

УДК 37.072

O.V. Volchanskyy

Kirovohrad State Volodymyr Vynnychenko Pedagogical University

**PROBLEMS AND WAYS OF PROMOTING UNIVERSITY RESEARCH IN
NATURAL SCIENCES (AMERICAN EXPERIENCE)**

Study was conducted with the support of University Administration Support Program Funded by the Carnegie Corporation and implemented by IREX (International Research & Exchanges Board, Washington, USA)

The paper deals with the problem of organizing corporate research in the USA higher educational establishments. Despite the difference in experience and possibilities of organizing research in Ukraine and the USA, this problem has great theoretical and practical value for both countries. As an example, the author presents the experience of rather successful organizational structure of scientific research in natural studies in the University of North Texas (UNT, Denton, USA), where he conducted a short-term study with the support of University Administration Support Program Funded by the Carnegie Corporation and implemented by IREX (International Research & Exchanges Board, Washington, USA).

The University has achieved a high position in modern science and research largely due to the effective organization and successful development of its corporate relations with the federal and state granting organizations as well as with other universities and private corporations across the country and around the world. The article gives a detailed survey of the Office of Research and Economic Development organizational structure, surveys the functions of its main divisions. It is highly desirable that the experience of our foreign colleagues should interest their Ukrainian counterparts and help us reach necessary balance between the theory, which our native science is rich in, and its practical application.

Keywords: *corporate research, financial support, "government – university" relations, corporate links between universities and industry.*

The significance of the survey

In the contemporary highly integrated and dynamically developing world new inventions are moving from university laboratories into the hands of consumers, via industry, faster and more efficiently than ever before. The positive experience of the developed countries has demonstrated that only a firm and lively linkage between a research / educational institution and industry / company can bring quick and plentiful financial revenues as well as overall societal benefits that should meet the ever-growing demand of a vast majority of the world's population.

Setting the problem

While the developed and most of the developing world is persistently advancing their research realizing that it can provide a powerful boost to their economies, Ukraine remains at the edge of this process, strongly kept in the tenets of its old stereotypes.

While the USA, an acknowledged leader in the University-Industry research, funds billions of dollars into creating new links of universities with other universities, local, national and international industries, Ukrainian government can boast of only a few million hryvnas given to universities in form of grants to support individual or small group projects. The same can be said about Ukrainian private funds.

University science is an important segment of the state science. According to the survey of July, 2014, the system of Ukrainian higher education can boast 68,9% of Doctors of Sciences and 72,6% of PhDs [1]. In this context it is very important to effectively use university science in promoting the development of the state economy, in creating the mechanisms of scientific studies effective support, as well as their results application.

Ukraine has already designed several innovative structures: 12 technoparks, 28 innovative business-incubators, 28 innovative centers. Nevertheless, realization of its scientific potential is currently not impressive. Science parks, even the best of them – "Kyiv Polytechnics" – demonstrate rather modest results [2].

The Cabinet of Ministers of Ukraine has approved the "Conception of the State Target Economic Program on Innovative Infrastructure Development". The goal of this Program is to create conditions for developing innovative infrastructure, providing support for scholars, innovators and industries [3]. It is also planned to work out the mechanisms to promote production and technological basis of scientific divisions and to implement the tools to encourage innovations. To achieve this, we need to amend laws in order to simplify and standardize the creation of various types of innovative structures. Credits and financial resources should be made accessible to such structures; technopolises and science cities should be designed. This is of utmost importance to the sphere of natural sciences, which traditionally require serious money.

In this situation one can find the experience of developing corporate research system in American universities rather useful. In the USA, like in most developed countries of the west, industry and academia have been collaborating for more than a century [4] with a strong institutional, legal and financial support of the Federal and State governments. Thus, in 1995 industry supported approximately 7% of total university research funding and up to 16% of research funding in the biotechnology field [5] while in 2007 the government's appropriations for Research and Development (R&D) activities totaled \$137 billion plus tax benefits that gave businesses an incentive to increase their R&D spending [7].

The objective of the article

The article under consideration is devoted to the problem of organizing corporate research in a US higher learning institution. Notwithstanding vastly different experiences and opportunities of its advancement in the US and Ukraine, the issue appears to be of a paramount importance in a theoretical as well as in a practical dimension for both countries.

Presenting the main issues

The main problems that get in the way of creating and developing corporate university-industry research in Ukraine are as follows:

1. Today in Ukraine there are no effective mechanisms of stimulating businesses to raise funds to finance research and development (tax and credit incentives, public contracts for the firms that should cooperate with universities. etc.).
2. Universities lack practical experience in the market research services, commercialization of research results, technology transfer, sufficient resource base.
3. There are no clear mechanisms of stimulating innovation activity in Ukraine, including real support of establishment and operation of parks, venture capital funds, technology transfer centers.

In the main part of the article, in the process of describing the structure of organizing the university research on the example of the University of North Texas (Denton, USA), we are going to address some of the above issues, as well.

A sample of surpassing this gap and solving the problem of science commercialization can be found within the University of North Texas, one of the leading American research centers with an annual budget of \$858 million, among which \$100 million are raised from state and private investors.

The University of North Texas, Denton, Texas, contains 163 buildings and 14 residence halls and has 36,000 current students enrolled in 97 bachelor's, 88 master's and 40 doctoral degree programs. The university awards more than 8,500 degrees a year. It prides itself on more than 300,000 alumni, many of whom are returning their bid to the University with generous donations and gifts the biggest of which in 2011 was \$22 million – a part of the total \$ 99 million University endowment that supported the considerable 2010-2011 budget of \$858 million. The University's 720 researchers, 894 teaching fellows and assistants fulfill the main functions of the public University – to give advanced knowledge to the students, to promote the national and world science and research, to boost the local and state industry, to leverage the life of the community.

It is ranked by the Carnegie Foundation as a *Research University in the High Research Activity Category*. UNT faculty produce groundbreaking research in a wide range of disciplines within the sciences and engineering, and make nationally recognized contributions in the arts and humanities. UNT also is home to many national centers and institutes, including the Net-Centric Software and Systems Center — an NSF Industry/University Cooperative Research Center; the Semiconductor Research Corporation, Center for Electronic Materials Processing and Integration; the Institute of Applied Science; the Center for Advanced Scientific Computing and Modeling (CASCaM); the Texas Center for Digital Knowledge; and the Center for the Study of Interdisciplinarity. UNT has developed many state-of-the-art research facilities, such as the Center for Advanced Research and Technology (CART), one of the nation's most extensive facilities for powerful materials characterization and analysis; a high-performance computational facility; and a clean room/nanofabrication research facility.

In addition, UNT is developing a research park (UNT Discovery Park) with technology incubator facilities on a 290-acre property near the main campus. The university is well integrated into the fabric of the city of Denton. UNT offers classes in downtown Dallas, just 35 miles away, and is developing a Design Research Center in the heart of the Dallas design district. The university boosts the Dallas-Fort Worth economy by more than \$1.3 billion each year, and UNT alumni impact the area's economy by more than \$10 billion annually. The University has achieved such a high position in modern science and research largely due to the effective organization and successful development of its corporate relations with the federal and state granting organizations as well as with other universities and private corporations across the country and around the world.

The Organizational Structure of Research Offices

This great mission is pursued through a complex structure of UNT research offices and centers. At the highest – all-university level - it is carried out by two offices: the Office of Research and Economic Development and the Advancement Office and a few other divisions

dedicated to search for donor money and collaboration with corporations. At the college level the research is concentrated in a set of College Centers. The Research Clusters rally researchers from different UNT colleges as well as invited researchers to work on some breakthrough issue of contemporary science.

The Office of Research and Economic Development

The Office of Research and Economic Development is headed by its Vice President. He is responsible for promoting the University’s mission in research, original scholarship, and artistic creativity; managing IPs and technology transfer; building and developing a research park (UNT Discovery Park); and fostering partnerships with government agencies, non-profit organizations, and industry.

He moves UNT into the ranks of Tier I institutions with high level of national and international recognitions through a set of actions:

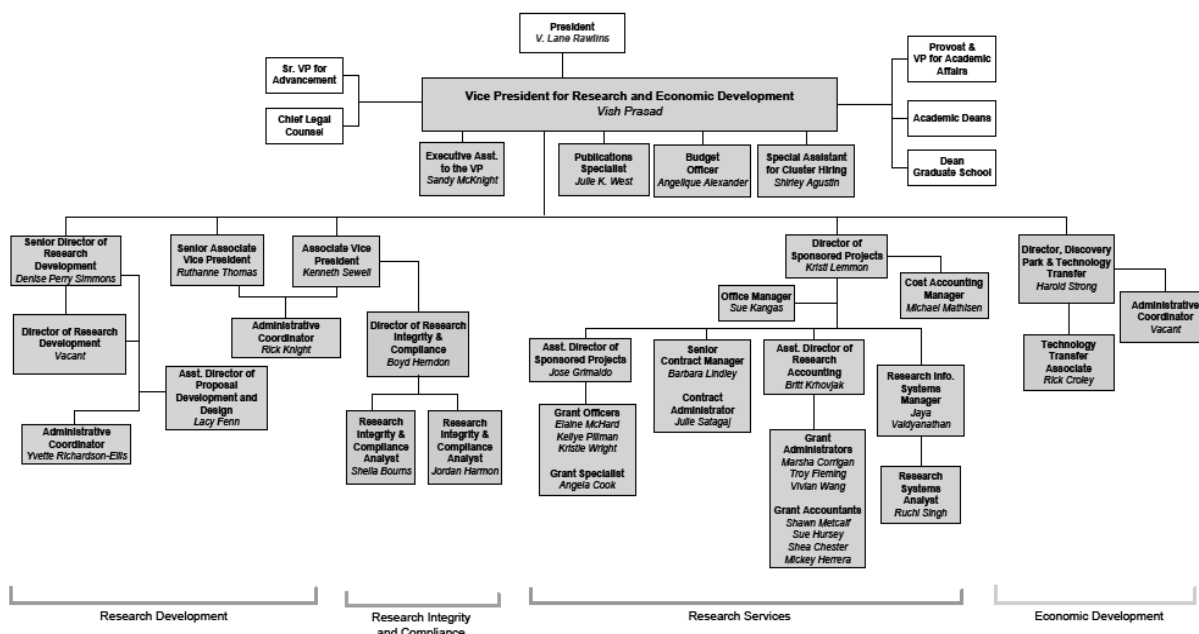
- hiring highly-accomplished senior and junior faculty,
- expansion of research infrastructure and funding,
- increase in philanthropic dollars for research,
- increase in number and quality of doctoral students
- developing Research Cluster Program [16].

These multiple tasks are pursued through four divisions of the Office of Research and Economic Development, each with its specific functions:

Research Development

- Assist faculty with proposal preparation
- Provide research training and seminars
- Build interdisciplinary teams
- Promote development of centers and institutes
- Develop research infrastructure
- Administer seed-funding, emergency grants, and small project grants

Table # 1. Organizational Chart: Office of Research and Economic Development



Research Integrity and Compliance

- Control integrity in the conduct of research
- Supervise adherence to Federal regulations and UNT policy and procedures
- Control export
- Submit guidelines to UNT persons conducting research
- Conduct trainings for all UNT persons conducting research [15].

Research Services

- Review, approve, and submit faculty proposals for extramural funding
- Process extramural awards
- Administer grants
- Administer research compliance and reporting activities
- Collect and report data on research activities

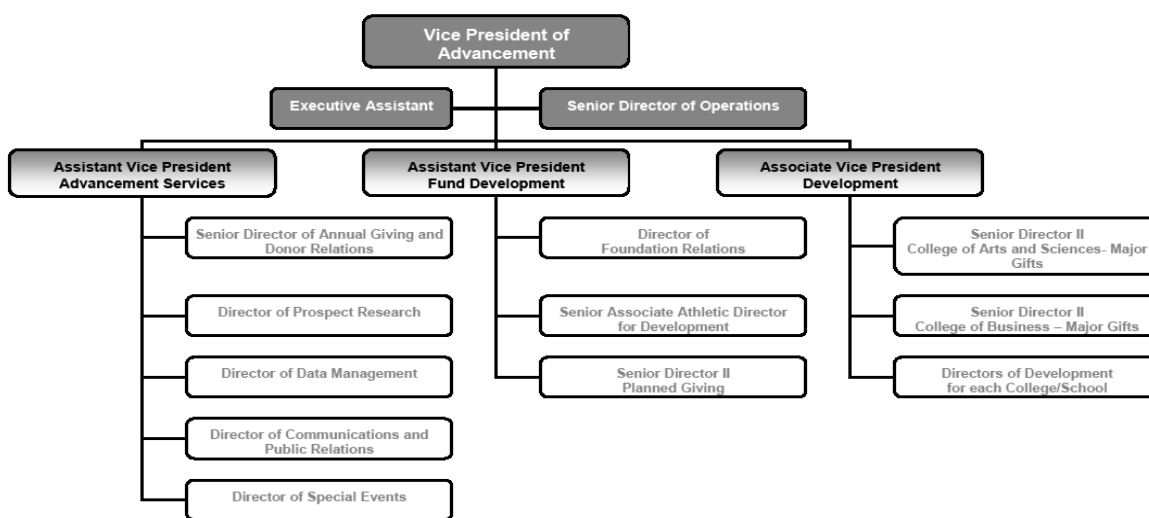
Economic Development

- Manage intellectual property
- Oversee patent and technology transfer process
- Promote commercialization through business incubators
- Coordinate interactions with local and regional government agencies and chambers for economic development
- Develop and manage UNT Discovery Park

The Advancement Office

The Vice President for University Advancement manages and oversees Advancement Operations and the offices of University Development, University Communications and Alumni Relations, as well as provides initiative, direction and oversight for the university's governmental relations activities.

Table # 2. Division of Advancement



University Advancement

- Carry out fundraising operations,
- Generate the external recognition, support and financial resources
- Expand the institution's private support
- Work with alumni, parents, donors and the community to broaden the resources

• University Advancement carries out its mission through the following operating units:

- Alumni Association
- Development
- University Communications [14].
- It works closely with the UNT Foundation and UNT Alumni Association [6].
- The University of North Texas Foundation, Inc.
- Accept, invest and/or manage private gifts, endowed funds and other assets
- Support and encourage philanthropic gifts to the University.

Corporate and Foundation Relations (CFR)

- Identify corporate and private foundations that offer funding for UNT projects
- Support research, education, diversity, health, community service, economic, environmental and arts initiatives at UNT (sent by Heather Rozell, Director, Foundation Relations)

Centers and Institutes: Organized Research and Service Units

The research activities are also done in 68 UNT Centers and Institutes that mostly function within the Colleges as the bed seeds of college research. Centers usually consist of a 3-5 of faculty, often from within the same department or college, focusing on a specific and distinguishable theme, an area of intellectual (teaching and research) or service activity.

Centers are required to show, by review and approval of the college and Provost Office, how they are unique, and often, how they will become self-sustaining within five years. There is a wide range of funding models, and many if not most centers are not self-sustaining in 5 years. If they do not perform well, they are removed from the centers list.

Institutes are, in effect large Centers, consisting of between 5-25 affiliates or members, many could be from off campus or across the university. Some are created, not from centers, but after a grant award, such as the IUCRC (Industry-University Cooperative Research Centers, a program funded by the US government through the National Science Foundation that takes innovative new research relevant to a cross section of U.S. economic competitiveness (e.g., cloud computing) and creates a university-corporate partnership where research priorities are driven by companies and universities.

As part of the implementation of the research plan, UNT has created fifteen research clusters [13] which are collaborative, cross-disciplinary teams composed of leading researchers, faculty, students, and institutions. Clusters engage faculty from a wide range of disciplines—from fine arts, humanities, and education to sciences, engineering, and business. The clusters are focused on attracting nationally and internationally recognized scholars, mostly at senior level.

A CRADA Cooperative Research and Development Agreements is an example of Joint research and development projects, the goal of which is to rapidly commercialize a set of technologies. Not currently at UNT.

We do have 2 examples of Testing and standards. One is the NuconSteel example in Engineering (a fully integrated designer and manufacturer of total framing solutions addressing both commercial and residential markets.) [11]. The other is the PFI (Partnership for Innovation) which takes a technology and places it after a couple years of research into the product testing phase according to industry standards. Much of the industry standard setting is done by the US

National Institute for Standards and Technology (NIST) [10]. NIST offers some grants and partners with some universities to accomplish their goals.

Concluding remarks

Thus, corporate research of an US University is financed through government-university liaison, University-Industry corporate linkages, numerous state and private grants and philanthropy. Governmental policies strongly affect the potential supply of research and technological inputs from universities. To a lesser degree, they also impinge on the demand for the services available from universities. But the decision to establish links ultimately rests with the firms themselves. Philanthropic sources often fund endeavors that no one else is ready to fund because they do not offer the right return-of-investment perspectives. An increasing share of this funding is going into life sciences.

The recent experience regarding the interaction between firms and universities is quite mixed. Though firms are more aware of the gains in competitiveness from innovation and are sensitive to the high returns from research and development, much of this outlay is by large companies. Meanwhile, in the interests of reducing costs, tapping a wider range of disciplines, canvassing a variety of technological options, and spurring multiple competing research initiatives, firms, whatever their size, are moving toward open innovation practices.

REFERENCES

1. Наука в університетах. Неухильно виконувати прийняті закони. Виступ академіка НАН України М.Ю.Льченка на Парламентських слуханнях на тему "Про стан та законодавче забезпечення розвитку науки та науково-технічної сфери держави", 2 липня 2014 р. [Електронний ресурс]. – Режим доступу : - <http://kpi.ua/ilchenko-science>.
2. Інноваційна інфраструктура 2017-2020. Аналітична стаття. [Електронний ресурс]. – Режим доступу https://www.eduget.com/news/innovacijna_infrastruktura_2017-2020-355.
3. «Про затвердження плану заходів з реалізації Концепції реформування державної політики в інноваційній сфері на 2015-2019 роки» - Розпорядження КМУ від 4 червня 2015 р. № 575-р. [Електронний ресурс]. – Режим доступу <http://zakon3.rada.gov.ua/laws/show/575-2015-p>.
4. R.C.Miller. Developing University-Industry Relations / R.C.Miller.B.J. Le Boueuf – Published by Jossey-Bass, 989 MarketStreet, San Francisco, 2009. – 158 p.
5. D.E. Drew Stem the Tide. Reforming Science, Technology, Engineering, and Math Education in America. – The Johns Hopkins University Press, Baltimore, 2011/ – 242 p.
6. Endow UNT [Електронний ресурс]. – Режим доступу : <http://endow.unt.edu>.
7. Federal Support for Research and Development. Congress Of The United States, Congressional Budget Office 2007 [Електронний ресурс]. – Режим доступу : <http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/82xx/doc8221/06-18-research.pdf>.
8. Giving to UNT [Електронний ресурс]. – Режим доступу : <http://www.unt.edu/development/giving.htm>.
9. Kuhlman G. A. Alliances for the Future : Cultivating a Cooperative Environment for Biotech Success [Електронний ресурс] / Gina A. Kuhlman. – Режим доступу : <http://www.law.berkeley.edu/journals/btlj/articles/vol11/Kuhlman.pdf>.
10. National Institute of Standards and Technology [Електронний ресурс]. – Режим доступу : www.nist.gov.
11. Nuconsteel : A Nucor Company [Електронний ресурс]. – Режим доступу : <http://www.nuconsteel.com>.
12. Plasma Processes. New Center Links : Academics and industry for Research on Chips [Електронний ресурс]. – Режим доступу : <http://www.unt.edu/untresearch/2010-2011/plasma-processes.htm>.
13. Research Clusters [Електронний ресурс]. – Режим доступу : <http://research.unt.edu/clusters>.

14. UNT Office of the President [Електронний ресурс]. – Режим доступу : <http://www.unt.edu/president/executivestaff/development.htm>.

15. UNT Research and Compliance [Електронний ресурс]. – Режим доступу : <http://research.unt.edu/ors/compliance/compliance.htm>.

16. UNT Research clusters [Електронний ресурс]. – Режим доступу : <http://research.unt.edu/clusters>.

Волчанський О.В.

Кіровоградський державний педагогічний університет імені Володимира Винниченка
**ПРОБЛЕМИ І ШЛЯХИ РОЗВИТКУ ДОСЛІДЖЕНЬ З ПРИРОДНИЧИХ НАУК В
УНІВЕРСИТЕТАХ (АМЕРИКАНСЬКИЙ ДОСВІД)**

Стаття присвячена проблемі організації корпоративних досліджень у вищих навчальних закладах США. Незважаючи на відмінний досвід та можливості організації таких досліджень в Україні та Сполучених Штатах, ця проблема має велику теоретичну цінність та практичну значущість для обох держав. Як приклад наводиться досвід досить успішної організаційної структури наукових досліджень в Університеті Північного Техасу (УПТ, м. Дентон, США), де автор проводив короткострокове дослідження за Програмою підтримки адміністрування університетів (UASP), яка координується Радою міжнародних наукових досліджень та обмінів (IREX, Вашингтон, США).

В статті детально розписана організаційна структура офісу науково-економічного розвитку та функції основних його підрозділів. Хотілося б, щоб позитивний досвід закордонних колег зацікавив українських відповідальних осіб та допоміг нам створити ефективний баланс між теорією, якою багата наша вітчизняна наука, та її практичним застосуванням.

Ключові слова : корпоративні дослідження, фінансова підтримка, відносини «уряд – університет», корпоративні зв'язки між університетами та промисловістю.

О.В. Волчанский

Кіровоградский государственный педагогический университет имени Владимира Винниченко
**ПРОБЛЕМЫ И ПУТИ РАЗВИТИЯ ИССЛЕДОВАНИЙ ПО ЕСТЕСТВЕННЫМ
НАУКАМ В УНИВЕРСИТЕТЕ (АМЕРИКАНСКИЙ ОПЫТ)**

Статья посвящена проблеме организации корпоративных исследований в высших учебных заведениях США. Несмотря на отличный опыт и возможности организации таких исследований в Украине и Соединенных Штатах, эта проблема имеет большую теоретическую ценность и практическую значимость для обоих государств. В качестве примера приводится опыт достаточно успешной организационной структуры научных исследований в Университете Северного Техаса (УСТ, г. Дентон, США), где автор проводил краткосрочное исследование по Программе поддержки администрирования университетов (UASP), которая координируется Советом международных научных исследований и обменов (IREX, Вашингтон, США).

В статье подробно расписана организационная структура офиса научно-экономического развития и функции основных его подразделений. Хотелось бы, чтобы положительный опыт зарубежных коллег заинтересовал украинских ответственных лиц и помог нам создать эффективный баланс между теорией, которой богата наша отечественная наука, и ее практическим применением.

Ключевые слова: корпоративные исследования, финансовая поддержка, отношения «правительство - университет», корпоративные связи между университетами и промышленностью.

ВІДОМОСТІ ПРО АВТОРІВ

Волчанський Олег Володимирович – кандидат фізико-математичних наук, доцент кафедри фізики та методики її викладання Кіровоградського державного педагогічного університету імені Володимира Винниченка.

Коло наукових інтересів: фототермічні та фотоакустичні явища в напівпровідниках, методика викладання фізики та астрономії, реформування вищої освіти України.