

Policy Recommendations for Linking University Technology Transfer and Economic Development in North Carolina: A Survey of Best Practices in the U.S.

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There is increasing interest on the part of both university administrations and state governments to have their university systems participate in local, regional and statewide economic development. For the State of North Carolina, this nexus between technology transfer and economic development has now become a mandate.

In spite of the keen interest in linking university-based technology transfer and economic development, there is still no consensus as to what constitutes “best practices”, or the highest value-added initiatives to achieve this end.

This discussion paper attempts to outline some of the best practices for linking university-based technology transfer and economic development, and to make broad policy recommendations that might frame a technology transfer-economic development strategy for the University of North Carolina system.

In developing this discussion paper several in-depth interviews were conducted with various agencies and technology transfer offices (TTOs) throughout the United States. These technology transfer agencies and TTOs¹ were identified as having experience and success with linking university-based technology transfer and economic development. To get a national perspective, all interviews were purposely conducted with non-North Carolina institutions.

In selecting the interviews, institutions located in a variety of regional settings, including both rural areas and large urban communities, were included.

As additional background, recent presentations on economic development from the Association of University Technology Managers (AUTM) and the academic literature on regional industrial cluster development were also reviewed.

It is our opinion, however, that the most important recommendations regarding best practices come from the in-depth interviews. The following agencies and TTOs were interviewed.

The public university-based TTOs from Montana State University, University of California San Diego, San Diego State University, University of California system-wide office, Purdue University, University of Utah, University of Colorado, and University of Maryland were contacted. These offices were all traditional TTOs responsible for technology transfer at their particular university, and have been identified by peers as TTOs that provide “best practice” linkages with economic development².

In addition, an interview was conducted with *TechLink*, the largest Department of Defense and NASA technology transfer agency in the United States. *Techlink* is charged with the commercialization of technologies of over 5,000 technologies developed in DoD and NASA laboratories and is associated with the State of Montana university system.

The *Center for Commercialization of Technology* (CCAT), an Office of Naval Research funded technology transfer and commercialization agency, was also interviewed. CCAT, with offices in California and Hawaii, is a consortium of several different public universities, Lockheed Martin, and SPAWAR. CCAT offers technology transfer and commercialization assistance to a variety of university and government laboratories, and to small private sector firms, particularly those that have received Small Business Innovation Research (SBIR) funding. CCAT offers not only technology

¹ Within university systems, Technology Transfer Offices, abbreviated TTOs, are also commonly called Offices of Technology Licensing, generically abbreviated as OTLs.

² Other universities identified by peers as best practice TTOs related to economic development were WARF (Wisconsin Alumni Research Foundation, which manages UW-Wisconsin's inventions), and of course, Stanford and MIT. However, these have not been contacted.

commercialization support, but also R&D grant packages.

And for an additional perspective, interviews were conducted with SPAWAR and *Naval Undersea Warfare Center-Rhode Island* technology transfer office personnel that specialize in the commercialization of dual-use technology.

Institutional Involvement

In general, university systems in traditionally rural or more isolated states, such as Montana and Utah, have clearly recognized and aggressively institutionalized economic development as a prime component of their university-based technology transfer. In these states this commitment is clearly evident and regularly discussed at the highest level of state and university governance.

In addition, some other states such as California, Indiana, Colorado, Wisconsin and Maryland, have certain public university campuses that are recognized as having strong “best practices” approaches to economic development.

In North Carolina, it appears that individual campuses have taken the lead in developing technology transfer-economic development linkages, and that there are large variations in commitment levels, institutional approaches, and performance of these individual campus efforts.

Best Practices and Policy Recommendations

The following is a summary of best practice policy recommendations based upon in-depth interviews with peer identified best practice universities, supported with background information from AUTM and the academic technology economic development-industrial cluster literature. These policy recommendations specifically focus on best practice methods for developing sustainable and synergistic linkages between university technology transfer and economic development.

Every Campus Should Have a Dedicated Economic Development Office

Each university campus should have a “point” person responsible for a broad range of economic development issues. At research universities, where there is significant technology generation, the

economic development office should be a liaison office with the campus TTO. At universities with less commercializable technology generation, the technology transfer responsibility should be under the economic development office, thus giving highest priority to economic development.

Regardless of the institutional arrangement, the university economic development office should have significant visibility, responsibility and prestige (title, etc). In addition, there should also be a well-identified system-wide office in economic development that can provide both policy insights and background resources.

Economic Development Relationships

Relationship building is one of the most important, and commonly cited, key success factors in linking technology transfer and economic development. This is built in three different ways, 1) staffing the TTO/ED office with a director that has business experience, including complete familiarity with equity capital, technology driven enterprises, and entrepreneurship issues as well as having internal legitimacy among faculty, 2) involving senior university administrators, industry leaders, and high ranking government officials to sit, and actively participate, on boards of the university economic development or Incubator efforts, and 3) become the primary office to offer classes, seminars, certificate programs, and internships in economic development to the region.

Pro-Active v. Passive Technology Transfer

Historically, due to the nature of patents and licensing most university-based TTOs have developed a legalistic/contract organizational culture. As such, most TTOs tend to take a passive perspective on technology transfer, relying on portals or established familiar connections with industrial clients. Best practices TTOs, however, put the primary emphasis on “pro-active” technology transfer practices, employing techniques such as cold calls to regional firms and state-wide firms, and linking local industry with total **system-wide** technologies, not just from the local campus.

This requires a formal and active participation of individual campus TTO efforts with other TTOs within the university system. The total “product” base for each TTO office should be the supply of all system-wide technologies for purposes of economic development.

Tie the TTO Mission Statement Directly to Economic Development

Each campus (and system-wide) TTO mission statement should include the following four components: 1) facilitate the transfer of UNC technologies to the public (local, state, and national in that order), 2) enhance the research and education experience of UNC researchers through technology transfer, 3) target economic development by leveraging UNC technologies, and 4) provide incentives to UNC faculty to innovate.³

Understand the significance of each of these four components, and develop specific programs to address each of these four components. Favor local and regional firm licensing and other partnership arrangements, rather than simply maximizing royalty revenues regardless of licensee location.

Create Reporting and Performance Metrics around the Four Components of the TTO Mission Statement related to Economic Development

Simple metrics of number of licenses is not sufficient. Instead create “deeper” measures of technology commercialization, such as number of new innovations adopted, number of university technologies in various stages of commercialization, number of jobs created in community, etc.

Adopted technologies should be regularly tracked and reported upon. TTO reports should identify (and reward) percentage of technologies commercialized at each of categories of local level, regional level, state level, and national level.

Create “Grow Your Own” Programs

“Grow your own” programs are designed to facilitate the founding and growth of local firms. Successful university-based “grow your own” programs involve, 1) high flexibility in licensing, including willingness, at the campus level, to take equity or revenue sharing in small nascent firms and/or provide reduced licensing fees, 2) assist in reducing the firm’s start-up costs, 3) facilitate funding (via NSF and SBIR grants, local development, or local angel networks) or even provide small seed grants to the high value-added/high potential firm, 4) Arrange or provide start-up, entrepreneurship management and

commercialization consulting, 5) recognize high value-added/high potential start-ups, and 6) encourage university faculty to spin-off technologies as “grow your own” firms.

Incubators

For rural, up to mid-size urban areas, incubators are seen effective. However, characteristics of successful incubators are, 1) strict admission requirements based on probability of success, 2) continuous review by incubator board, 3) 18-24 month maximum lease, 4) active board that provides a broad range of assistance, including assisting with legal, accounting, and managerial issues, 5) low lease rates, 6) both lab and office space, not just office space, and 7) incubator board comprised of high-level local industry, university, and government.

For urban areas, encourage local developers to develop incubator-type of space, if unavailable, then university incubator would be required.

Another option mentioned is to allow local firms to “rent” lab space on campus (University of Montana), particularly if the firm is a spin-off of faculty member. Free rent, if space is available, should result in split of profits/equity position with university, etc.

Small Business Innovation Research Initiatives

Create strong incentives for university faculty to be involved with industry-tied research grant development, such as SBIR, STTR, and Broad Agency Announcement (BAA) efforts.

This includes release time, cash or “seed” payments to faculty for SBIR grant writing, strong TTO support for SBIR writing, and in-house skills for SBIR housed within, or coordinated with, the campus TTO. SBIR assistance should be complete and highly visible.

Aggressively Pursue a Government Funded Technology Transfer Agency for UNC

Several states, including California, Montana, Hawaii, and West Virginia, have been very successful in developing congressional funded technology transfer agencies within their state (need to work closely with Congress). Typically, these agencies are formally associated with local universities, and are funded for purposes of technology development. Best example is the

³ Adapted from the University of California, San Diego TTO mission statement, <http://invent/ucsd.edu>

Center for Commercialization of Advanced Technology (CCAT) which is a consortium of the University of California-San Diego, San Diego State University and the Navy, and the Office of Technology Transfer and Commercialization (OTTC) associated with California State University, San Bernardino.

Recommendation is that the UNC system-wide work with Congress (and possibly jointly with other university systems) for a similar technology transfer agency. Most optimum association/location of such an effort would be with a mid-sized growing campus of the University of North Carolina system, in a mid-urban area.

Inward Technology Development

Develop university-based portals and outreach initiatives for local industry to assist in improving local industry's technology. University involvement in development of improvement technologies can be under contract, reverse licenses⁴, or even equity involvement.

Investment in Technology Commercialization

Most university technology tends to be at proof-of-concept or, at best, lab prototype. Technologies at this stage are more difficult to commercialize. Successful commercialization of technology is enhanced by two TTO investment strategies:

1) For High-Potential Technologies, TTO Investment in Advancing Stage of Development. Oftentimes, the technology development has not evolved sufficiently to demonstrate or "shop around" the technology. Best practice TTOs invest in bringing high-potential technologies to at least a working or "pre-beta test" lab prototype stage which can be demonstrated to local industry. This will greatly enhance the ability to commercialize the technology. Advancing the stage of development for high-potential technologies will make it easier to license as well as attract outside equity capital for a regional "grow-your-own" strategy.

For example, one university TTO in Montana regularly contracts with another university academic department to "de-bug" and create working prototypes of certain algorithms that were developed in other laboratories. Using the newer

versions of the algorithms, potential licensees have showed much greater interest in the technology, resulting in several partnerships with local firms.

2) For High-Potential Technologies, TTO Investment in Independent Commercialization Studies. A good independent commercialization study will significantly enhance the chance for commercialization. For high potential technologies, the investment is well spent.

A commercialization study will "triage" the technology, investigate the various market verticals for the technology, identify the market potential, study and recommend certain changes for the packaging of the technology, and identify appropriate licensees or other market penetration strategies. Special attention can be given to local economic development strategies.

Technology commercialization studies are highly specialized and a good TTO-economic development strategy. In general, however, technology commercialization studies should be sub-contracted to departments or other agencies with substantial experience in this area.

The University of North Carolina system has one or two units with substantial experience in developing advanced technology transfer and commercialization studies.

For example, under contract with several DoD Technology Transfer Agencies the Department of Management at UNC-Wilmington has performed over thirty in-depth commercialization studies for highly advanced technologies developed at various U.S. research labs, including UCSD, UCR, UCLA, Los Alamos Government Laboratory, SPAWAR, NUWC, NASA, University of Maryland, and several private labs, including Lockheed-Martin and Kelly Space Systems. These studies have resulted in a high rate of successful commercial adoption.

In addition, the State of North Carolina has several private firms that perform technology commercialization studies that could also be used.

All Regional Universities Should Have an Undergraduate Engineering Program

There is strong consensus from both interviews regarding "best practices" and the research literature on industrial cluster development that any serious system-wide university strategy linking technology transfer and economic development requires that all regional universities have, at least, a small undergraduate engineering program. There are three reasons for this:

⁴ University-generated intellectual property (IP) developed under contract to solve a particular problem of an industrial partner, then licensed back to that industrial partner.

1) Almost all economic development research suggests that it is impossible to develop a regional mid- to high-technology industrial cluster without a local undergraduate university engineering program. Its undergraduate students provide a primary entry-technical base for the local industrial clusters including both existing firms and “grow-your-own” start-up firms. Research indicates that “quality-of-life” and a local undergraduate engineering program are the primary reasons for technology-based industrial location and industrial cluster development.

2) The faculty of a local engineering program can often adapt and apply advanced university generated technologies to the specific industrial needs of the local region.

3) A local engineering program provides greater opportunity for local inward technology development

Recommendation is that regional universities currently without an engineering program immediately implement an undergraduate program. It could be small, with the specific engineering disciplines targeted on the needs of the surrounding community⁵.

Other Recommendations

Other recommendations include:

1) TTOs should work closely with local manufacturing and similar industry-related centers, to develop formal ties.

2) Target mid-sized and smaller local firms with most technologies. Only a few “killer application” technologies will ever be “sold” to Fortune 500 firms.

3) Always keep options open, don’t be tied down to strict protocols – key objective is to always commercialize the technology.

4) Use team approach, with outside expertise.

5) Always shop around technology, and create competition for a license or “grow-your-own” deal. This will assist the TTO in judging

how local industry values that particular technology.

6) Consider using more Cooperative Research and Development Agreements (CRADAs) and other partnerships; rather than simply licenses.

7) Become actively involved in other university-developed technologies that have commercial potential, such as those developed by Schools of Management, Business, Education, and Psychology. All the same ideas about “grow your own”, equity positions, etc., apply for non-hard science technologies.

Conclusion

In order to have successful local economic development, one “best practices” university technology transfer officer noted that “technology by itself is not very valuable; it must be integrated with regional and local relationships.” This discussion paper attempts to provide a summary of “best practices” policy recommendations. These policy recommendations are well supported by both interviews with peer identified “best practice” university technology transfer activities that encourage regional economic development and the current state-of-art research regarding technology-based industrial clusters.

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⁵ A potential model could be the University of San Diego, which has a small undergraduate engineering program (only industrial and electrical engineering, with about 8-10 total faculty), but housed as a department within the Business School in order to minimize overhead and costs.