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A University's Role for Regional Innovation: Arizona Universities' Contribution to Regional Economic Growth

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Abstract : Over the last two decades, interest increased with regard to how some research universities made direct impacts on surrounding regional economic activities and growth. Although the role of basic research for most research universities has remained strong, pressure has intensified to broaden its missions to include helping local and regional economic development efforts. Consequently, many research universities have evolved their basic scientific research mission from the production of scientific knowledge to the sharing and exchange of knowledge with local industries by actively engaging in local economic development (Uyarra 2010). Previous examination has shown that most research universities contribute to local and regional economic development by various functions they provide. They are as follows: Creation of Knowledge, Human-capital creation, Transfer of existing know-how, Technological innovation, Capital investment, Regional leadership, Knowledge infrastructure production and Influence in regional milieu (Drucker and Goldstein 2007). This paper will review the existing literature on the role of universities and its impacts on local regional economic growth and development. In addition, this paper will show how two major research universities (The University of Arizona and Arizona State University) have contributed to the growth of Arizona during last two decades. It is believed that the existence of these two research universities have been instrumental in making industries more diverse and highly attractive, particularly in the Phoenix Metropolitan Area.

Keywords: Role of universities, Regional economic growth and development

1. INTRODUCTION

Over the last two decades, interest has increased with regard to how some research universities, particularly large public universities, make direct impacts to surrounding regional economic activities and growth. Although the role of basic research for most research universities has remained strong, pressure has intensified to broaden its missions to include helping local and regional economic development efforts. Still, the impact of the traditional mission of the large universi-

ties can be seen in the following areas: 1) increasing source of new useful knowledge; 2) training graduate students in the production of basic research; 3) creating new instrumentation and methodologies; 4) increasing the capacity for scientific and technological problem solving; 5) contributing to the creation of new firms with the acquired basic research skills. (Salter and Martin 2001) However, many research universities have evolved their basic scientific research missions from the production of scientific knowledge to the sharing and exchange of knowledge with local industries by actively engaging in local economic development. (Uyarra 2010)

In an attempt to further understand universities' roles and contributions to their local and regional economy, various studies have identified eight major activities. They are: 1) knowledge creation and its infrastructure; 2) human-capital creation; 3) transfer of technology and the existing know-how; 4) technological innovation; 5) capital investment and increased local demand; 6) regional leadership; 7) knowledge infrastructure

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production; 8) influence on regional environment. Although each item represents a clear university activity, they are not mutually exclusive contributions to the local economic development. These activities seen in the aggregate represent positive effects on the regional economy, ranging from direct and indirect

contributions to long-term economic gains in the region. (Drucker and Goldstein 2007; Duch et al. 2008; Pastor et al. 2012)

As shown in <Fig. 1>, universities affect the growth and development of local communities in various ways. First, universities provide Economic Base Industry through employee

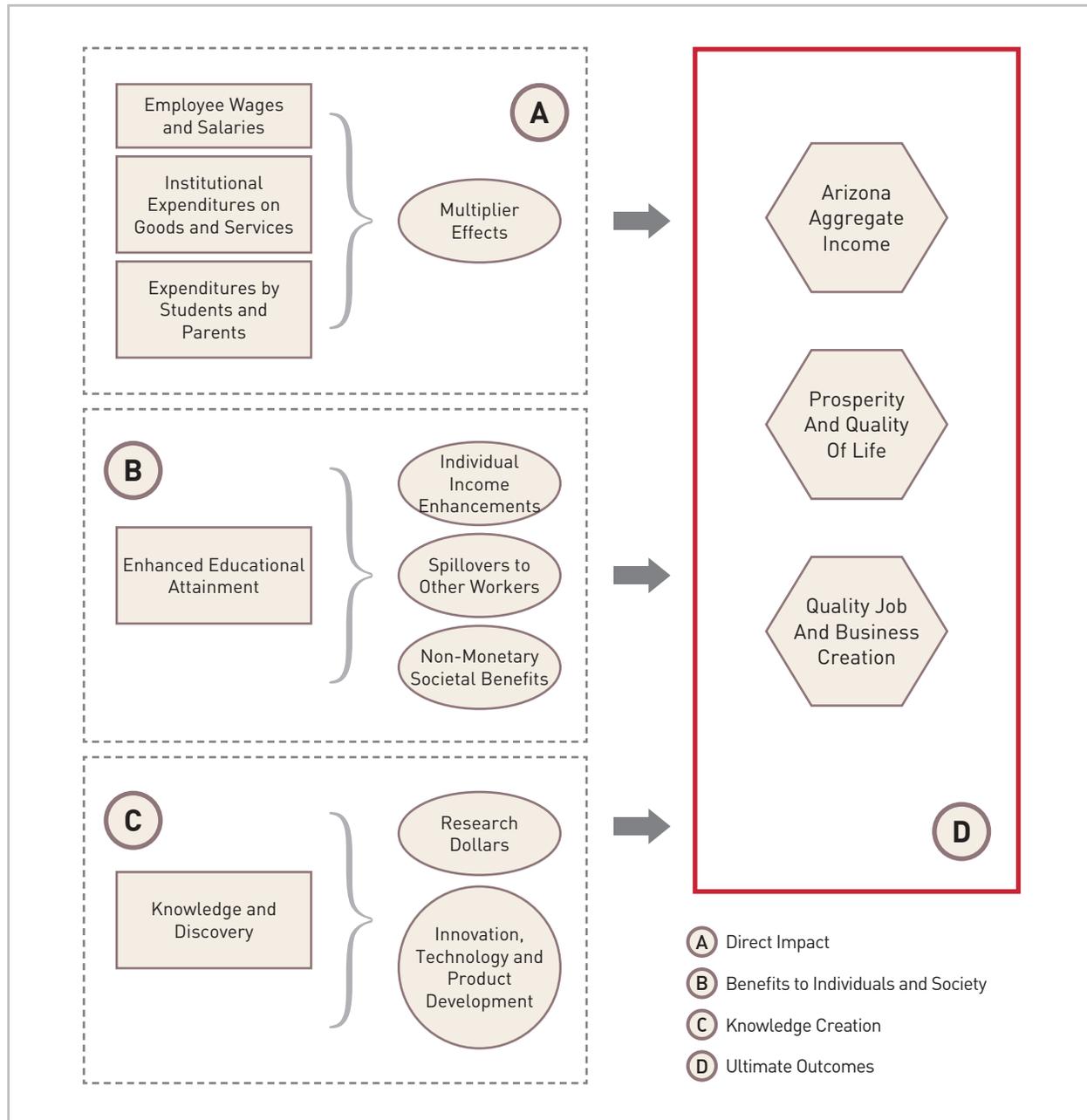


Fig. 1. The Relationship between Higher Education and Economic Well-being

Source: Hill and Hoffman (2009)

wages and spending by students, visitors, and employees (Box A). Second, universities as institutions of higher learning, enhance human capital development, thereby benefiting individuals and society. Higher individual earnings and an active civic engagement are strongly related to higher educational attainment (Box B). Research findings conducted by universities do create new knowledge that largely infuses innovation. Local communities may use this newly developing knowledge to compete in the knowledge economy (Box C). Through this process, local communities and regions would enjoy higher quality of life and enhance their economic development efforts (Box D). (Hill and Hoffman 2009)

According to some earlier studies, the availability of local academic knowledge transfers as well as the location of high-tech industries is strongly related to spatial concentration of economic activities and the health of various regional economies in America. (Varga 1997; DeVol 1999) The vitality of high-tech related industries can determine which metropolitan areas are succeeding or failing. Although the high-tech economy poses some risks for an income gap, a decline in job security and tenure, and much needed financial resources for retooling of displaced workers, many local government officials still promote high-tech industries, expecting the overall positive implications of the high-tech related business expansions. (Varga 1997; DeVol 1999)

Findings from a recent case study, Waterloo, Ontario, Canada, reinforce the importance of university in relationship to high-tech related regional growth. Most firms surveyed state that the presence of the University of Waterloo was the most important factor in their location decisions as well as the strength of regional economy. In fact, neither formal nor informal links to the university is critical in developing high-tech related economy. (Bramwell and Wolfe 2008). It is, therefore, important to recognize that the presence of research intensive universities in a given metropolitan region, has strong influences on the innovation behavior of young and small firms as well as on regional economic competitiveness. (Audretsch et al. 2012)

However, it is must noted that the presence of universities in many regions does not provide all sectors of high-tech related industrial growth and development. Electronics and In-

struments industries are often tied to university research activities and they are distance sensitive with metropolitan statistical areas. (Anselin et al. 2000)

More recent study suggests that in order to attract more young and talented individuals, local governments must develop an environment that is more culturally diverse and tolerant. Most young, talented people, who have high-tech based skills, often seek for an exciting environment that provides dynamic and fluid surroundings (Florida 2002 and 2006). Still, favorable local tax structures or incentives, compensation costs, land and office space costs, energy cost, and the existing business climate of local areas are all considered to be important for firms to locate.

In recent years, some studies look at how the high-tech related cities and regions are initiated and developed. The Route 128 corridor of Boston, Massachusetts is a result from engineering universities and strong research institutes working together to promote knowledge transfers and regional economic growth. The Research Triangle Park in North Carolina is developed with local government initiatives by promoting both high-tech and medical research related firms for innovation and start-ups. Land owned by local government is used for the location of firms. The Silicon Valley areas of Northern California houses a number of highly regarded educational and research institutions without a well-defined partnership with local government. The growth of high-tech related industries has intensified with strong corporation involvements. (Kang 2014)

The rapid changes in technological advancement, global business, and growing retail and service industries have reshaped the exchange of goods, capital, labor and information sharing. As a result, spatial integration has diminished the importance of political and regional barriers. It has also modified the traditional economic space relevant to firms, institutions and governments in many parts of the world. Within this context, a regional innovation system is created by a symbiotic relationship between universities as knowledge generating and businesses as knowledge using subsystems as shown in <Fig. 2>. It is believed that through this cycle of innovation system, global knowledge refills local knowledge pool, and at the same time, attracts global investors (Benneworth 2007).

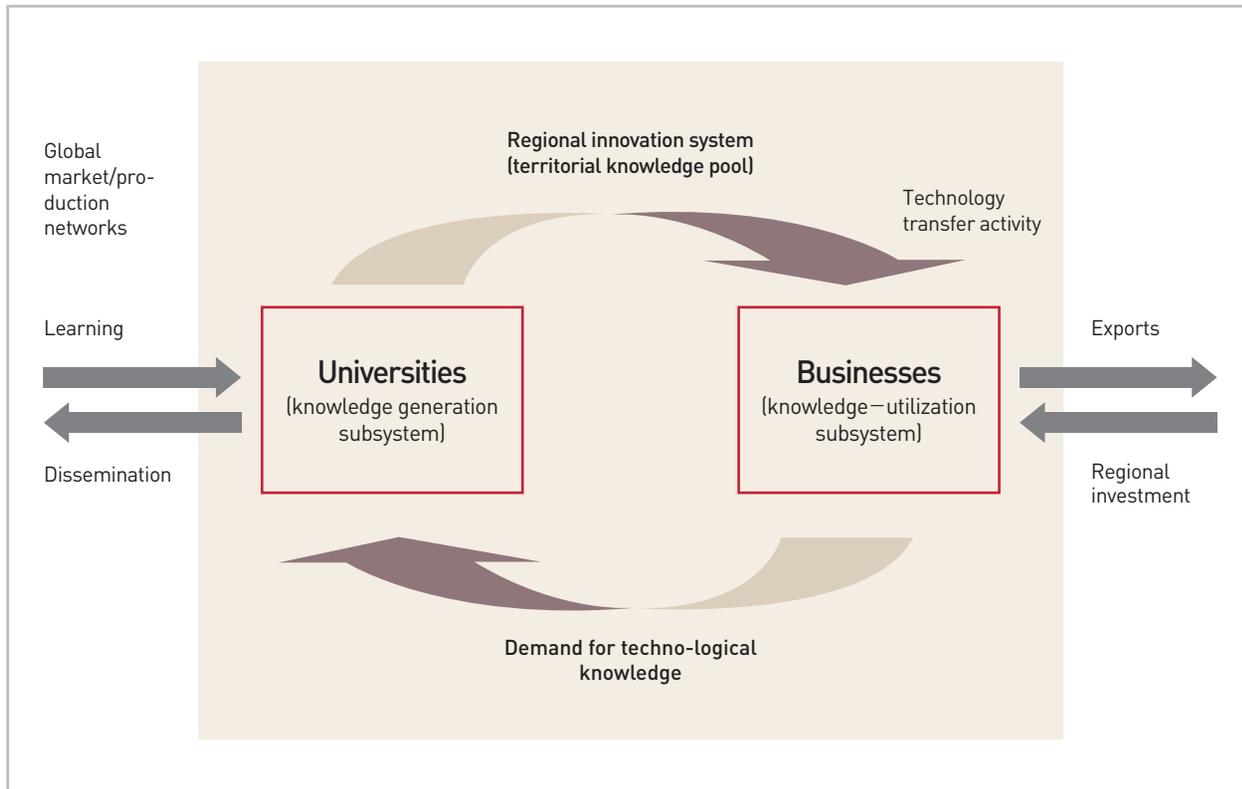


Fig. 2. The Regional Innovation System
 Source: Benneworth and Hospers (2007)

2. OVERVIEW OF PHOENIX AND THE STATE OF ARIZONA

The State of Arizona has three state universities serving more than six million people. Northern Arizona University has mainly a teaching mission and is located in the city of Flagstaff, Northern Arizona. The University of Arizona is a land grant university and has strong research and teaching missions. The university is located in the city of Tucson, Southern Arizona. The Phoenix Metropolitan area has a research and teaching mission university, Arizona State University, and includes a network of Maricopa community colleges where much needed training for high-tech companies have taken place. More and more, the University of Arizona, city of Phoenix and the surrounding communities have come together to provide special incentives, and created a closer working relationship with Arizona State University to develop

a better community growth for businesses and residents alike. (Charney et al. 2007)

The city of Phoenix, with the population of more than 1.5 million is now the fifth largest city in America. Total population of the Phoenix metropolitan area is about 4.0 million and is still one of the fastest growing places in the country. More than 517 square miles (1,338 square km) of land and a slightly more than 50% of the land in the city being currently developed, the city of Phoenix offers plenty of room for long-term growth. (US Census Bureau 2014)

The financial crisis in America did hit hard the state of Arizona including the Phoenix metro area. During the Great Recession, the concentration of high-tech activities in Arizona experienced its decline. As a result, the state of Arizona in 2005 exhibited weaker than previous presence of high-tech industries and was somewhat close to the national average. Still, total economic impact of high-tech activities on

the Arizona economy (both direct and indirect impacts) in 2005 was 10 percent of employment, 11 percent of value added, and 13 percent of earnings in Arizona, respectively. (Rex 2008)

Until 2005, however, the employment base for the Phoenix metro area showed tremendous growth, reaching more than 1.7 million. A steady influx of new workers and increasing supply of highly educated graduates from the state's two largest universities, the University of Arizona and Arizona State University, enriched the quality of labor. Before the Great Recession, the annual average growth for employment in the Phoenix area ranged from 70,000 to 84,000 annually. (Charney and Leones 1995; Rex 2008)

In recent years, the economic activities in the state of Arizona including the Phoenix metro area have shown a modest recovery. As the largest city in the Phoenix metro area, Phoenix is still targeted as an ideal place for business. Its growing business and economic activities have been vital not only to the surrounding Southwestern states and California, but also to the international markets of the Pacific Basin and Mexico. Newly locating businesses have mentioned various reasons for their

location decision; more than sufficient pool of the educated labor force, excellent transportation infrastructure, friendly business environment, easy freeway access and rail service destined to major ports and the quality of life indicators.

Based on County Business Patterns and Government Employment and Payroll studies (2000-2009) and as shown in Table 1, Arizona's share in knowledge-based industries employment was about 268,000, representing about 32.3% of all sectors in the state of Arizona. This 32.3% was about the same as the U.S. average of 32.5%, indicating the recovery of Arizona's contribution to the knowledge-based economy. (Hogan 2011)

Various manufacturing companies like Intel, Honeywell and Allied Signal still have strong presence in the Phoenix metro area, while other transportation, service and financial companies like Southwest Airlines, US Airways, American Express, Charles Schwab, and Avenet are also present. The blend of high-tech, manufacturing, agriculture, trade and service industries located in the Phoenix metro area makes it a healthy and diversified economic base.

In 2005, the state of Arizona had about 115,000 high-tech jobs, while Maricopa County (Phoenix area) and Pima County

Table 1. Knowledge Economy Employment by industry, Arizona and United States

	Arizona, 2009	Share of Total, 2009		Change in Share, 2000 to 2009		
		Arizona	United States	Arizona	United States	
TOTAL OF ALL SECTORS	2,480,784					
TOTAL KNOWLEDGE-BASED	831,494	100.0%	100.0%			
High-Technology Manufacturing*	51,364	6.2	3.5	- 0.5	- 1.6	
High-Technology Services**	68,372	8.2	9.4	0.4	0.8	
Knowledge Creation***	268,456	32.3	32.5	4.1	1.5	
Information Technology***	23,174	2.8	3.3	- 0.3	- 1.4	
Professional Services	96,753	11.6	14.5	- 3.7	- 0.5	
Other Knowledge-Based***	Financial Services	131,840	15.9	13.6	0.0	- 0.5
	Health Care	191,535	23.0	23.2	4.5	1.9

<Notes>

* Six manufacturing industry groups included in the BLS definition of level I high-technology industries

** Ten services industry groups included in the BLS definition of level I high-technology industries

*** Industry groups included in the DMWD definition, excluding any overlap with the BLS high-technology groups

Source: U.S. Department of Commerce, Census Bureau: County Business Patterns and Government Employment and Payroll (2000 and 2009). Citation at second hand from Hogan (2011), p.20.

(Tucson area) showed total high-tech employment of 84,800, and 25,200 jobs, respectively. These two major metropolitan counties are represented by more than 95 percent of the total high-tech jobs, indicating the importance of university activities in research and human capital development. As shown in <Table 2>, manufacturing of aerospace products and manufacturing of semiconductor and other electronic components have a strong presence in the Phoenix metro area. (Rex 2008) According to a recent study of national cities, the Phoenix metro area ranked 29th for the overall high-tech industry presence, 17th for the types of companies, 15th for the high-tech employment, and 63rd for adults

with master's and/or doctoral degrees, respectively. (Phoenix Business Journal, March 31, 2009)

Just for science and engineering employment among the largest 25 metropolitan areas, the Phoenix metro area ranks 13th for engineering jobs and 24th for scientists, respectively. Lack of scientist activities in the Phoenix metro area is because the University of Arizona has a major medical school located in Tucson, Arizona. (Charney et al. 2007)

In 2007, the University of Arizona College of Medicine-Phoenix opened its four-year medical school program (Phoenix Biomedical Campus). This medical campus became a reality due to strong statewide collaboration of the Arizona Board of

Table 2. High Technology Employment by Category and Selected Countries in 2005

	AZ	Mar	Pima	Others
Manufacturing				
Pharmaceutical and Medicine	1,613	884	688	41
Computer and Equipment	743	647	88	8
Communications Equipment	1,294	1,191	32	72
Audio and Video Equipment	348	249	99	0
Semiconductor and Other Electronic	17,129	15,759	1,102	269
Navigational & Control Instrument	9,286	6,825	2,128	333
Aerospace Product and Parts	21,949	10,161	11,560	228
Semiconductor Machinery	1,177	1,148	29	0
Optical Instrument and Lens	165	6	137	23
Photographic & Photocopying Equip	85	74	9	3
Manufacturing Subtotal	53,789	36,943	15,871	977
Services				
Software Publishers	5,384	3,698	1,643	28
Other Telecommunications	218	182	2	34
Data Processing and Related	8,314	7,527	685	99
Architectural and Engineering	24,896	19,225	3,292	2,367
Computer System Design	18,454	14,530	2,209	1,467
Scientific Research & Development	4,582	2,719	1,574	288
Services Subtotal	61,848	47,881	9,405	4,283
High-Technology Total	115,637	84,825	25,276	5,260

Source: Thomas (2008)

Regents, the three state universities, the City of Phoenix, the Translational Genomics Research Institute and Phoenix-area teaching hospitals. Research activities from the medical campus are expected to increase employment opportunities for scientists in the Phoenix metro area. (University of Arizona College of Medicine 2014)

Arizona State University Research Park started in 1984 and has grown over the last thirty years. At present, the Research Park on its 320-acre site has 48 companies with more than 4,500 employees. The Research Park allows Arizona State University to provide practical information on cutting-edge knowledge based on applied research and development to private industries. The latest addition to the Research Park is GoDaddy Global Technology Center. The center will provide about 1,300 employees. (ASU Research Park 2014)

3. CONCLUSIONS

Over the last two decades, the role of universities has changed. Although their basic scientific research undertaking has remained strong, many universities are engaged in local economic development by sharing and exchange of cutting-edge knowledge with local industries.

As discussed earlier in the paper, universities contribute to local economy by generating wages and spending by students, visitors, and employees. Universities as institutions of higher learning contribute to the development of human capital. Regions with strong human capital development capacity enjoy diverse economic activities as well as high quality of life. Therefore, it is imperative that the state of Arizona develop policies to improve its human capital development by supporting two major universities in the state.

Studies have also shown that local political and economic environment along with the availability of well-educated labor force is another critical factor in making the location decision for local high-tech firms, particularly for small and medium sized manufacturing companies.

However, the presence of universities in many regions does not provide all sectors of high-tech related industrial growth and development. The state of Arizona and the Phoenix metro area have a narrow base of high-tech activities. Manufacturing of aerospace products and manufacturing of semiconductor and other electronic components have a strong presence at present time. (Hogan 2011)

A close and creative working relationship among Arizona's universities (especially the University of Arizona and Arizona State University), government policy makers, business and civic leaders is a critical component, if the state of Arizona wishes to remain relevant in the world's knowledge-based economy.

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