AMERICAN UNIVERSITIES AND KNOWLEDGE ECONOMY

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INTRODUCTION

The reality of shortage of natural resources that affects the world already now signals the necessity to make their consumption more efficient and that task requires application of high technologies. Creation of so-called smart-systems that meet the demands of the 21st century man also requires technologies that assimilate deep scientific knowledge. All the above determines the attitude to the role of science in the countries, which strive for the leadership in the civilized world of the 21st century.

The USA is undisputed leader both in production and in scientific research, that is why the study of their experience creation of new high technologies including the integration of science and production appears to be very important.

It is known that American university has a world - class standards for fundamental, basic research. Less well known that in the past 10 to 15 years a new model for the American university, as a partner in its regional and state economy, has also emerged.

For much of the post-World War II era economic development practice focused on manufacturing and the needs and interests of the American manufacturer financing of building and equipment to reduction of personal property. Notably absent from this list of state and local economic development tools were any of what are now recognized as elements of the knowledge economy: workforce and education programs, technical assistance and advise from faculty and university labs, or sponsored research.

Higher education at most was a tax burden to these manufactures. As to research, either that was left to larger firms with immense internal research and development operations or ignored completely.

Digital revolution at the beginning of ‘80s and then the biotech revolution of the’90s are fundamentally changing the dynamics of economics. The need for knowledge workers with skills to develop and produce value-added products dramatically changes labor and talent requirements. Worker can no longer be considered commodities that are easy to find and replace. Business capital involves seed and venture capital sources. Collaboration across and within sectors - private, public, higher education, nonprofit – requires more networking and relationship building. And with these changing dynamics the role of higher education becomes much more critical for the growth and survival of all industries, not just technology-driven enterprises.

MISSION AND GOAL STATEMENT

Practically all leading US Universities have included in their mission key words about universities responsibility on the economic and social development of their states and about the university role in such development.

"The University of Maryland is land-grant university whose mission has always been to facilitate the state's development. With the university as a partner, the state of Maryland is transforming itself into a technology hub, an innovative economy based on knowledge industries, with the focus on information technology, biotechnology, nanotechnology, defense and space companies" (*University of Maryland*).

"University provides excellence in undergraduate education, graduate education; research, scholarship, and creative activity; technology transfer and promotion of economic development; continuing and distance education; cooperative extension; public and professional service; the promotion of health and human development; and the cultural advancement of our society" (*Penn State University*).

"To improve the lives of people in Pennsylvania, the nation, and the world through integrated programs in teaching, research, and public service" (*Industrial Research Office of Penn State University*).

"Georgia Tech is a leading center for research and technology development that continually seeks opportunities to advance society and the global economic competitiveness of Georgia and the nation" (*Georgia Institute of Technology*)

"Through the active integration of teaching, research, and extension, North Carolina State University creates an innovative learning environment that stresses mastery of fundamentals, intellectual discipline, creativity. North Carolina State University provides leadership for intellectual, cultural, social, economic, and technological development within the state, the nation, and the world" (*North Carolina State University*).

"Become the catalyst for the development of Ohio's technology-based economy. Increase collaborations with the private sector to enhance research, successfully transfer University technology, and provide experiential learning and career opportunities for students. Make SciTech a national leader in technology transfer and University-related enterprise development " (*Ohio State University*).

"Through its focus on teaching, research, and outreach, the university creates, conveys, and applies knowledge to expand personal growth and opportunity,

advance social and community development, foster economic competitiveness, and improve the quality of life. Market faculty talent and university capabilities within the university and to outside agencies and businesses in order to foster partnerships and transfer research results to the commonwealth, the nation, and the world" (*Virginia Polytechnic institute and state University*).

"Our mission is to educate young men and women to be industry and academic leaders, and to create new technologies that will fuel economic prosperity. Partnerships with industry are essential to both our education and research mission" (*Jacobs School of Engineering University of California at san Diego*).

"Will be a leader among educational institutions by building on its tradition of innovation, problem solving and interdisciplinary collaboration to meet the changing needs of society. To transfer intellectual products to society" (*Carnegie Mellon University*).

The statements about most important role of scientific research in the life and developments of American Universities are confirmed by the statistical data. According to NSF National Rankings for FY2002 the total research expenditures of top leading 15 Universities are located in the limits more than 1 billion dollars - approximately half of billion dollars:

1. Johns Hopkins University - $1,190,235
2. University CA Los Angeles - $787,598
3. University of Michigan - $ 673,724
4. University WI-Madison - $ 662,101
5. University of Washington $ 627,273
6. University CA San Francisco $ 596,965
7. University CA San Diego $ 585, 008
8. Stanford University $ 538,474
9. University of Penn $ 522,269
10. Cornell University $ 496,123
11. University Minnesota $ 494,265
12. University Penn State $ 492,739
13. University CA Berkeley $474,746
14. University CA Davis $ 456,653
15. MA Institute of Technology $ 455,491

INDUSTRY RESEARCH PARTNERSHIPS

For the building of new economy based on knowledge the partnership relations between universities and enterprises realized in different forms play key role.

For example, over the last 15 years, Penn State has enjoyed tremendous growth in R&D expenditures, on a scale that has placed the University squarely in the ranks of the nation's top research institutions. From a total of $192 million in FY 1988, expenditures have increased 184% to $545 million in FY 2003. According to National Science Foundation data for 2002, the latest year available, Penn State ranked 12th among all U.S. universities in R&D expenditures. An indication of the wide-ranging quality of the University's research program is that in ten of the fields ranked by the NSF, from chemical engineering to sociology, Penn State appeared among the top five institutions.

One of the things that makes Penn State unique is the strength of its interdisciplinary research efforts. The Materials Research Institute incorporates faculty from the colleges of Earth and Mineral Sciences and Engineering, the Eberly College of Science, and the Applied Research Laboratory into a research program that is ranked first in the nation.

Long a leader in industry-sponsored research, Penn State ranks third nationally in this category, behind only Duke University and Massachusetts Institute of Technology in the 2001 NSF tally. It isn't surprising, then, that the University has made rapid recent gains in the area of intellectual property. According to a study published by MIT's *Technology Review*, Penn State's patent activity increased by 175% between 1997 and 2002, the highest percentage gain of any U.S. university.

The list of partnership-stimulating activities o Penn State University is extensive. It includes the organizing visits by faculty and students to companies, hosting company visits to the campus, linking faculty to companies around major programs and smaller projects, and maintaining databases of faculty capacities. For example, Penn state works with the Community of science (COS) to maintain an online database of faculty areas of expertise.

There is a well-developed structure for managing industry research and an attempt to be "customer-friendly" in terms of policies and procedures concerning industry research partnerships.

The Industrial Research Office functions as the primary point of entry for Penn State research partnerships with industry. The mission of the IRO is straightforward: "To establish long-term, mutually beneficial relationships between Penn State industry. And government in order to stimulate cooperative research activities".

The office also develops directories of Penn State capacities, that describes faculty members' interests and expertise, as well as the foci and capacities of centers, institutes, and laboratories. Complete contact information is also provided, and the document has been disseminated to potential sponsors in

government agencies and industry. The IRO also publishers a CD-ROM with all of the above information plus intellectual property available for licensing.

The IRO, as a function of its service to industry and faculty will do COS searches. It publishes (hard copy and online) a Penn State Research and Technology Directory, which list over 300 research centers and laboratories, including a contact person, phone and fax numbers, and an Internet address. In addition, a company can download from the IRO Web site a “Request for Information” form, specify its needs and interests, and fax it to the office.

Georgia Tech has an enviable record of industry partnerships. National Science Foundation data indicate that Georgia Tech industry-sponsored research expenditures in FY 1999 were $ 19.8 millions, or 23,8 % of total research expenditures. This significantly exceeded the national average of 6,7 % and Georgia Tech ranked second among the top 100 universities. There are several reasons for the significant scope of industry research funding. One is the value that Georgia Tech places on industry relationships. For example, the College of Engineering Strategic Plan promises that the college will become a model for corporate interaction by:

- assessing and improving infrastructure that supports interactions with industry, including contracting flexibility, overhead structure, and intellectual properties agreements;
- creating strategic alliances with corporate partners that encompass multi-faceted interactions with faculty and students;
- coordinating knowledge of industrial interactions to provide optimum service to companies.

Second is the generally efficient system of policies and procedures via which research contracts are handled. Early in 1999, Georgia Tech established the Industry Containing Office, which serves as a strategic delivery system to help the institute reach its goals. It supports faculty by providing industry, commerce, and the professions with access to Georgia Tech's expertise and resources. The office pays particular attention to providing "one stop shopping" as well as continuity of service between the company and assigned containing officers.

Third is the accumulated experience and success that Georgia Tech has had in pulling together industry-oriented centers and institutes. There are a number of centers on campus that significantly involve companies as a members, financial supporters, or substantive contributors. Among the more significant are the Microelectronics Research Center, the Georgia Centers for Advanced Telecommunications Technology and others.

The University of Maryland, College Pack (UM) is a nationally and internationnaly known comprehensive research university, the largest research university in the D.C. region and the state of Maryland. The University is a top 20 public universities and one of only 10 public and private universities in the nation that have graduate programs in engineering, computer science, physics

and mathematics that are each ranked among the nation's top 20 programs by *News & World report*.

The University of Maryland has the greatest economic impact on the state of Maryland. Its value adds up to approximately $ 1.8 billion each year, according to the study by the Jacob France Institute in Baltimore. The university generates $ 5.93 in economic activity for every $ 1 of state tax funds appropriated.

The achievements of The University of Maryland technology Advancement Program (TAP), an incubator program, are compelling testimony to the magnitude of the university's contributions to the economic development of the region. Based on University bioscience initiatives, investment of $ 250 million have been generated. TAP has graduated 26 bioscience-related companies since 1985. The TAP program is very effective at helping bring new businesses to the area. Beyond the economic impact, the university provides a wealth of services to the community and public, enhancing Greater Washington's quality of life.

TECHNOLOGY TRANSFER

The amount of research performed by U.S. universities, $ 36,3 billion in FY 2002, provides a tremendous opportunity for technology transfer. Universities have become increasingly active in managing their intellectual property portfolios. They are also achieving corresponding outcomes in terms of patenting, licensing, and royalties. For instance, one study estimated that $ 33 billion of U.S. economic activity and 280,000 jobs are attributable to academic licensing of technology.

Among the key structures of Maryland University in the field of technology transfer first of all it is necessary to note Maryland Technology Enterprise Institute (MTECH).

The mission of the Maryland Technology Enterprise Institute is to enable technology commercialization, strengthen companies and catalyze new ventures in Maryland. To that end through their programs MTECH give the various service to Maryland companies and the university community:

- Commercializing technology through matching funds for collaborative research projects between Maryland companies and faculty: Maryland Industrial Partnership (MIPS) program.
- Business incubator for technology-based early stage companies: Technology Advancement Program (TAP).
- Knowledge-based engineering, technical and management solutions for Maryland manufacturers: Maryland Technology Extension Service (MTES).
- Advanced education, workforce training and consulting for biotechnology companies: Biotech Program.
- Extensive services to help Maryland student and faculty start their own companies: Venture Catalyst program.

- Vibrant living-learning program designed to help undergraduate students start their own companies: Humman CEOs program.
- Real-world, student-faculty research projects for undergraduates: ASPIRE.

MIPS program accelerates the commercialization of technology in Maryland by jointly funding collaborative projects between companies and University System of Maryland faculty. With more than 680 project awards since 1987, worth a total value of $119 million, MIPS projects create results. MIPS-supported products have generated more than $ 300 million in sales, added jobs to the region and infused state-of-the-art technology into the global marketplace. MIPS projects help companies find solutions to technical challenges and to develop products, processes or training materials. MIPS projects are conducted by university faculty and graduate students in conjunction with company researchers. MIPS projects give university faculty the opportunity to perform research leading directly to the commercialization of technology.

MTES makes Maryland manufactures more competitive by offering knowledge-based solution in engineering, technology and management. The program's impact on Maryland manufacturers, from 2000 to 2002 alone, was $ 53 million. MTES helped those companies increase and retain sales, lower costs and avoid unnecessary investment.

Venture Catalyst program (VC) makes it easy for faculty, researches and students to evaluate ideas and launch their own companies by providing an extensive, expert infrastructure of consultants and support services. These services are nourished, complemented and supported by educational programs, workshops, networking opportunities and training. VC includes three major components. 1) Technology Entrepreneurship Education. 2) Networking. VC maintains a robust mentor network that includes attorneys, venture capitalists, sales consultants, and retired executives. 3) Accelerator.

This program helps University innovators bridge the chasm between great ideas and viable commercial ventures by offering direct, hand-on consulting services to help faculty, researchers and students start their own companies. The program offers assistance with legal matters, fund raising, executive recruitment, sales and marketing strategy, forecasting, and business plan preparation.

The office of Technology Commercialization (OTC) facilitates the transfer of intellectual property to business and industry through the development and management of a high-quality portfolio of diverse technologies. OTC negotiates and executes licensing agreements in order to provide benefits to the university, to stimulate economic development and to improve the overall quality of life.
The Office of Technology Commercialization oversees the university's portfolio of patented technologies that are products of university research. A list of the technologies that are available for commercialization are listed on the OTC Web site

Georgia Tech has one of the more active and successful technology transfer programs in the nation, and one that is closely attuned to the economic

development mission and entrepreneurial culture of the institution The mission thrust, policies, and practices of the office are clearly oriented toward enabling Tech's would be entrepreneurs, as well as attending to more straightforward licensing deals with established companies.

The Georgia Tech Research Corporation (GTRC) actively encourages faculty participation in start-up companies. Twenty-one start-up companies have been granted licenses for GTRC intellectual property in recent years.

A recently launched initiative within the Office of Economic Department and Technology Ventures (EDTV) is likely to significantly expand the scope of technology transfer for the university, particularly through the start-up route. Venture Lab is to be a "one stop shopping" resource for faculty members interested in commercializing the technology emerging from their labs but who may not have a great deal of knowledge or experience in this area. Four service components will comprise the core of the new program's activities.

INDUSTRIAL EXTENSION / TECHNICAL ASSISTANCE

The other form of interaction between Universities and industry is providing problem-solving technical assistance for state-based companies. In most cases, these types of assistance relationships do not involve research or new knowledge, but rather tap into the established expertise of faculty members, graduate students, consultants, and extension staff.

Maryland Technology Extension Service (MTES) core areas of expertise include improving productivity in manufacturing and office environments; enterprise software selection; environmental and safety regulation compliance; waste minimization; process design; materials evaluations; strategic management and planning.

In addition to the expertise of its consultants, MTES can link companies with faculty expertise or address to specific technical and business challenges, with specialized university laboratories, university resources for marketing, management and other business needs, vast resources within the National Institute for Standards and Technology's Manufacturing Extension Partnership (MEP) network, both state and regional business and technical resources, federal laboratories.

One of the leaders in this work is Penn State University. Established in 1965, the Pennsylvania Technical Assistance Program (PENNNTAP) has provided assistance services to more than 20,000 clients throughout the state. The services are provided free, and the clients are small manufactures and other businesses. All of the technical specialists who work directly with companies have particular areas of expertise as well as industry experience, and all are employees of Penn State. The PENNTAP technical staff coordinate their own efforts and with efforts of other service providers through e-mail, by regular personal contacts and by participating in regional service provider network meeting.

While clients are not charged for assistance services, any engagement is limited to 20 hours of contract time. On rare occasions fees will be charged for additional specialized services. In some cases a company's problem will be sufficiently complex that a referral will be made to a faculty member, another program, a federal lab or a trade association. These additional resources may involve a fee, which is negotiated between the company and the service provider. In most cases, Penn State faculty will provide assistance at no cost or arrange for the involvement of a graduate student at a very nominal cost. Occasionally, an assistance engagement will lead to a contract research project.

In most academic departments in which faculty or students frequently get involved in PENNTAP, these assignments are considered worthwhile and consistent with the research, education and service goals of the units. Faculty members use their interactions with PENNTAP clients as examples in their classroom instruction.

ENTREPRENEURIAL DEVELOPMENT

Universities that are actively involved in economic development operate or partner with local efforts to foster start-up, technology-based companies. Activities may include business incubation services and facilities, locally based seed funds, entrepreneurial courses and majors, and various entrepreneurial events (venture forums, conferences).

The Technology Advancement Program (TAP) of Maryland University is an "incubator" facility offering space and support services for early-stage companies engaged in developing technology-based products or services with commercial potential. TAP's services and dynamic atmosphere create an environment where entrepreneurs flourish, with flexible, furnished office and laboratory space, modern IT and biotechnology infrastructures, in-house business support and convenient office facilities.

The University of California-San Diego (UCSD) is a significant and effective player in entrepreneurial development in the San Diego area, primarily through it CONNECT program. CONNECT was established in 1985 as an economic development organization focused on technology-based entrepreneurship.

One of the services of CONNECT includes providing various short courses for new companies or world-be entrepreneurs. The courses are frequently coupled with various conferences that are in turn organized around themes of interest to local technology entrepreneurs.

Another example, Springboard, is oriented toward early stage entrepreneurs and selected companies. Participants receive four to eight weeks of coaching in business plan development by experiences technology executives. Then participants prepare a formal presentation to a feedback panel, typically consisting of an investor, an industry executive, an accountant, a lawyer, and one or more other business service professionals. Springboard has helped more

than 150 companies raise more than $ 200 million in capital. In the frames of the Springboard program it is interesting to note the Technology Financial Forum. This is held annually, and is oriented toward young companies that have already received some seed investment. During the forum entrepreneurs have an opportunity to present their business plan to venture capitalists and other investors.

In addition to community-oriented activities, CONNECT also provides or brokers assistance to UCSD technology transfer activities that involve start-ups. CONNECT's role lies in fostering linkages to business service providers, capital, or other "virtual incubation" activities, and these are performed on a case-by-case, as needed basis.

INDUSTRY EDUCATION AND TRAINING PARTNERSHIPS, CAREER SERVICES AND PLACEMENT

One more direction of universities and industry interaction is partnering in education and training activities. This is likely to encompass a variety of non-degree educational programs that are responsive to the human resource needs of companies. These may include graduate certificate programs in technical or management areas, executive development programs, weekend MBA programs and corporate-focused distance education.

For example, in Maryland University the System of Centers for Professional Education is formed. This system allows to receive Biomolecular Engineering Graduate Certificate, Customized Corporate Training, Executive Business Training, Training in the field of Executive Programs for Governmental and Non-profit Organizations, Industrial Television System (TV), International Training and Education and special Courses for the Workplace.

While nontraditional educational programs will certainly be part of a university's efforts to meet industry's training needs, all universities also have career services functions to enable their graduates to move from the world of classes to the world of work.

The mission of the Career Center at the Smith School of Business of Maryland University is to link student and employers by providing students with cutting-edge training and employment opportunities, and employers with well-qualified future employers.

The Career Center provides a portal for recruiting Maryland students for employment. With its Web-based employment program, TERP Online, employers can access student resumes, post jobs and make changes in their on-campus recruiting schedules.

The Co-op and Career Services office operates several programs for employers:

- Cooperative education, which represent a joint effort between business, government and education that combines classroom theory with career-related

work experience. Through Co-op, students alternate semesters of full-time study with semesters of full-time paid employment. Co-op is designed to enhance a student's academic training, professional growth and personal development. At the same time, employers benefit by increasing recruitment and retention, cutting labor coast and pre-training future employees.

- Summer and part-time employment, which provide the benefits of reducing the coast of recruitment and training by allowing preview of potential future hires; instilling new energy into the organization through the enthusiasm of student employees; providing management development opportunities for current employees by providing them with supervisory roles; encouraging students as goodwill ambassadors from the employing organization to the university.
- Internships, which are work experiences for which students receive academic credit.

CONCLUSION

The study that has been carried out showed that:

1. There is active governmental policy in the USA aimed at creation of new science intensive technologies.
2. There is multi-dimensional efficient management infrastructure, that provides the implementation of the mentioned policy.
3. The USA universities play the most active role both in formation and in the implementation of the mentioned policy, and they are the centers for creation of new efficient technologies.
4. The achievements of the USA in along that line are governed by well coordinated functioning of all parts of the mentioned system including the active role of the state in the determination of research and scientific priorities of its own development on the bases of the research carried out in the scientific and technical fields and with the help of efficient system of scientific management, which took many decades to develop.