An Impact Analysis of University-Industry Innovation

Report Submitted to the:
University at Buffalo Office of the Vice President for External Affairs,
UB Office of Science, Technology Transfer and Economic Outreach (STOR), and
Center of Excellence in Bioinformatics and Life Sciences (COE)

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I. Introduction

Research universities are cornerstones of innovation. From their laboratories, medical centers, institutes and classrooms come discoveries, marketable products and specialized knowledge that propel industries and regions.

Innovation doesn't happen within university walls alone. Rather, university-industry partnerships undergird innovation, connecting needs, insights and investment from the field with expertise, equipment and breakthroughs from the academy. University-industry alliances take many forms. University-based knowledge is transferred to industry through university-generated patents and licenses to new technologies. University-incubated start-up companies benefit from boosts to their human, financial and intellectual capital, enhancing longer-term business prospects. Firms too small to have their own laboratory and research equipment, and larger businesses seeking additional capacity and cost efficient R&D, take advantage of space-sharing agreements and access to university resources from purchase discounts to the expertise and talent of faculty and students. Alliances with university scientists create synergies and help firms make a stronger case for research grants and funding. In addition, universities continue to provide the critical pipeline for a skilled workforce to drive innovation and growth among private businesses.

Universities benefit as well from their partnerships with industry. University-originated research may develop into successful products ripe for commercialization. Commercial successes not only bring material support, they also burnish the reputation and prestige of the university in the eyes of scientists, faculty, students and the community at large. Research success attracts more research dollars from investors seeking a strong return on their investment. Successful innovation partnerships in turn draw other companies, scientists and faculty engaged in related research.

Successful university-industry alliances can also benefit their communities through new businesses, additional jobs and the infusion of new money to support and grow the regional economy. Innovation inventions from the personal computer to cell phones spurred their regions, states and home nation. Well-paying jobs associated with the innovation economy enable employees to purchase homes, eat out and enjoy a range of amenities with dollars left to invest back into the community as through charitable giving. More broadly, new products brought to the market through innovation advances all realms, from health care to engineering to recreation.

Yet not all advancement leads to net job gains. At times innovation impels new-found processes and products that create efficiencies allowing the same amount of work to be completed with fewer people. While this aspect of innovation doesn't produce jobs and, in fact, may lead to job losses, these cost-saving discoveries can offer companies an edge in a global marketplace where competitiveness is critical to the longer-term survival of businesses.

As the largest public research university in New York State, the University at Buffalo ("UB") is a major innovation institution, not least because of its robust industry partnerships. This study investigates the nature and value of selected UB-industry partnerships as they affect the economy of Western New York and New York State. Commissioned by the University at Buffalo Office of the Vice President for External Affairs, in partnership with the UB Office of Science, Technology Transfer and Economic Outreach (STOR) and the New York State Center of Excellence in Bioinformatics and Life Sciences (COE), the initiative generates baseline data quantifying the economic and jobs impact of UB-private industry partnerships. While this assessment captures only a portion of the value associated with the university's contribution to regional and statewide innovation, a better understanding of these selected partnerships and key metrics provides a starting point for better positioning Western New York as a growing nucleus for research and innovation and may help the university secure additional funding to advance current efforts. Initiatives similar to this are not unique to this region but rather are being undertaken by other universities and university clusters across the nation such as in Massachusetts, Philadelphia, and Michigan.

While innovation spans all fields and disciplines and is catalyzed by many units across UB, this study limits itself to a subset of university-industry partnerships formed through UB's primary research and outreach arms, the UB Office of Science, Technology Transfer and Economic Outreach (STOR), the New York State Center of Excellence in Bioinformatics and Life Sciences (COE), and the Center for Advanced Biomedical and Bioengineering Technology (CAT), which is physically located within the COE. These university units are currently most recognized for the role in driving technology commercialization and economic development through engagement with industry.

This study is part of a larger effort by UB to assess its full impact on the regional and state economies. It expands upon an impact analysis conducted in 2007 and updated in 2009 that assessed the economic impact of the university's academic and related operations. Commissioned by the university, these

previous impact studies and this current one were conducted by the University at Buffalo Regional Institute (UBRI), a major research and policy center with expertise in economic impact analysis.

II. Key Findings

- This study identified close to **200 companies** that have partnered with UB through the university's STOR, COE and CAT programs.

- Nearly **half have been clients of UB's business incubator program for emerging businesses** receiving services such as wet lab space, flexible rents, administrative support and access to UB resources. The other university-industry linkages involved technology transfer (patents and licenses), funding support, business development, and space in COE's facility with access to research resources.

- **Companies receiving incubator services at UB are more successful than average**; seven out of ten still exist today, compared to the 50% five-year survival rate of small businesses across the nation.

- The **large majority of the surveyed companies—75%—are located in New York State**, with most of these in Erie and Niagara Counties.

- The **survey respondents represent four generally growing industries and clusters**: (i) life sciences, (ii) electronics, (iii) software/internet, and (iv) professional and technical services.

- About **1,100 jobs exist at the responding companies, with most of these jobs in New York State and Western New York**; the average wage at these companies is over $20,000 higher than the regional average ($63,026 versus $40,960).

- **Small businesses dominate the population of survey respondents** with almost three-quarters of them having fewer than 25 employees.

- **80% of responding companies have turned research into a marketable product or service, as these companies reported $585 million in recurring sources of income such as government contracts and product and service sales**; at the same time, 20% of respondents are focused almost exclusively on R&D, dependent on private and public grants, investments and loans as their only revenue sources.

- Respondents reported garnering a **large majority (68% or $111 million) of their grants and other one-time revenues over the past five years from the federal**

government and private investors. New York State grants and bank loans account for proportionally less (32% of the total or $53 million).

- Between **one-half and two-thirds of revenues generated by responding innovation companies in New York come from out-of-state sources**, representing new dollars to the state.

- **This study finds that about $179 million was pumped into the worldwide economy** last year by survey respondents

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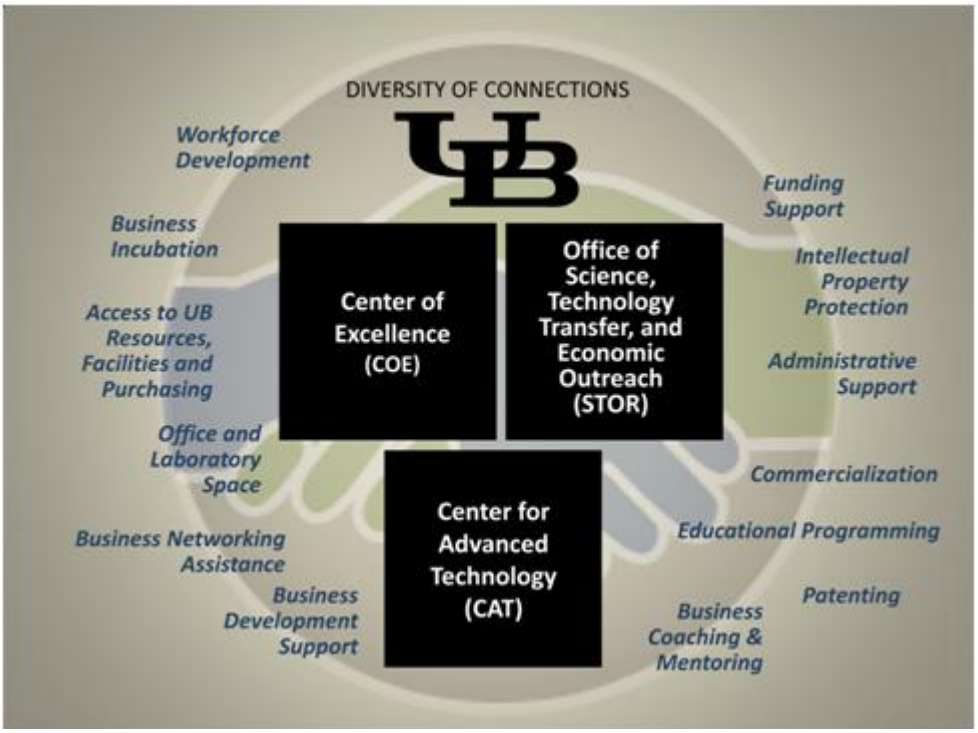
and the COE for labor, equipment, facilities and other purchases. The majority of this (about 60%) stayed within New York State, while almost half (44%) remained even closer to home in Western New York.

- The **estimated total economic impact of survey respondents located in NYS is $176 million,** with three-quarters of this accruing to and circulating through the economy of Western New York.

III. Scope and Methodology

The following outlines the scope of this study and the methods employed to develop the findings presented.

Defining University-Industry Innovation: Serving as the basis for this study are selected university-industry partnerships forged by the university's STOR, COE and CAT programs. These university-based programs exist to facilitate university-industry linkages by nurturing private-sector innovation and the commercialization of new ideas. This is accomplished through a myriad of support programs and services that provide assistance ranging from funding to lab space to business development assistance. The diversity of connections forged between the university and industry is illustrated on the diagram above.



The partnerships included in this study varied quite widely between STOR and COE/CAT, both in number and the kinds of connections these companies have had with the university. STOR identified 158 companies with which it had partnered since 1985. These partnerships included all companies that have been a client of STOR's incubator program, receiving a suite of services that foster the growth and development of emerging businesses. Also included were companies founded by a UB faculty member or student in which UB owns the intellectual property and has licensed it through STOR to the company, as well as companies founded by a then-current UB student or faculty member.

COE and CAT identified 35 companies that had a contractual relationship with COE or CAT for funding or co-location at the COE facility. Some of these overlapped with STOR partners. This subgroup of all COE and CAT companies matches the universe of companies the COE and CAT regularly assess for economic impacts, as required by NYS funding agencies. According to COE, this subgroup significantly underrepresents the full universe of companies that COE and CAT have worked with.[1]

The finances and employment related to the central operations of the COE itself are also included in this study. In isolating these, a "but for" test was applied, meaning the analysis included only the revenues, spending and employment that would not exist but for the operations of COE. Financial and employment data from Roswell Park Cancer Institute and Hauptmann-Woodward Medical Research Institute were not available for inclusion, even though these two entities are significant partners of the COE and were within the original proposed scope of the study.

Geographic Scope: This study examines the impact of the selected companies on Western New York and New York State. Consistent with the geographic scope of the UB's impact study *The Difference a University Makes: An Impact Analysis of the University at Buffalo*, Western New York is defined as Erie and Niagara counties.[2]

Timeframes: The employment numbers reported for survey respondents reflect current 2010 figures. The revenue, expenditure, and economic impact data reflect companies' most current completed fiscal year. For most, this would be 2009. Non-recurring revenues reflect what companies reported receiving over their past five completed fiscal years (in 2005 through 2009).

Methodology and Process: This project aimed to assess the collective impact of selected UB partners and the COE on the region and the state. Study findings are based on an analysis of data and information gathered from a subgroup of the 183 university partner companies identified as being affiliated with STOR, COE or CAT. The process of identifying these selected UB innovation partners and gathering their current contact information included reviewing the lists of companies provided by the COE and STOR, verifying and updating this information using company information from several

[1] The COE and CAT have worked with dozens of life sciences companies in the five-county region as well as some located elsewhere in New York State and beyond state borders. Unless they had a contractual relationship as noted, the COE did not identify them for inclusion in this impact report.

[2] This definition of the region is not the same as that used by STOR or COE. COE, for instance, used a five-county region encompassing Erie, Niagara, Cattaraugus, Chautauqua and Genesee counties in estimating its economic impact.

different business databases in LexisNexis,[3] and developing a database for these businesses to house the most current information gathered. In cases where there was no contact information and the company could not be identified, the analysis included a search of public corporation records and filings to help determine whether a company was no longer active or had been dissolved. For most companies, this effort yielded company contact information, the name of the founder or current leader, the general nature of the company's relationship with UB, and its operational status, that is, whether the company was active or not. (See **Appendix A** for a list of active companies identified by this study.)

Synopsis of the Process

- Understand UB impact data needs and develop questionnaire *(September 2009-February 2010)*
- Identify and verify study participants *(November 2009-January 2010)*
- Gather questionnaire data from these companies *(March-June 2010)*
- Conduct preliminary data analysis *(May-June 2010)*
- Analyze final data and present findings *(July–August 2010)*

A key aspect of this process was understanding and prioritizing the impact data useful to STOR, COE/CAT and UB, and matching this against information already available or collected through other data gathering processes, particularly those undertaken by COE/CAT as part of its reporting requirements to New York State. The result of this effort, which included a series of discussions with STOR, COE/CAT and the UB Office of External Affairs, was a 2 ½ page questionnaire (**Appendix B**) soliciting information on company employment, revenues, spending, mission and successes.

Preceded by a letter to potential company respondents from UB President John Simpson introducing the initiative and requesting participation (**Appendix C**), the survey gathered responses from companies primarily during March and April 2010 with extensions into June 2010. Altogether, 47 of

[3] These business databases included various business databases such as Netvention Company Profiles (companies having an active website), Gale Group, Inc. (250,000 U.S. public and private companies) Hoover's Company Records (major U.S. companies), and OneSource Information Services (50,000 U.S technology companies). State corporation records were also searched to help determine if a company was still in business.

the identifiable active companies completed the survey, a response rate of 34 percent. The COE also submitted a completed survey associated with its core operation.

This study uses IMPLAN (IMpact analysis for PLANing) to assess the total economic impact of the UB innovation partners responding to the survey. IMPLAN is a region-tailored, computer-based input-output modeling system that traces dollars spent inside a region to provide total economic impact in dollars and jobs leveraged. IMPLAN relies on county-level data across 500+ sectors of the economic to estimate economic impacts. These totals reflect direct impacts as well as indirect and induced economic activity flowing from direct impacts. In calculating impacts for New York State and the Western New York region, this study assesses the impact of those companies located within the study region. The relatively small portion of in-region spending by out-of-state companies (amounting to 1.5% of the total in WNY) was not included in economic impact figures.

This Study's Universe of Companies

183 companies submitted by STOR, COE and CAT

139 still active and operational

44 inactive or unable to contact

47 active companies responded to questionnaire providing information for analysis on their employment, spending and revenues

The analysis calculated impact values for the 47 company respondents along with the central COE operation. (**Appendix D** summarizes key findings from the questionnaire and notes the separate impacts of STOR and COE/CAT respondents.) Because this subsample represents roughly one-third of the active companies surveyed, results significantly underestimate the actual impact of all 183 companies identified for this study, as well as the even larger impact associated with the broader universe of UB-innovation partners beyond the scope of this study.

Because the sample of survey respondents could not be determined to be representative of surveyed non-respondents, extrapolating survey results to the universe of 183 companies was not possible. However, for scenario purposes, **Appendix E** presents results of an extrapolation exercise yielding results based on an assumption that data for non-respondents mirrored that of respondents.

Because of the challenges inherent in isolating impacts that are the direct result of UB support,[4] the analyses generally reflect total company employment, revenue and spending rather than any portion determined to be directly attributable to the UB-industry collaboration. The only exception was for Computer Task Group (CTG). Because only a small portion of CTG's workforce (80 out of 3,085 total employees) has been affected by the company's partnership with UB, the analysis included only these employees. Accordingly, because the 80 employees represent 2.5% of the company's total employment, the study included 2.5% of its spending and revenues, a reasonable assumption given that employee wages represented the large majority (75%) of total company spending by CTG.

[4] Even with companies incubated at UB, the connection between cause and effect gets blurry over time. Typically an array of factors (e.g., a good idea along with adequate funding, talent to implement the idea, connections with potential consumers) drive significant business growth and success, making it difficult to determine that any one factor is wholly responsible for outcomes.

IV. Summary of Findings

a. Seeding Innovation Enterprises

183 UB-Industry Partnerships Identified for This Study

148 through STOR

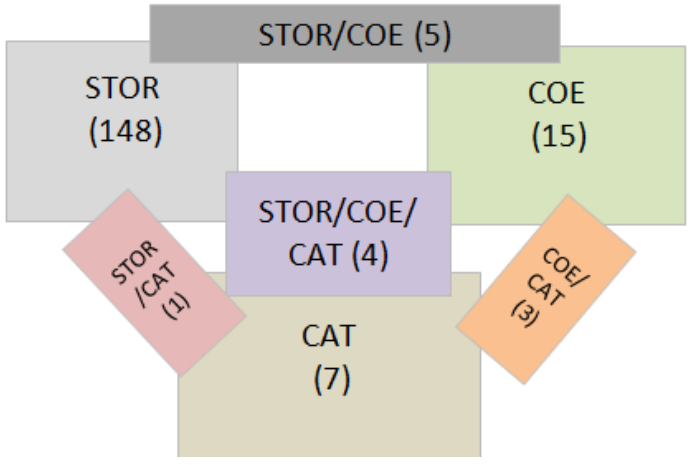
25 through COE/CAT

10 through both STOR and COE/CAT

The selected business partnership activities of three UB units—STOR over the past 25 years and COE and CAT since the new millennium—yielded a sample of 183 companies that have partnered in some way with UB. These companies are diverse, running the gamut from those readily recognized for their innovative new products (SmartPill and its GI Monitoring System, for example) to smaller, up-and-coming firms that might well have the next generation's miracle pill in the making. Some, including Electrocell and Oncology Research Therapeutics, were incubated by the university; others connected to UB in different ways, including licenses, office space, funding support, and business development assistance. Many focus on life sciences and biotechnology research (CH3 Biosystems and Oncology Research Therapeutics are examples); others, such as ONY, perform pharmaceutical manufacturing, marketing, and sales in addition to research. Whereas some are mature companies with dozens of employees (SAMCO and ONY), others have yet to reach a stage in which they generate enough revenue to support more than one or two core employees.

The 183 UB-Industry Partnerships by the Numbers

(The numbers in parentheses represent the number of companies, out of the 183 surveyed that have partnered with the university through STOR, COE, CAT or a combination of these.)



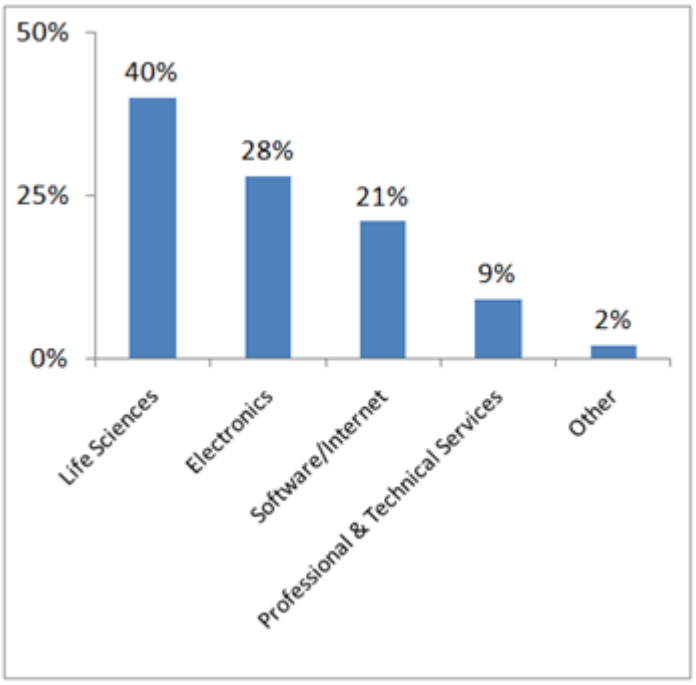
Roughly four-fifths of the surveyed companies came from STOR which provides incubator services to companies just getting off the ground as well as licenses to university intellectual property and other business support and development services. About half of these connections with STOR reflect

companies that were clients of STOR's incubator program for emerging businesses. Fifteen percent of the studied partnerships have been with the COE, and about 5% of UB-industry partners studied have utilized the UB CAT program, which fosters the creation and expansion of life sciences companies through competitive funding awards and other research and business support services.

Out of the 183 companies identified for this study, the 139 still-active businesses span the globe from the university's backyard in Amherst and Buffalo to nations in Asia. The majority of surveyed firms (75%) are located in New York State with most of these (nearly nine out of 10) in Western New York and many located near UB campuses. About one in five companies operate within the United States outside New York, most commonly in California (7 companies), Pennsylvania (4 companies) and New Jersey (4 companies). The final 5% of companies operate outside the country in Canada, Japan, Ireland, Poland and France. That the large majority of partner firms are located not far from UB speaks to the university's value as a hub for selected industry clusters where research and innovation are facilitated by geographic proximity.

Three out of four companies identified for this study are located in New York State with the overwhelming majority of these (nearly 90%) right here in Western New York.

The large majority of survey respondents (N=47) are life sciences and technology firms.

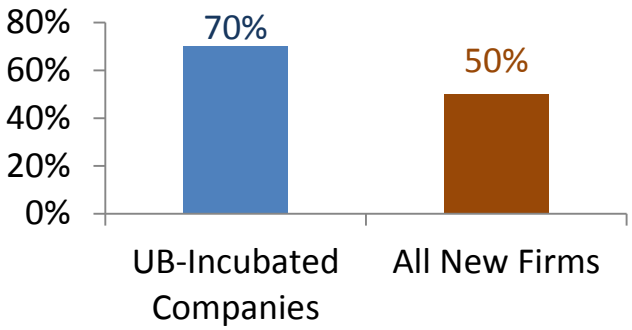


Survey results reveal that an estimated 40% of the businesses are life sciences companies involved in biomedical research, pharmaceutical production, and medical product design and manufacturing. This industry cluster is a target sector for growth in the Western New York economy by organizations such as the Buffalo Niagara Enterprise and others that address business attraction and retention issues.

Slightly over one-quarter of the firms are nonmedical technology businesses involved in the research, design and production of high-tech electronics and components, such as sensors, control equipment, and electronic products. Roughly one in five are software/Internet development companies, while nearly one in ten provide specialized professional and technical consulting services, such as bioengineering, licensing and procurement.

More notable than the sheer number of companies seeded and supported through this sample of UB partnerships is their relative success. The data reveal that an estimated 70% of companies that have been clients of STOR's incubator program are still in operation. This compares favorably to the 50% five-year survival rate for small businesses across the nation,[5] suggesting that the array of services provided to incubator clients at UB prove critical to their longer-term economic survival.

The survival rate of UB-incubated firms is significantly higher than that for all new firms across the nation.



[5] See Small Business Administration, "Frequently Asked Questions," September 2009, online at http://www.sba.gov/advo/stats/sbfaq.pdf.

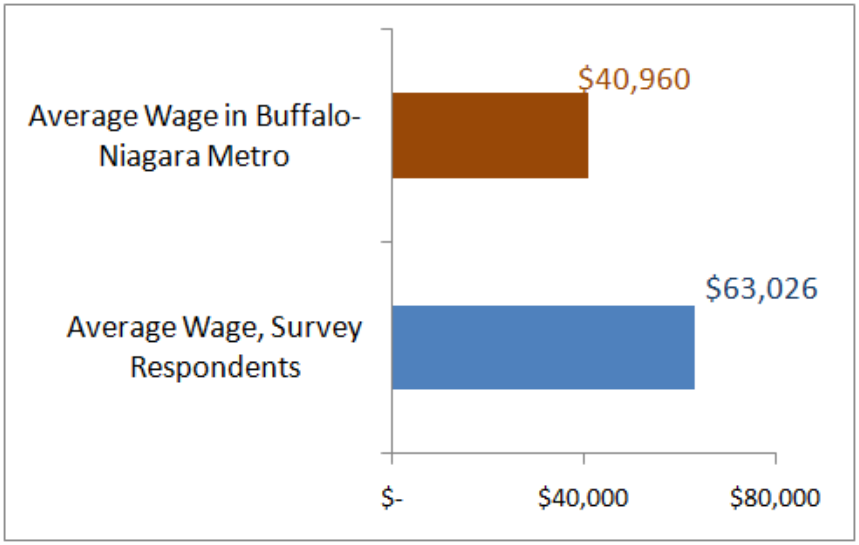
b) Building an Innovation Workforce

Innovation companies partnering with UB are contributing to the region's economy. The COE operations plus the 47 companies responding to the survey employ 1,111 workers. 90% of them are full time.

	47 Survey Respondents + COE
Employment *(full and part time)*	**1,111**

Employment at these responding companies ranges from a small handful of employees to over one hundred. Most, 75% in all, are small with fewer than 25 employees each. Only 5% are large, yet these big employers in the sample of survey respondents, including Trek, Reichert, Kistler Instruments, Computer Task Group, and CUBRC, account for one-quarter of employment reported. This trend holds across the region's economy as a whole, where small employers account for the majority of firms but represent a disproportionately smaller share of total employment.[6]

The average wage of survey respondents is significantly higher than the average wage across all occupations in the region.



Jobs created by UB's innovation partners, which range from scientists and biotechnicians to packers, tend to pay well. The average annual wage across the 47 companies and the COE is $63,026 per full-time employee or equivalent. This is over $20,000 higher than the Buffalo-Niagara metropolitan average annual wage in 2009 of $40,960, reflecting the average mix of jobs in the economy.[7] It

[6] Analysis of regional data from the Quarterly Census of Employment and Wages for 2009 shows that over 90% of firms are small (with fewer than 50 employees) but account for less than half of all employment in the region.

is also nearly double the $35,400 average annual wage for the declining number of production jobs in the region.[8]

c) Fueling the Regional and State Economy

Revenues: Business revenues demonstrate the impact of total dollars generated by innovation companies. These commonly represent the influx of new dollars to a region's economy, meaning they would not be here if the company did not exist or was located elsewhere. UB's innovation partners responding to the questionnaire (including the COE's core operations) reported $186 million in recurring revenues from product and service sales, government contracts, investment returns and other recurring sources.[9]

	47 Survey Respondents+ COE
Revenues from product sales, government contracts, investments and other recurring sources:	**$186 million**

Three-quarters of recurring revenues were reported by companies located in New York State. Roughly 90% of these revenues came from out-of-state investors, customers and other sources. These new dollars would likely not be here but for the companies.

Survey data reveal great variance in company revenue levels, characteristic of the very different financial makeup between firms focused on research and those that have successfully turned research into a product that sells. One-fifth of companies completing the survey reported $0 in recurring revenue, an indicator that these firms are focused primarily on product development

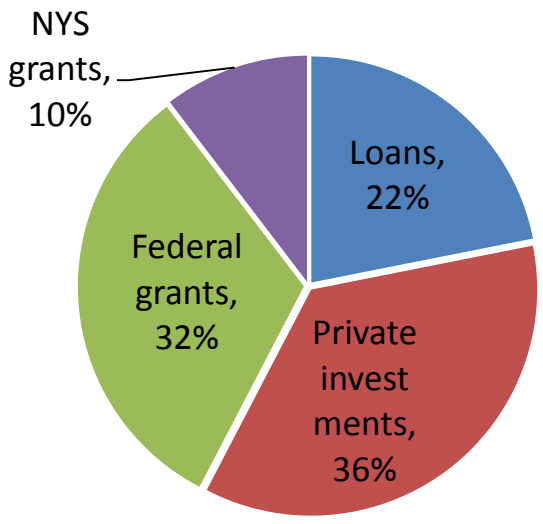
[7] This is the average wage across all occupations in the Buffalo-Niagara Metropolitan Area in 2009, as provided by the U.S. Bureau of Labor Statistics.
[8] The average annual wage across survey respondents was calculated by dividing total wages reported by total full time jobs. Two part-time jobs were treated as one full-time equivalent for purposes of this calculation.
[9] Four of the 47 companies responding to the questionnaire did not report revenues (even though they reported employment), either because these figures weren't available or they had privacy concerns.

and do not have a product on the market yet. The other four-fifths reported at least some recurring revenues. The median for the group was $200,000. One in four respondent companies reported at least $5 million in recurring revenues, an indicator they have a successful product on the market.

	47 Survey Respondents + COE
Revenues from public and private grants, investments, loans and other one-time sources over past 5 years:	**$163 million**

Nonrecurring, one-time revenues received over the past five years totaled $163 million for survey respondents. Nonrecurring revenues are a vital indicator of the capacity of businesses to attract strategic investments from government and the private sector in the form of gifts, grants, investments and loans. While utilized by companies of all sizes, these investments are especially critical during the research phase of product development for start-up firms when both costs and risks are high and the company has not yet generated a product to sell to support itself.

Strategic investments come primarily from private investors and federal grants. These two sources accounted for two out of three one-time dollars received over the past 5 years.



A fifth of UB business partners responding to the questionnaire are surviving on these one-time revenue sources alone; they had no regular, recurring income in their last fiscal year. At the other extreme, nearly one-quarter of respondents attracted no strategic investments over the past five years, suggesting that if these companies are engaged in R&D, such support comes from profit from product sales.

Survey findings reveal that the biggest backer of survey respondents is private investors, which have contributed venture capital, angel funding, foundation grants and individual investments. These represent over one-

third (36% or $59 million) of all one-time revenues reported for the past five years. The federal government grants were the second largest investor for responding companies. Federal grants to respondents amount to $52 million or 32% of total one-time revenues. Loans comprised about one-fifth of one-time dollars received, while NYS invested a relatively small 10% of the total.

Slightly more than half of this one-time revenue—53%—was new to New York State, meaning that if these survey respondents were located outside the state or did not exist, this money would probably not be in the region. The loss attributable to just the survey respondents would be $87 million over a five-year period.

Spending: While revenue analysis reveals the source of investments into innovation, spending analysis tells a story of how and where innovation companies are investing. Companies responding to the survey together with the COE reported $179 million in spending during their last fiscal year.

	47 Survey Respondents + COE
Total Company Spending	**$179 million**

Roughly 60% of this was spent in New York State and almost half in Erie and Niagara counties. (These percentages include the relatively small proportions of local spending done by out-of-region and out-of-state companies.) Employee wages represent 38% of spending.[10] Other major purchases of research and development companies can include business and lab space, computer services, utilities, and scientific consulting services and other expenditures.[11]

[10] The proportion of spending on wages reported by company respondents varied widely from a low of 10% of total company spending to a high of 85%.

[11] These examples come from IMPLAN matrices which trace dollars from one industry such as scientific research and development to others that provide supporting products and services. The questionnaire used for this study did not ask companies for a breakdown of their expenditures, so specific expenditure items responding companies are not available.

Economic Impact: The economic impact of spending by responding companies is greater than their direct spending and employment in the region and state. Direct spending supports additional rounds of indirect and induced spending as company suppliers and workers make purchases with money received from the companies. This is known as a multiplier effect.

The total dollar economic impact, including impacts generated in successive spending cycles, of the COE and respondent companies is $176 million in New York State, with three-quarters of this accruing to Erie and Niagara counties.

	47 Survey Respondents + COE
Economic Impact in NYS	**$176 million**
Economic Impact in WNY	**$134 million**

The return on New York State's investment in UB cannot be reliably calculated. It would require an assumption that state money appropriated to UB and the COE, which support university-based research as well as STOR and COE's operations, can be specifically linked to the economic impact of university-industry partnerships. Moreover, because 90% of state dollars reported went to the COE, the impact on STOR and COE/CAT companies is impossible to credibly determine.

V. Insights and Recommendations

Because this initiative establishes a baseline for future expansion of the study scope to additional UB-industry partners, this report offers insights and recommendations to facilitate data and information gathering and increase the accuracy of impact measurement.

1. **Relationships with UB-industry partners.** The lack of current contact information for several companies suggests that some have not been contacted by the university as a UB-industry partner for some time. Additionally, conversations with industry partners during the data collection phase indicated that some no longer see themselves as a UB-industry partner. The pattern of survey responses showed that companies with closer connections to UB were more apt to be engaged and complete a questionnaire. Due to the nature of research, product development and commercial success, companies may be satisfied by the immediate and short-term gains of university-industry partnerships. From the university's perspective, however, this relatively short-term relationship sacrifices longer term, collective gains that are possible from maintaining university-industry connections. It appears that UB may not be fully capitalizing on the potential longer-term value associated with industry connections.

   Recommendation: Revisit partnerships with industry to determine where maintaining ongoing interactions could be worthwhile. Maintaining and deepening selected relationships past the point of formal or contractual partnerships recognizes the value these industry partnerships bring. Stronger, ongoing connections would improve data collection efforts for analyses requiring partner data and increase the fold of potential UB advocates and donors. Maintaining connections will not be a "one-size fits all" plan. Rather, a successful strategy will recognize the different needs and commitments of company subgroups in which the university invests (e.g., life sciences versus high-tech; small versus large, within-region versus beyond-region) and the kind of informal connections these companies value most, particularly ones that would facilitate better outcomes for the companies.

2. **Tracking UB-Industry Partners.** Creating a database of current contact information for this study's UB's industry partners was a significant and time-consuming element of this study. UB's lack of a consistent process for updating, verifying and maintaining information with industry partners, particularly former ones, will continue to hamper innovation impact and other UB efforts

involving these companies and others that were not included in the current study but will be in the future. While COE, CAT and STOR (and perhaps other UB units with industry connections) have records on current partner companies, regularly verifying and updating information for "alumni" companies is not a systematic, routine or a funded part of these operations.

Recommendation: Implement a process for maintaining current contact and other information on UB-industry partners. A consistent, centralized process for keeping company information up to date, past the point of formal connections, would enable the university and any unit within UB to readily report on its business partners by connection point, and would greatly facilitate getting in touch for events, conferences, news articles, research projects, or studies of this kind.

3. **Innovation Impact Data Management.** Some UB partner companies are approached multiple times during the year by different UB units to gather similar kinds of data. This practice not only burdens companies—particularly small ones without sufficient support staff—it also compromises the success of any single data collection effort and frustrates successful relationship building. This impact study envisioned the creation of a centralized innovation impact data management system that would efficiently gather and manage data needed for both economic impact analyses and STOR's, COE's and CAT's regular reporting requirements to New York State and national associations. Although the current effort successfully built a data management system, the user interface and storage components are limited to economic impact data needs and do not include additional data collected by COE and needed for its reporting. Because of historic difficulties obtaining required data from its partners, the COE has evolved a data collection process involving personal contact and conversations with partner companies, as well as an approved letter template for CAT companies per NYSTAR requirements. Committing to an online or electronic data collection system, while more efficient, was thought by COE to potentially hamper its current practice based on personal contacts. As a result, numerous UB partner companies will continue to be approached by UB more than once annually for roughly similar data. This challenge can be expected to grow as additional UB industry partnerships are added to the study over future years, since there are other units of the university that also interact with businesses and may seek data from them.

Recommendation: Pursue a centralized system for impact and related data from business partners. Pursuing a centralized and streamlined impact data collection process would minimize the burden to companies of data reporting, thereby improving data quality and UB-partner relations. One model would be an initial baseline "data ask" responded to via an online system. Because the system would store prior data, companies would need to simply review and update the current record, recording changes when appropriate. The fact that nearly all surveys completed for the current impact analysis were submitted through the online system, as opposed to the print or phone formats available, suggests that companies prefer online mode for submitting data. In this light, each UB unit seeking data—COE, STOR, External Affairs, and others—would benefit from joint participation in a centralized impact data management effort, an innovation that would not preclude continued personal or other contacts with partner companies. Notably, realizing the greatest value of a central system requires participation from all UB units regularly seeking data from partner companies.

4. **Scope of Data Collection.** The goal of this study was as close to one hundred percent response rate as possible, a goal based in a belief that partner companies would readily comply with a parsimonious data request. The 34% survey response rate indicates the need to rethink UB's relations with partner companies as discussed above. It also suggests that the survey, while modest in length at 2.5 pages, was too long or probing to elicit company response, indicating the data elements the university attempts to collect from companies might be further prioritized and reduced. While a study based on less company-specific data will reveal less information about these partnerships, higher survey response rates will provide more complete results on the selected impact elements the university cares most about.

Recommendation: Revise the survey to request the minimum of data necessary for impact analysis and reporting requirements, estimating additional impacts where possible and appropriate. Tying data collection to specific reporting goals and audiences could increase response rates. For example, UB interest in reporting on its role in job creation and development of selected industries may be satisfied by collecting only job numbers and industry sector data from partner companies. Additional impact measures could then be estimated using publically available data such as average wages across selected sectors of the

region's economy or average sales per firm in selected industries. While this approach requires estimation, it might result in a greater response rate without compromising reporting goals.

5. **The Full Picture of UB-Industry Innovation.** The sample of companies selected for this study reflected just a subset of all of UB industry connections and therefore underrepresents the university's full role in and contribution to innovation. There are connections made by COE and CAT there weren't included in this study. Moreover, there are industry connections made by units other than STOR, COE and CAT across the university that contribute to innovation but were not included such as those forged by The Center for Industrial Effectiveness (TCIE) and the Center for Inclusive Design and Environmental Access (IDEA).

   Recommendation: Map out of the full picture of innovation at the university and develop a plan for capturing all appropriate connections over a multi-unit effort. To accomplish this, it is recommended that criteria be developed for inclusion as a UB-innovation partnership. A standardized definition applied across the range of UB units and their industry connections will be important to the COE as it considers broadening the scope of companies it includes for impact analysis for this study. It will also assist other units at UB for which innovation is less integral to the units' overall mission.

6. **Parsing Partnership Impact from Partner Impact.** The focus of this current impact analysis was to assess the collective impact of UB innovation partner companies on the state and region. Conversations through the project revealed an additional unrealized interest in isolating how much of partner companies' impact stems directly from their partnership with UB.

   Recommendation: Consider a follow-up study to isolate the impacts of UB-industry partnerships. Such an effort could be approached as an extension of the current study, specifically asking companies to quantify what percentage of their current operations is attributable to the support provided by UB. Companies may be able to estimate whether, say, a license to UB technology was successful and how much of total product sales it now generates originates in UB assistance. Targeting this facet of impact analysis would be particularly useful as the scope and nature of UB partner relations broadens in future iterations through inclusion of operations such as the Center for Industrial Effectiveness, Center for Assistive Technologies and Center for Inclusive Design and Environmental Access, which may interact with industry

partners in distinct ways. The impact data collected by the COE and CAT, which allows companies to self-determine the portion of their performance attributable to the relationship, could serve as a starting point for such a study.

7. **Economic Footprint of Innovation Partners.** The data gathered by this study reveal that companies' economic impact tends to be greatest in their host community. This location is where the company operates, attracts revenues and makes investments; it is also where their employees work and live. If regional and statewide impacts are a priority of UB, partnerships should target companies located in these areas. The most valuable enduring connections the university might foster would be the ones providing companies with an ongoing incentive to stay local.

   Recommendation: Consider opportunities to maximize regional and statewide impacts through university investments into partnerships with industry, knowing that companies that are located within and do more of their spending in the study area have greater impacts. All else equal, this means, for instance, selecting to connect with companies located in Western New York or New York State, over ones that are not, where this option is available. It might mean also considering the allocation of university resources to foster greatest investments into partnerships with companies more likely to stay local.

VI. Appendices

A. Selected UB-Industry Partners

The study identified 139 active UB-innovation industry partners, listed below. Included is information on the nature of the partnership and the company location. Companies are arranged according to their linkage with the university. The 19 that have partnered with the COE are shown first, followed by the 106 with partnerships with STOR. The final 14 have more than one kind of connection with UB.

UB-Industry Partner	Type of Partnership	STOR Incubator	City	State	Country	In Western New York
AndroBioSys, Inc.	COE		Buffalo	NY		X
Buffalo BioSciences, LLC	COE		Buffalo	NY		X
CUBRC, Inc.	COE		Buffalo	NY		X
Diagnaid, Inc.	COE		Williamsville	NY		X
Greatbatch Medical, Inc.	COE		Clarence	NY		X
Harvest Precision Components	COE		Buffalo	NY		X
Health Transaction Network	COE		Williamsville	NY		X
Nutricyte Corporation, Farmis,	COE		Sanborn	NY		X
Orius Innovations	COE		Buffalo	NY		X
SAMCO Technologies	COE		Buffalo	NY		X
Therex, LLC	COE		Buffalo	NY		X
Air Innovations, Inc.	COE		North Syracuse	NY		
Atlantic Corridor, USA	COE		Tullamore	County Offaly	Ireland	
Blue Highway, LLC	COE		Syracuse	NY		
Diffinity Genomics	COE		West Henrietta	NY		
MedGraph, Inc.	COE		Rochester	NY		
New Scale Technologies	COE		Victor	NY		
PharmIdeas USA, Inc.	COE		Oakville	ON	Canada	
SensGard	COE		Pittsford	NY		
3RDL (3rd Learning)	STOR		Buffalo	NY		X
Absolute Energy	STOR	X	Grand Island	NY		X
Academic Management System	STOR	X	Amherst	NY		X
Advanced Cytometry Instrumer	STOR	X	Amherst	NY		X
Aerostar Group	STOR	X	Amherst	NY		X
Aquasol Corporation	STOR	X	North Tonawanda	NY		X
As It Is, Inc.	STOR	X	Amherst	NY		X
ATTO Technology, Inc.	STOR	X	Amherst	NY		X
BioClay (Austin Research Labs)	STOR		Buffalo	NY		X
Buffalo Computer Graphics	STOR		Blasdell	NY		X
C.J. Brown Energy, P.C.	STOR	X	Buffalo	NY		X
CarShare	STOR		Buffalo	NY		X
CedarTech	STOR		Williamsville	NY		X
Conserval Systems, Inc.	STOR	X	Buffalo	NY		X
Conway Process Equipment Co	STOR		Williamsville	NY		X
Dakmed, Inc.	STOR	X	Buffalo	NY		X
Dynavox	STOR		Pittsburgh	PA		X
EB Associates Laboratories Inc	STOR	X	Williamsville	NY		X
Ecosponsible	STOR		Amherst	NY		X

UB-Industry Partner	Type of Partnership	STOR Incubator	City	State	Country	In Western New York
Electrocell	STOR	X	Amherst	NY		X
Fredwal, Inc.	STOR	X	Lockport	NY		X
Gencyte, LLC	STOR	X	Buffalo	NY		X
Gene OB	STOR		Amherst	NY		X
Glassline	STOR	X	North Tonawanda	NY		X
GSE Learning Software	STOR	X	Amherst	NY		X
Hotel Solutions (Lorica Solutio	STOR		Buffalo	NY		X
HVR Advanced Power Compone	STOR	X	Tonawanda	NY		X
Hybrid Technologies	STOR	X	Amherst	NY		X
Imagination Software Corp.	STOR		Buffalo	NY		X
iNetworkUSA	STOR		Buffalo	NY		X
Integral Information Systems	STOR	X	Buffalo	NY		X
Integument Technologies, Inc	STOR		Tonawanda	NY		X
Kristal Systems, Inc. (Kistler In	STOR	X	Amherst	NY		X
Laser Photonics Technology	STOR	X	Amherst	NY		X
LifeCell DX	STOR		Buffalo	NY		X
Lynx Technologies Inc.	STOR	X	Grand Island	NY		X
Medical Acoustics, LLC	STOR		Buffalo	NY		X
Mika Trading	STOR	X	North Tonawanda	NY		X
Northeastern Biomechanical M	STOR		Buffalo	NY		X
Numitec	STOR	X	Amherst	NY		X
OmniPharm Research Int'l, Inc	STOR	X	Buffalo	NY		X
Oncology Research Therapeuti	STOR	X	Amherst	NY		X
P.C. Assistance, Inc. (The PCA G	STOR	X	Buffalo	NY		X
Pneuma Partners (Pneuma Pha	STOR	X	Amherst	NY		X
Quality Inspection Services	STOR	X	Buffalo	NY		X
Radar Test Labs (Esensors)	STOR	X	Amherst	NY		X
RCS Performance Systems, Inc.	STOR	X	Buffalo	NY		X
Recra Environmental, Inc. (Test	STOR	X	Amherst	NY		X
Reichert	STOR		Depew	NY		X
Si-Revolution Solar Co.	STOR		Buffalo	NY		X
Snyder Seed Corp.	STOR	X	Buffalo	NY		X
Sprung-Brett RDI	STOR	X	Amherst	NY		X
SSL Industries	STOR	X	Amherst	NY		X
Tactus Technologies	STOR		Getzville	NY		X
Talker, Inc.	STOR		Cheektowaga	NY		X
Technicor, Inc.	STOR	X	North Tonawanda	NY		X
Teeter Marketing Services LLC	STOR	X	Sanborn	NY		X
The Randforce Associates	STOR	X	Amherst	NY		X
TheraSyn DM, LLC	STOR		Buffalo	NY		X
Therex Technologies	STOR	X	Buffalo	NY		X
Universal Coherence Imaging	STOR		Buffalo	NY		X
Veritay Technologies, Inc.	STOR	X	East Amherst	NY		X
Virmatics	STOR	X	Buffalo	NY		X
Vocal Technologies, Ltd.	STOR	X	Amherst	NY		X
Waste Stream Technology, Inc.	STOR	X	Buffalo	NY		X
WeLanguage	STOR		Buffalo	NY		X
Zenhire	STOR	X	Amherst	NY		X

UB-Industry Partner	Type of Partnership	STOR Incubator	City	State	Country	In Western New York
ABG (American BioHealth Grou	STOR		San Diego	CA		
Bio Med Sciences, Inc.	STOR	X	Allentown	PA		
Bion Technologies, Inc.	STOR	X	New York	NY		
Chakra Biotech	STOR			SINGAPORE		
Chemicon (Millipore Bioscienc	STOR		Temecula	CA		
Chodorow Associates, Ltd.	STOR	X	Beverly Hills	CA		
CPF Medpath (Quest Diagnosti	STOR	X	Maddison	NJ		
Daedalus Innovations	STOR		Philadelphia	PA		
DINE Systems, Inc.	STOR	X	Wilmington	NC		
Dynamic Eye	STOR		Pittsburgh	PA		
Ecostar, LLC	STOR	X	Holland	NY		
EOI	STOR	X	Hauppage	NY		
Gilead Sciences, Inc.	STOR		Foster City	CA		
GreaterBuffalo.com	STOR			NY		
IRIS	STOR		Delray Beach	FL		
Machine Perception Laborator	STOR		La Jolla	CA		
Med1 Medical	STOR			TX		
Mentor Café	STOR					
NanoAxis	STOR					
Nanobiotix	STOR		Paris	Paris	FRANCE	
NuvOx Pharma, LLC	STOR		Tucson	AZ		
Oncologics	STOR		Lafayette	LA		
OsteoInvent Biologics	STOR		Long Island City	NY		
PeptiDream	STOR		4-6-1 Komaba, Me	Tokyo	JAPAN	
Productivity Mgt. Grp. (Gartner	STOR	X	Stamford	CT		
Scivanta Medical Corp	STOR		Spring Lake	NJ		
Simulated Surgical Systems	STOR					
Sleep Solutions	STOR		Glen Burnie	ML		
Solco Basel, inc.	STOR	X	Warszawa		Poland	
Solexant	STOR		San Jose	CA		
Strem Chemicals	STOR		Newburyport	MA		
Tel-Instrument Elecs, Inc.	STOR	X	Carlstadt	NJ		
Tempo Pharma (Cerulean Phar	STOR		Cambridge	MA		
TeraSpecter	STOR		HIGHLAND PARK	NJ		
Trek, Inc.	STOR	X	Medina	NY		
UNIDYM	STOR		Sunnyvale	CA		
Velosum	STOR		Sandy	UT		
Wallace Wireless	STOR	X	Toronto	ON	Canada	
YSI	STOR		Yellow Springs	OH		
ONY	STOR/CAT	X	Amherst	NY		X
The SmartPill Corporation	STOR/CAT		Buffalo	NY		X
Pill Crusher Ventures, LLC (Firs	STOR/COE		Batavia	NY		
Buffalo BioBlower	STOR/COE/CAT		Buffalo	NY		X
CH3 BioSystems	STOR/COE/CAT		Amherst	NY		X
Kinex Pharmaceuticals	STOR/COE/CAT		Buffalo	NY		X
ZeptoMetrix	STOR/COE/CAT		Buffalo	NY		X
First Wave Technologies	STOR/COE/CAT		Batavia	NY		
Medical Conservation Devices	STOR/COE/CAT		Batavia	NY		
Applied Health Resource Mana	COE/CAT		Buffalo	NY		X
Computer Task Group, Inc.	COE/CAT		Buffalo	NY		X
Empire Genomics, LLC	COE/CAT		Buffalo	NY		X
Menai Medical Ltd.	COE/CAT		Buffalo	NY		X
TheraSyn Sensors, Inc.	COE/CAT		Amherst	NY		X

B. Business Questionnaire

INNOVATION IMPACT

University at Buffalo
The State University of New York

Thank you for taking the time to tell us about your business.

For questions, please contact
UB Regional Institute at (716) 878-2440.

Please complete and return by
April 23, 2010

UB Regional Institute
The State University of New York
UB Downtown Gateway
77 Goodell Street, Suite 302
Buffalo, NY 14203

E-mail: regional-institute@buffalo.edu
Fax: 716-842-0154

Introductions

Name of person completing survey
(Please enter your first and last name.)

Title

Please describe
the primary **nature of your company's business**
(e.g. life sciences research, software development, medical manufacturing)

Employment is a key indicator of a thriving economy. Please tell us about your workforce:

Include all paid employees; do not include unpaid volunteers or interns.

How many employees work full time at your company?
(Full time is 32 hours or more a week.)

How many part-time employees do you employ?
(Part time is less than 32 hours a week.)

Business spending helps tell the story of how innovation companies are investing in the region.

From your last completed fiscal year.

What was your company's **total spending** last year? $

This is the amount your company spent on everything from wages, benefits and rent to utilities, lab equipment and more.

Please estimate **what percentage of your total spending...**

...was on employee wages. %

Employee wages should include only wages and salaries paid to employees and should not include the cost of employee benefits or employee-related taxes paid by your company.

Please estimate **what percentage of your total spending...**

...occurred in Erie and Niagara Counties. %

Spending within Erie and Niagara Counties includes amounts paid to an office within this area, even if that business's core operations are located elsewhere.

...occurred in NYS. %

In-state spending should include amounts paid to an office within New York State, even if that business's core operations are located outside New York.

Business revenues show the impact of total dollars generated by innovation companies. Understanding the percentage of revenues from outside NYS demonstrates the influx of new dollars to this region.

Recurring Revenues

From your last completed fiscal year.

How much in **revenues did your company generate last year from recurring sources** such as product and service sales, government contracts, returns on investment, etc.? $ _____

Include revenues from year-to-year revenue sources. Do not include one-time revenue sources such as grants, gifts, loans or venture capital.

Approximately **what percentage of these revenues...** **...were from sources outside NYS.** _____ %

Out-of-state revenues include those generated from buyers and other purchasers located outside New York State.

Non-Recurring Revenues

Non-recurring revenues are a vital indicator of the capacity of businesses to attract strategic investments. Information on the nature and source of these investments helps portray the landscape of support in the innovation sector.

From your last FIVE completed fiscal years.

How much did your company obtain in **private investments**? $ _____

Private investments include venture capital, angel funding, foundation grants and other individual investments. Do not include funding from public (federal or state) sources.

Approximately **what percentage of these private investments...** **...were from sources outside NYS.** _____ %

How much did your company receive in **federal grants?** $ _____

Grants are unlike loans and do not need to be repaid. Include all federal grants, even those that might have been restricted to specific purposes or programs. Do not include federal funding that benefited primarily the funder.

How much did your company receive in **New York State grants?** $ _____

Include all state grants, even those that might have been restricted to specific purposes or programs. Do not include federal funding that benefited primarily the funder.

How much did your company obtain in **loans?** $ _____

Loans are funding that will be repaid.

Approximately **what percentage of these loans...** **...were from sources outside NYS.** _____ %

Share your success story.

Beyond the numbers, please **share your success stories with us.** Feel free to provide any additional documents that help us understand your company's achievements and accomplishments.

C. President's Letter to Companies

March 10, 2010

NAME
ADDRESS

Dear :

I write to request your participation in an important University at Buffalo initiative to assess the impact of university-industry collaboration in our region.

As the leader of a company that has partnered with UB, you certainly understand and appreciate the positive impact university-industry collaboration can have throughout Western New York. Now more than ever, UB-industry partnerships—in research, education, and technology transfer—are driving innovation and supporting our region's growing knowledge economy. Furthermore, the impact of these partnerships and other joint initiatives can be seen in the form of new enterprises, technologies, and jobs.

Now, however, we require a more objective understanding of the economic returns of these partnerships and our other joint programs with business and industry. In fact, we need this detailed assessment if we are to secure investment and support for continued university-industry collaboration. I have therefore asked the University at Buffalo Regional Institute—a research and public policy center within the university—to administer this initiative, which we are calling "Innovation Impact." Over the next week or two, representatives of the Regional Institute will contact you to provide further details about how you can participate and to describe the kind of information being sought.

I believe that Western New York is at a pivotal time, with its economy rapidly evolving for success in the 21st century. As part of the UB 2020 strategic plan, we are committed to driving economic growth through expanded industry partnerships that will position our community as a hub for research and innovation. Your participation in "Innovation Impact" is critical to demonstrating the precise role university-industry innovation plays—and will continue to play—in our region's economic future. While I appreciate that participating in "Innovation Impact" will take brief time away from your business responsibilities, I hope that you will provide your knowledge and perspective to help us achieve these larger goals.

Thank you for your consideration of this request. I look forward to our continued partnership, as together we strive for the innovation and growth Western New York so needs and richly deserves.

Sincerely,

John B. Simpson
President

D. Impact Data Summary

	Questionnaire Results			Total from Questionnaire[2]
	UB Center of Excellence	COE/CAT Partners (12 companies)	STOR Partners (38 companies)	47 companies + COE
Employment (full and part-time jobs)	28	401	726	1,111
Wage (average)	$73,571	$69,157	$58,464	$63,026
Spending	$10,300,000	$64,718,505	$112,909,999	$178,988,504
in NYS	$8,240,000	$51,653,797	$50,965,174	$105,050,062
in WNY	$7,210,000	$37,117,686	$40,133,288	$79,130,466
Estimated Annual Economic Impact (of companies located in Western New York and/or New York State)				
on NYS	$15 Million	$92 Million	$78 Million	$176 Million
on WNY	$11 Million	$68 Million	$68 Million	$134 Million
Revenues				
Recurring	$7,300,000	$56,330,808	$105,605,603	$185,883,860
Non-recurring (over past 5 years)	$30,000,000	$47,673,195	$90,165,496	$163,438,625
UB-Industry Partners (excludes UB COE)				
Number		12	38	47
Location				
in WNY		8	26	33
in NYS		12	28	38
Company Size				
small business (<25 employee)		6	30	34
medium sized (25-99 employee)		5	7	11
large (>99 employee)		1 (CUBRC)	1 (Reichert)	2
Industry Sector				
Drug/Medical/Biotech		8	14	19
Electronics		2	11	13
Software/Internet		1	9	10
Services		0	4	4
Other		1	0	1

[1] The total represents less than the sum across COE, COE Companies and STOR Companies because of overlap between COE and STOR companies. Some companies have partnered with both COE and STOR and are included in both of these respective columns. However, companies are counted only once for purposes of tabulating totals from the questionnaire.

E. Hypothetical Exercise

The findings presented in this report underestimate the full impact that the companies selected for this study are having on the region and state. Because there is value in assessing what results would be if all 139 active companies completed a questionnaire, we extrapolate here the findings associated with the 47 survey respondents to the full group of 139 companies and the operations of the COE.

	EXTRAPOLATED FINDINGS
	139 Active Companies + COE
Employment (full and part-time jobs)	3,200
Wage (average)	$59,900
Spending	$531 Million
in NYS	$307 Million
in WNY	$252 Million
Estimated Annual Economic Impact	
on NYS	$540 Million
on WNY	$384 Million
Revenues	
Recurring	$585 Million
Non-recurring (over past 5 years)	$462 Million

As shown in the chart, we estimate that a group of 139 companies that mirrors the survey respondents would generate 3,200 full- and part-time jobs at an average annual full-time wage of $59,000. These companies could be expected to spend over a half-million dollars, and the economic impact of this activity on the economy would amount to $540 million in New York State, with the majority of this ($384 million) accruing to Western New York. These contributions would be made possible by the $585 million in recurring revenues these companies could be anticipated to generate from product and service sales and as well as from other regular income sources, and the $462 they would likely attract from angel investors, venture capitalists, government grants and loans over a five year period.

These numbers provide a hypothetical exercise for what the fuller picture of innovation impact might be had a 100% survey response rate been achieved. The numbers here are not statistically precise estimates, since precision in extrapolation requires that that the population of companies for which we have results (our survey respondents) is representative of the mix of companies that did not respond. Response patterns suggest, however, that this was not the case. The data show that companies that had more recently participated in STOR's incubator program were more likely to respond than those with university connections more distant in time. These recently incubated companies are likely smaller than those that have had years to grow. On the other hand, it might be the case that some companies did not respond because they have not been very successful and had not grown. We do not know the level of imprecision that such biases create and provide the extrapolated results simply as a hypothetical based on the assumption that this study's survey findings are representative.