in other fields in a separate category. The other main criterion is the size of the research staff in the sciences and in Engineering. These "postdoctoral appointees and other non-faculty research staff with doctorates" play a key role in the research enterprise, and most appointments of this nature are funded by competitive grants. As such, they also indicate the scope of the research activities on a campus.

⁴⁰ National Science Foundation, *Higher Education Research and Development Survey, Fiscal Year 2012: Higher education R&D expenditures, ranked by all R&D expenditures, by R&D field: FY 2012*. http://ncesdata.nsf.gov/herd/2012/html/HERD2012_DST_21.html

⁴¹ Carnegie Foundation for the Advancement of Teaching, *Carnegie Classifications Data File*, 2012. <http://classifications.carnegiefoundation.org/resources/>

⁴² Birx, Anderson-Fletcher, and Whitney, "Growing an emerging research university," 11-35.

⁴³ Carnegie Foundation for the Advancement of Teaching, *Carnegie Classifications Data File*, 2012.

<http://classifications.carnegiefoundation.org/resources/> Note: The data gathered by the Carnegie Foundation exclude research doctorates in clinical health fields (Audiology, Occupational Therapy, Physical Therapy, and Clinical Psychology).

⁴⁴ The median is a particularly useful metric in this regard because outliers amongst the 108 RU/VH institutions may distort the mean.

⁴⁵ Carnegie Foundation for the Advancement of Teaching, *Carnegie Classifications Data File*, 2012. <http://classifications.carnegiefoundation.org/resources/>

⁴⁶ Carnegie Foundation for the Advancement of Teaching, *Carnegie Classifications Data File*, 2012. <http://classifications.carnegiefoundation.org/resources/>