Towards an Abstract Model for Academia and Information Technology Sector Collaborative Partnerships: Responding to the "West Texas Coalition for Innovation and Commercialization" Initiative

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Abstract

This paper is written within the context of the West Texas Coalition for Innovation and Commercialization initiative, which was spawned out of Texas Governor Rick Perry's 2004 vision of building the future economy of Texas. That vision builds a competitive advantage for Texas through six target industry clusters: advanced technology and manufacturing, aerospace and defense, biotechnology and life sciences, energy, information and computer technology, and petroleum refining and chemical products. The West Texas Coalition for Innovation and Commercialization initiative was launched when economic development directors from Abilene, Amarillo, Lubbock, Midland, Odessa, and San Angelo convened to fulfill the Governor's vision. This initiative is realized through the Texas Emerging Technology Fund which provides a facility to assist start-up companies and to commercialize research and development results. This paper is based upon practitioners' research and explores how collaborative partnerships between academia and industry in West Texas can benefit one another, and enhance the exploitation of new knowledge and technologies for commercial applications. The dynamics of an industry-academic link ensures that industry leaders and practitioners' research will be strategically aligned. The result will lead to innovative technology, commercial spin-offs, employment provisioning, and support of further research. A by-product of this paper is a possible proposal to conduct a study in San Angelo. This intended proposal may be submitted to the San Angelo Small Business Development Corporation for consideration of future funding. Pursuant to the outcome of the possible study in San Angelo, the template of the proposal will be introduced throughout West Texas.

1

1. INTRODUCTION

In September 2005, economic development directors of the west Texas cities of Abilene, Amarillo, Lubbock, Midland, Odessa, and San Angelo convened together with guidance of Texas Governor Rick Perry's office, and posited the West Texas Coalition for Innovation and Commercialization (WTCIC) to promote innovation and entrepreneurship in West Texas (http://www.wtcic.org). These cities are linked to the WTCIC through their Small Business Development Centers (SBDC). The WTCIC was spawned out of Texas Governor Rick Perry's October 2004 vision of building the future economy of the state of Texas (http://www.wtcic.org/etindustries/index.html). That vision focuses on building a competitive advantage for Texas through six target industry clusters: advanced technology and manufacturing, aerospace and defense, biotechnology and life sciences, energy, information and computer technology, and petroleum refining and chemical products. The WTCIC is now one of seven regional centers of innovation and commercialization across Texas. The vision is being realized through the Texas Emerging Technology Fund (TETF) which provides Texas with a competitive advantage by assisting start-up companies get off the ground, and expediting research and development (R&D). (http://members.texasone.us/site/PageServer?pagename=tetf_homepage).

The TETF is augmented with federal and outside investments to match funds earmarked for new emerging technologies in Texas. This program focuses on three main areas of investment: (i) promoting research collaboration between public and private sector institutions by providing incubation and expansion for new and existing businesses, respectively; (ii) assisting innovators to acquire capital they urgently need to bring an idea to life. This new surge of capital enhances the access to pre-venture capital by matching research grants from federal and private sponsors; and (iii) attracting nationally known knowledge workers from research institutions to ensure that Texas universities are on the cutting edge of technological R&D. To better understand these three investment clusters and their relationship to any one of the six targeted industries for economic development in Texas, it is important to understand the relationship between industry and academia. This is especially true if other "business angel" institutions have an affinity to such partnerships. Further, it is important to determine how entrepreneurship can foster relationships with research and training institutions.

This paper is written as a response to the WTCIC initiative. It presents an academic process, based upon practitioners' research, which will explore how collaborative partnerships between academia and industry in West Texas would benefit one another in the WTCIC cluster of information and computer technology (I&CT). This academic process will exploit and evolve additional knowledge by advancing information technology (IT) in the West Texas region. (The terms or acronyms I&CT and IT are used interchangeably in this paper.) The dynamics of this industry-academic link will ensure that industry leaders and practitioners' research will be strategically aligned. (The link builds on the spirit of innovation and provides the opportunity for strategic alignment that focuses on entrepreneurial growth through economic development activities.) The effect will lead to innovative technology, commercial spin-offs, employment provisioning, and the support of further scientific research. Further, this research will revitalize and encourage local economic development in IT within the small urban areas in West Texas. A by-product of this paper is a proposal that is intended to conduct a pilot study beginning in the city of San Angelo. This proposal will be submitted to the San Angelo SBDC for consideration of future funding. Pursuant to the outcome of the pilot study in San Angelo, the template of the proposal may be introduced throughout West Texas.

This paper is organized as follows. In Section 2, we present the researchers' perspective of the breadth, or *definition*, of the new "techno-economic" archetype of IT, which is commonly known as *Information and Com-*

2

munication Technology (ICT) in many parts of the European and African continents, and is commonly referred to as *Infocomm* in Asia. We defend the notion of the WTCIC initiative and identify the subsectors that constitute the target industry cluster of IT. In Section 3 we present a revision of our earlier work on an abstract model of collaborative partnerships (Mhlanga et al., 2007 and Mhlanga and Vardiman, 2009). The revised model presented in this paper was developed using a methodology process that focused in three key areas of practical experience, research findings, and a vision of IT strategic alignment that supports economic growth. We encapsulate developments in the dynamics of industry-academic links from an international perspective. We then join together and present our perspective towards an abstract model of collaborative partnerships between academic disciplines and local industry and business. Finally, Section 4 concludes with an outlook and direction for future work. By recognition of the ideas presented in this paper, we will continue to work on harnessing the abstract model. The defined abstract model will lay the foundation for a proposal to conduct a pilot study, to determine the status of the IT sector, beginning in the city of San Angelo. Pursuant to the outcome of the pilot study in San Angelo, the template of the proposal may be introduced throughout West Texas.

2. IT INDUSTRY IN PERSPECTIVE

Having experienced severe declines in the wake of the dotcom collapse, the IT sector has witnessed a turnaround in recent years, with many communities again looking towards it as a potential source of economic growth (Rees, 2007). The IT industry has become so broad that it is becoming impossible to draw a line between computer science, electronic engineering, telecommunications engineering, and to some extent physics. Advances in these areas are contributing to the fast expansion and proliferation of IT. It is a service technology, which would not make much sense if it were not applied to virtually every aspect of life.

The Office of Workforce Information and Performance in the Maryland Department of Labor, Licensing and Regulation (2006) offers a very good treatment of the definition of the IT industry cluster. The regulation states that the IT industry is comprised of computer and electronic products manufacturing, IT wholesale distribution, IT services, computer systems services, and IT equipment repair and maintenance. In observance of the WTCIC initiative and not to stray away from the context, our definition of the IT industry cluster comprises all the aforementioned IT industries except two. First, key businesses will use IT to operate more efficiently and productively; secondly, institutions that are involved in IT training. Hence the following identifies and defines the IT industry cluster:

- Computer and electronic products manufacturing – IT industry that that manufactures or assembles IT equipment. The equipment includes computers, wired and wireless communication devices, transmission equipment, audio and video entertainment products, magnetic and optical equipment, and software reproduction. R&D is included in this industry.

- IT wholesale distribution – IT industry that is a wholesaler who is engaged in the distribution of computers and related goods. This includes electronic parts and equipment such as communications, broadcasting, and radar equipment, and data storage devices. Electronic commerce markets which use the Internet or other electronic means that brings together buyers and sellers (for a commission or fee). The exchange of IT goods is included in this industry.

- IT services - IT industry that develops and/or publishes software and provides support services to users; businesses that publish and/or broadcast on the Internet (including sites for news, sports, radio, books, videos, and games); providers of Internet access and Web operation (which may include Web hosting, Web page design, e-mail service, and related assistance); providers of specialized hosting activities(including Web, streaming services, or application hosting); application service provisioning, and data processing; and other information services, such as news syndicates, libraries, and archives.

3

- Computer systems services – IT industry that provides computer systems expertise to clients on a contract or fee basis. Customized services may involve writing, testing, and supporting software to meet a client's needs; designing computer systems that integrate hardware, software, and communication technologies, often including installation, training, and support as part of the service; providing on-site management and operation of clients' computer systems and/or data processing facilities, or supplying support services for such facilities; and other computer related services such as software installation and computer disaster recovery.

- IT equipment repair and maintenance – IT industry that repairs and maintain IT office equipment. Computers, printers, data storage devices, and photocopying machines are among the devices maintained.

- IT use – IT industry of select businesses that utilize IT to operate efficiently and productively. (Note: Indeed, virtually every kind of business today utilizes IT for competitive advantage. However, we will highlight only a few key business areas, which include the automotive industry, construction, architecture, agriculture, the media, energy, financial services, health care, hospitality, retail, transportation, and geospatial technology.

- IT training – IT industry that offers IT education and training. (Note: includes educational institutions who are accredited and degree [associate, bachelor's, master's, and PhD], industry certification, and post-secondary vocational training institutions)

3. DYNAMICS OF ACADEMIC-INDUSTRY LINKS

A Global Perspective of the Dynamics of Academic-Industry Partnerships

Partnerships between academia and industry, and their relevance to economic development, have attracted a global attention in recent years. Indeed, academia and indus-try complement each other in having knowledge and skills of great value to economic development. While academia is looking at industry as an avenue for growth and enhancement of the educational services it provides, industry is also looking to universities to help in educating its workforce and solve business challenges. For academia, collaboration with industry is one of the major avenues through which scientific innovations can be transformed into goods and services that benefit society. As Siegel (2006) points out, the partnerships are also particularly relevant in marketplaces such as IT, where new technologies quickly become old technologies and new knowledge quickly becomes old knowledge, and where the best professionals are those who continually update their skills. Establishments such as Microsoft IT Academy and the Oracle Academy Initiative in higher education institutions develops platforms for academia to offer programs that give students hands-on experience with industry products and that lead to certification in these products (Narayan, 2009).

In his presentation at the Center for Research on Information Technology and Organizations, Rieger (2008) presented four primary academic-driven partnership models for academic-industry partnerships, employed mainly in the US over the last 10 years. The four models focus on (i) academic-based case study or survey research approaches oriented toward strategic issues within industry, and the dissemination of results to as broad a base as possible, in order to attract sponsoring companies or grants, (ii) direct placement of students into industry positions utilizing a combination of industry-specific education, and internships with sponsoring companies, (iii) programs, events, and partnerships oriented toward showcasing the specific expertise of the researcher or research center, with the intent of attracting sponsoring companies, and (iv) maximum membership of industry companies at varying levels of sponsorship fees in order to fund research activities of the professor or research center.

The local economic development environment generally influences the types of academic-industry partnerships. Case studies conducted by the Local Innovation Systems

4

Project at MIT (Lester and Piore, 2004) examined different innovation strategies, of new product and service development (cell phones, medical devices, and blue jeans), that were employed by some of the US economy's most dynamic sectors. This project noted that different patterns of partnerships could be instantiated and be more appropriate for different local economic development needs. The four patterns of partnerships, also denoted pathways, that could be instantiated, were encapsulated by Hughes (2006) to have the following areas of emphasis: (i) entrepreneurial development, at both the university and the local community level, through leading-edge scientific and engineering R&D, (ii) aligning university curricula to meet the human and technical resource needs of locally declining industries and businesses, (iii) bridging emerging technological niches and skills gaps that result from diversification of local industry strategies, and (iv) employing best practices to upgrade existing local industries.

The *science park phenomenon* is a collection of businesses and academic organizations that typically focus on product advancement and innovation. (Some of the synonyms for "Science Park" include *Research Park*, *Technology Park*, *science and technology (S&T) park* and *technopolis*.) Science parks are generally associated with and operated by higher education institutions in collaboration with private companies and in many cases government as well. They provide a support structure for entrepreneurship and a facility where new businesses can be "spun out" from a university or company. They provide a facility for sustainable development through technological generation (or unpacking), adaptation, and transfer. They have been in existence since the early 1950's and continue to evolve to respond to R&D trends. The report (Battelle Memorial Institute, 2007) prepared by Battelle Memorial Institute (BMI) gives an accounting of how North American science parks progress by providing facilities that respond to current R&D trends. The BMI success is attributable to: (i) seeking out strategic partnerships with companies, universities, and federal laboratories rather than depending on internal R&D to generate innovative ideas; (ii) seeking out an industry interested in advanced research who are in proximity of a particular research institute especially an institution that is interdisciplinary and with multiple locations, often across multiple institutions, and an industry who seeks proximity to the research institute; and (iii) recognizing that a state or region can compete for technological growth like a science park. And, realize that an attractive physical environment will stimulate both industry and university interaction.

Science parks are generally widespread around the world with dominance in developed countries. For example, the Association of University Research Parks (AURP) promotes the development and operations of research parks that foster innovation, commercialization and economic competitiveness through collaboration among universities, industry and governments in North America (http://www.aurp.net/more/mission.cfm).
One United Kingdom (UK) counterpart of AURP is the UK Science Parks Association (UKSPA), which has continued to create an environment that supports both the creation and growth of technology-based businesses for two decades (http://www.ukspa.org.uk).
In Portugal, Taguspark is Lisboa's S&T Park which, in partnership with some leading universities, is comprised of several R&D laboratories and business incubators in various areas of technology including IT (http://en.wikipedia.org/wiki/Taguspark).
In Asia, The Kanagawa Science Park (KPS) was the first science park established in Japan in 1989 through a cooperative effort between the national government and private sector companies which promote R&D. The KPS provides sophisticated test measurement services, and facilitate the distribution and utilization of patented technologies (www.ksp.or.jp/english/index.html).
Developed countries have continued to show an interest in science parks and how they may benefit from the science park model (Quintas et al., 1992). Each of these consortiums continues to compare notes on different science park models that exist in the world today (Vedovello, 2000).

Developing countries are strategically linking their technological research to both commerce and industry. The result, they have discovered, is that technology leads to commercial spin-offs. But, they have also

5

found out that forging academia-industry partnerships requires careful consideration. They have discovered that an appropriate partnership model that considers the diverse local environment is the most successful (Sirat, 2007). For example, the BUILD (Boosting University-Industry Links for Development) project in Palestine is highly successful because it supports a best practice policy for managing academic-industry partnerships. BUILD equips Palestinian universities with the knowledge and skills to (i) understand the importance of academic-industry links, and (ii) promotes academic-industry partnerships within the local community (http://www.ua.es/en/internacional/internacionalizacion/build/pdf/report_build_seminar.pdf). One of Thailand's higher education funding reforms is to cut public spending in order to stimulate academic-industry links (Schiller, 2007). Kruss (2005) South African research revealed that several dynamics between academia and industry exist especially in high-technology areas like IT, biotechnology, and new materials development. This, she found, is characterized by the obstacles of fragmentation, inequalities, and unevenness. Zimbabwe seeks to align education to the economy by exploring partnerships between industry and academia, with desire to harness the country's wealth, create jobs, and support further university research (Mhlanga, 2001).

Abstract Model of Collaborative Partnerships

Our previous research (Mhlanga et al., 2007 and Mhlanga and Vardiman, 2009) focused on a synergistic platform for utilizing the support and resources of several key players to create an environment for economic development. This research considered the academic support coming from the IT, Entrepreneurship and Economics areas of the institutional course preparation and the industry support coming from the IT businesses, local funding and community involvement.

Key to our research is the development and utilization of skilled talent as prepared by academia and utilized by the local IT industry. This paper expands on our initial research and provides the opportunity to focus

directly on the role of academia and industry in providing a positive upward trend in economic growth and the utilization of the knowledge gained by our local available labor market.

The inference between academia and the IT industry is clear. For academia, technology development amounts to conceptualization and execution coupled with validation at the laboratory level. For the IT industry, the interest lies in translating the laboratory concept into a commercial outcome.

The question becomes, how do we provide mechanisms to foster interaction between academia and the IT industry that will promote economic development? We must move beyond the traditional thoughts of partnerships that are built on collaborative design teams that look at the laboratory concept to a true partnership of establishing and sustaining a synergistic approach built on the skills, talents, opportunities, and experiences of both the current IT industry and available local academia resources.

The WTCIC initiative moves us towards a more synergistic approach by focusing on economic developmental efforts within a shared partnership from the key stakeholders with the highest potential for growth and reward. Hence, in order for there to be a long-term IT growth strategy, a collaborative effort from both the IT industry and local academia is imperative. This collaborative effort will foster and promote foundation synergies and innovation that will result in many opportunities within the local community. The strategic alignment successes gained from a working partnership will be based upon the collaborative efforts of both the IT industry and academic research which will foster knowledge workers and student development from local industry.

The academia and industry interface is the interactive and collaborative arrangement between academic institutions and business corporations for the achievement of certain mutually inclusive goals and objectives (Rizvi and Aggarwal, 2005). Ultimately, the goal of partnerships is to lay a foundation for a sustainable growth. A model is necessary that will utilize each stakeholder's contribution and combined strengths to grow the IT

6

industry. The growth of the IT sector moves from an innovative process of identifying new opportunities and resources to one that becomes entrepreneurial by nature. It is fundamentally a linking process that builds on the WTCIC initiative by moving from a model of individuality to a larger view of a community which focuses on the IT industry as a whole, and, promotes the idea of growing the IT sector with the use of innovative technology which, in turn will create more jobs.

As previously stated the utilization of the core strengths and unique partnerships between academia and industry has been expanded to show the upward trending focus on economic development as noted in Figure 1 below. Figure 1 illustrates our perceptions of the trending direction for IT sector involvement and contribution to economic growth. The trend moves upward toward economic development which creates expansion of entrepreneurial participation and support from key stakeholders within the community. Each of the key stakeholders provides a support role for growth which comes from the desire to assist the local community (i.e., job creation) with synergies grown from the IT industry and academia partnerships.
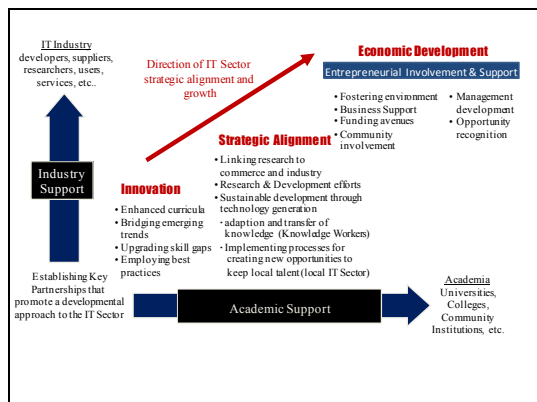

Figure 1: IT within the collaborative framework for growth

Academia is made up of local colleges and universities including research institutions and IT expertise. These provide a combination of talents, resources, networks of human capital that can channel innovative processes and strategic direction to foster entrepreneurial growth activities.

As part of the entrepreneurial growth process additional partnerships and support systems will be required from the local community funding agencies, management development opportunities and new business ventures that are supported by local talent and capital investments. Opportunity recognition can include both local and global business demand and expansion. Sustaining strong partnership between industry and academia will require a strong effort by each party and one that will promote an ongoing review of the process (Fegan et al., 2006).

4. CONCLUSION

Academic-industry partnerships have attracted global attention in recent years, and their relevance to economic development has become obvious. These partnerships are particularly relevant in areas such as IT, where technological changes take place rapidly, and where the best practitioners are those who keep abreast of rapid change.

There is need to create avenues for a close academia and IT industry interaction through all the phases of technological development, starting from conceptualization to commercialization. This paper has presented work towards an abstract model of collaborative partnerships between academic disciplines and local IT industry and business. The model will represent a synergistic partnership that is built upon skills, talents, opportunities, and experiences of the local IT industry and by utilizing local academia resources. It will require an expanded entrepreneurial approach of the stakeholders.

Our work towards an abstract model of collaborative partnerships sets the stage in support of the creation of knowledge, and to ensure that scientific and technological advances made possible by research institutions find their way into the private sector. It also induces an expansion of our research to investigate the dynamics of the knowledge worker infusion at each critical stage of economic development. The transfer of knowledge from academia to the IT industry, where it is applied, must be strategically aligned for continuous IT sector expansion, as identified in our current abstract model. This transition will further define our ab-

7

stract model to include the relationship of knowledge worker infusion into current and future entrepreneurial possibilities.

The defined abstract model will lay the foundation for a possible pilot study with a focus to establish (i) key players, or stakeholders, in the IT industry cluster in San Angelo, and the services they provide; (ii) relationships (or lack thereof) of these stakeholders with academia; and (iii) challenges, opportunities and prospects for the IT sector in San Angelo, within the context of the WTCIC initiative. An additional outcome of the study could be a white paper on the status of collaboration within the IT sector and academia in San Angelo.

Pursuant to the outcome of the pilot study in San Angelo, the template of the proposal may be introduced throughout West Texas. Subsequently, we intend to devise a conceptual framework under which the IT industry cluster in West Texas can harness the potential of becoming a critical vector of the so-called "value-added" economy, and of making a significant and lasting impact on effecting innovation and facilitating a paradigm shift that enhances the sustainable development of the quality of life in the region.

Realization of the WTCIC initiative ensures, in part, that West Texas harnesses its IT sector in the wake of globalization. Our research will preempt the future place of IT in West Texas and across the board.

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