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Best Practices of Creating Innovation Exchange Web Portals Across the States

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June 9, 2016

**BEST PRACTICES OF
CREATING INNOVATION
EXCHANGE WEB
PORTALS ACROSS THE
STATES**

**CENTER FOR
ECONOMIC
DEVELOPMENT**

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TABLE OF CONTENTS

Introduction	1
Lessons Learned from Existing Portals.....	2
Methodology.....	2
Key Discoveries	4
Public Policy Recommendations.....	33
Appendix 1: Review of academic literature.....	36
References	42

TABLE OF FIGURES AND GRAPHS

Figure 1. Location of Seven Web Portals	3
Appendix Figure 1. University-Industry Collaboration Formation Process and Activities	36
Appendix Figure 2. Dimensions of Success Drivers for University-Industry Linkages across Relationship Phases.....	40

INTRODUCTION

Since their initial development in the late 1990s, expert web portals have been an evolving tool for universities, systems of higher education, and economic development organizations. The web portals are searchable, web-based databases of university scholars and researchers that feature, at a minimum, information on their expertise, innovation products and publications. Many of the portals are growing to include information on universities' physical assets and equipment, regional strengths, and additional services such as networking and analytical tools for research.

Although these searchable databases have proven useful in helping economic development leaders, government, research colleagues, and internal university staff, their role in generating industry-university collaboration is disputable. Recently, more demonstrable and tangible results of deploying innovation and building partnerships from these portals are becoming a sought-after objective for funders and stakeholders. However, none of the portals' administrative teams have been able to specifically measure the impact of interaction generated via the portal on industry or the regional economy at large. Developing and sustaining these tools is costly and time consuming; instead, many stakeholders involved deem them a necessary public good – a “non-rivalrous” and “non-excludable” knowledge resource that everyone can consume with no restrictions. Therefore, evaluation of the return on investment of these portals has been largely ignored by involved parties. This, along with the cost of developing and maintaining such portals, serves as a growing obstacle to sustaining them. It has been argued that unless these portals are specifically designed with industry in mind, they do very little for commercial users.

This report is a summary of the results of a study assessing best practices and challenges facing existing web portals created to promote university resources to a broader audience. It intends to inform interested parties in Ohio about the ecosystems that surround existing web portals in other states. The report analyzes ecologies of existing web portals in other states, addresses the role of “super users” (i.e. organizations that can reach industry users, such as economic development agencies) play in enhancing the successful utilization of a web portal, and considers sustainable funding and training mechanisms surrounding existing web portals.

This study was conducted by researchers from the Center for Economic Development at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. The research was funded by the Ohio Manufacturing Institute of Ohio State University through an Ohio Development Services Agency grant and with input from the Ohio Department of Higher Education Ohio Innovation Exchange industry engagement team.

The study is based on a review of the latest academic literature concerning university-industry relationships, applied and technical reports provided by relevant web portals, and extensive interviews with selected portals' managing teams. Additionally, the report provides a methodology, summarizes lessons learned, and illustrates a detailed description of seven web portals: Florida ExpertNet, Michigan MCRN, New York FuzeHub, North Carolina ReachNC, Texas InFluent, Arizona Experts, and University of California's Technology Transfer. The report concludes with recommendations for developing Innovation Exchange Hub in Ohio and Appendices detailing the literature review.

LESSONS LEARNED FROM EXISTING PORTALS

The development of statewide web tools was inspired by academic research framed along New Growth Theory, which emphasizes endogenous knowledge-based growth as well as multiple anecdotal stories suggesting that university-developed innovation can become a significant source of economic growth. Growing mobility of knowledge and the increased importance of social networks were two other components that motivated public investment in statewide, web-based tools to match university-generated innovation with potential consumers.

In the late 1990s, many states dedicated significant funding to the development of publicly accessible web-based space featuring university experts, innovation and other resources. Learning from their experience, this study takes a methodological approach, using a combination of academic literature findings, open-ended interview responses, and analysis of collected data - leading to the development of a set of recommendations for how to develop the Ohio Innovation Exchange, a state-wide web portal highlighting innovation and other growth-oriented resources across Ohio.

METHODOLOGY

The research team focused on existing web portals in other states to gain insight into a variety of issues associated with creating, managing, and sustaining web portals developed for dissemination of university innovation and collaboration with industry.

The research questions of this study included acquiring the following data:

- Who is the targeted audience of the portal?
- What was the initial goal in creating a web portal?
- Who manages and owns the portal? Who manages and owns the data?
- How was the portal's development funded? How is it financially sustained?
- How is the web portal marketed and promoted for use? Towards what industries and size of companies is it specifically marketed?
- How does the portal leverage "super users" (i.e. organizations that can reach to specific circles of individual users, such as economic development agencies, university commercialization offices, and chambers of commerce)?
- Should university staff be involved in the process of connecting portal users to appropriate university resources (i.e. business-level, or concierge-type services)? If so, what services are provided? Who is responsible for staffing and financing that service?
- How is the portal usage tracked? What metrics are analyzed?
- How is the usage of web portals evaluated? Are there existing practices to calculate a web portal's return on investment?

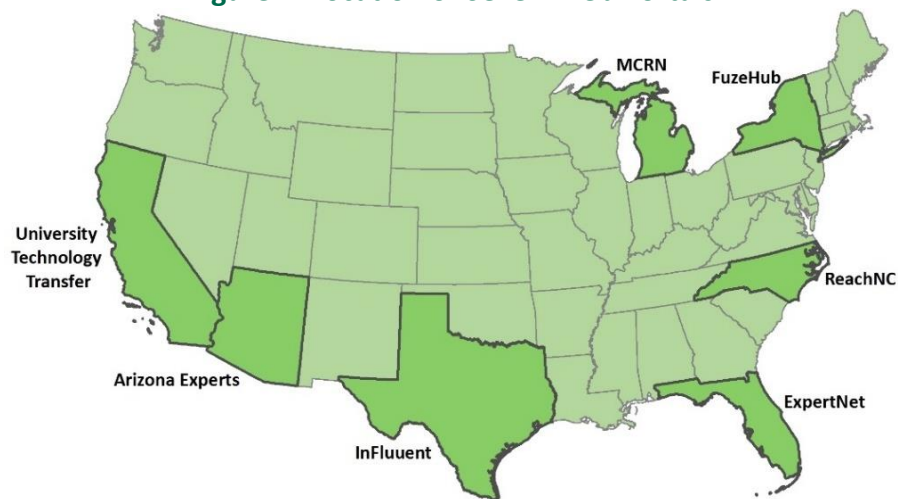
The criteria used to select existing web portals for study were as follows: (1) a web portal should be a statewide web-based tool promoting university innovation; (2) more than one university should be a partner in a portal; and (3) a portal should intend to engage users outside of the university system(s).

In searching for existing web portals that met the defined criteria, the Center’s researchers reviewed 56 public university systems in all 50 states, as well as the websites of 18 state Manufacturing Extension Partnerships (MEP) systems and centers. The MEP centers were narrowed down to states with 250,000 or more manufacturing jobs using 2014 Bureau of Labor Statistics data. The center also surveyed licensing agreements promoted on Elsevier’s website.¹ The search resulted in the selection of seven web portals across the country. In addition to the seven selected cases, there were eight other portals identified that had a searchable web tool shared between two or more universities for either licensed technology or faculty experts. Two institutions, Georgia Research Alliance and the Washington State University system, hold licensing agreements with Elsevier, but their portals are inaccessible to the public, requiring login credentials for access. One press release indicated that New Jersey was building its own web portal, spearheaded by Rutgers, with the collaboration of nine public and private universities.²

The University of Nebraska system³ and the University of Minnesota system⁴ each have system-wide Elsevier-powered portals. Although both portals compile profiles from multiple campuses or medical centers, the flagship campuses are the only ones considered universities of “highest” or “higher” research activity by the Carnegie Classification of Institutions of Higher Education. The research team reached out to the managing parties of the eight web portals.⁵ As a result, ten extensive interviews were conducted on the operation of seven selected web portals:

- Florida ExpertNet
- Michigan MCRN
- New York FuzeHub
- Arizona Experts
- North Carolina’s Reach NC
- Texas InFluent
- University of California’s Technology Transfer

Figure 1. Location of Seven Web Portals



¹ Source: <https://www.elsevier.com/solutions/pure/who-uses-pure/clients>

² Source: <http://rdi2.rutgers.edu/new-jersey-big-data-alliance>

³ Source: <https://nebraska.pure.elsevier.com/>

⁴ Source: <https://experts.umn.edu/>

⁵ Management of Indiana’s INDURE never responded to our request for an interview.

KEY DISCOVERIES

Different states started to develop expert web portals in the late 1990s, with a majority of them launching between the late 2000s and early- or mid-2010s. Of our sample, Florida ExpertNet was the earliest portal, launched in 1999, followed by North Carolina's Reach NC and Michigan Corporate Relations Network more than a decade afterward in 2011. New York's FuzeHub and Arizona Experts were launched in 2013. Texas' InFluuent, the most recently launched portal, launched in 2014.

Goals and Audience

The portals share one or more of three primary goals: (1) creating a web portal as a public good to enhance innovation exchange among universities, companies, government and scientists; (2) establishing a collaboration between universities and industries to catalyze economic development through employment growth, expanding research dollars, and enhancing economic output; and (3) marketing their respective regions for research, business, and living. While there is certainly a thread that ties these three goals together in terms of purpose and direction, each of them prioritizes separate aspects of the portals. These differences become more apparent while studying each portal in depth.

The portals' managers highlighted the importance of all these goals in interviews. However, the primary motivation behind the creation of each portal was different. Development of Reach NC aimed to engage universities in collaboration across the state system to pursue large federal grants, while FuzeHub and MCRN's funding through business development initiatives made economic development the highest priority.

Managers of each portal in our sample were asked to identify the portal's primary audience. FuzeHub and MCRN identified the business community as a primary audience; Florida ExpertNet, while broader in premise, has also shifted its marketing objectives more recently to concentrate on businesses. Arizona Experts, InFluuent, and Reach NC are designed to serve a broad audience. New York's FuzeHub stood out as the only portal devoted to strengthening collaboration between academia and small- and mid-sized companies. It is important to mention that all portals are evolving in terms of their focus, audience, partners, management techniques, and sustainability measures.

Funding and Staffing

One of the main topics discussed by interviewees was the mechanisms and challenges involved in both attracting and maintaining funding for the portals, as well as overall portal sustainability. The main sources of funding for the developmental and operational expenses of the existing portals included state economic development funding, university system funding, special grants (at both the state and federal level), and university budget appropriations (e.g. a single university in the case of Florida ExpertNet). None of the existing portals implemented a strategy for securing long-term financial sustainability; the funding for the portals ranges from annual to three-year grants, with a majority of the portals being funded on an annual or bi-annual basis. None of the portals are considering fee-based usage services, and MCRN is the

only portal considering private funding alongside current public support. By and large, the web portals of university experts and other university innovation-related resources are perceived as public goods - requiring government support for dissemination of information and building partnerships across multiple audiences, including university experts, businesses, and the public sector.

The main conceptual thrust of these web portals was to eliminate intermediaries between university experts and innovations and consumers of this information. However, many web portals decided to include built-in, business-level, or concierge-type, services hoping to eliminate a barrier for companies that do not know or have no resources to navigate through the portal's resources. In addition to staffing the business-level services of web portals, almost all existing web portals maintain staff for technical support, even if they are utilizing outsourced technical platforms (primarily Elsevier's). In our sample, all but one of the portals included funding for technical and administrative staff—usually for one or two positions. Arizona Experts is the only portal that does not include funding appropriated for staffing. Typically, the portal programs fund the salary of a number of staff members who share tasks across different projects.

One major expense of running such web portals is costs associated with the licensing of publisher software (such as Elsevier). Universities are likely to be expected to bear the burden of costs associated with entering a portal's network. For example, the University of Texas' Board of Regents paid for each institution's Elsevier license. The licensing cost may serve as a barrier to launching and sustaining such portals, especially at a time when universities are under increasing pressure to limit expenses.

Management

Web portals vary in terms of their management structure. More specifically, portals in our sample differed based on university systems, involved parties, portal housing, funding sources, and management structure. Florida ExpertNet was the only portal in our sample that was housed in a research center and staffed under a single university, Florida State University. The physical infrastructure, management, and maintenance of other portals were located within state educational departments or university systems. Yet, for grant writing and management purposes, often a single university takes a lead position. For instance, the University of Michigan was singled out in the structure of MCRN as the fiscal agent. The University also staffs the business-level services, which is housed in their Center of Business Engagement Services. Arizona State University is taking a lead in securing funding, while not additionally benefiting from a grant.

Two portals, Reach NC and InFluent, were maintained by a system-wide administration office. Alternatively, the administration of portals may also be housed in a nonprofit organization. For example, Florida State University houses FL ExpertNet, whereas MCRN and FuzeHub are housed by associated nonprofits. FuzeHub is managed by a publicly funded not-for-profit group supported by the NIST/MEP program. A nonprofit organization as host allows for more flexibility in funding strategies and auxiliary services beyond referencing existing resources and experts. In FuzeHub's case, that could mean staff

offering direct expertise service not provided within its network of university-sponsored resources or regional MEP Centers—like cyber-security.

Usage and Special Audience

Web-portal usage may focus specifically on certain audience types, such as small- and mid-sized companies, fast-growing industries, or super users, those who serve as relationship managers to companies. Additionally, portal systems rely on business-level or concierge-type services to enhance their usage. Among MCRN and Reach NC, the universities pay to provide such services through their own resources. Florida ExpertNet provides services via the FSU center that manages the site. InFluent and Arizona Experts lack any dedicated business-level services. Often, university representatives are located at tech transfer offices, applied research offices, or specific centers (of excellence, medical research, etc.). For example, FuzeHub uses business-level services as a primary entrance point and heavily depends on it. In the case of MCRN, each member university pays for business-level services separately, and many member universities built their own business engagement services modeled off of the University of Michigan’s industry services.

The FuzeHub portal in New York State deliberately excludes a public searchable database for university faculty experts or any other university resources; it instead replaces public search features with a simple online questionnaire interface asking users to submit requests and wait for a staff consultant to connect a company with an appropriate expert or resource within the New York network of MEP and university research centers. This system of serving manufacturing companies was selected due to the portal’s exclusive mission to serve small- and medium-sized companies using databases of innovative research.

Marketing and Super Users

Marketing was yet another major theme discussed by portal managers interviewed for this study. Virtually all portal managers emphasized the importance of marketing for increasing the usage of expert web portals and for long-term sustainability of such tools. With the exception of FuzeHub, the managers noted that none of the portals’ have dedicated budgets for marketing built into their existing financial structure.

One frequently mentioned marketing tactic is participation in or sponsoring of conferences hosted by universities or university systems for researchers and practitioners focused on relevant topics such as advanced manufacturing and bio-medical topics. It was acknowledged that “direct marketing” through sponsoring conferences and ad campaigns would most likely boost usage of the portal; however, it is an expensive method for reaching out to potential users. A dedicated marketing budget would be a very useful solution for most portals to tackle.

Interviewees emphasized the portal’s engagement with super users, which are relationship managers who have direct access to multiple businesses and other users, such as economic development agencies, Manufacturing Extension Partnerships centers (MEPs), associations of entrepreneurs, and chambers of commerce. All managers of existing portals emphasized that they are partnering and promoting the portals to super users. However, no structured training was delivered specifically to these users. Only two

portals, Florida's ExpertNet and Michigan's MCRN, have created or are in the process of creating widgets or iFrames for their search tools, which may be embedded into the websites of super users. These widgets serve as internet-connected off-site content with direct connections to a main web portal, or as interfaces to parts of a web portal's database related to the region where a partner is located.

Training and Evaluation

None of the portals had a structured training component built into their development or maintenance. Some management teams provided training, usually at the beginning of a portal's operation, to faculty at participating universities, to librarians (at universities where the access to a portal was promoted via the university library), or to super users. Training components were included in the operational duties of support staff or were conducted occasionally and by request. None of the interviewees felt that training components were worth more attention than what was already devoted to the current projects.

A crucial lesson learned from the study of expert web portals is the key role of metrics evaluation. For the long-term sustainability of these portals, an assessment of portals' uses and benefits should be conducted. Measures such as return-on-investment (ROI) and value added can be used for such evaluations. However, this is an area in which all the sample portals are currently lacking. None of the portals studied have been able to precisely measure a return on investment. Evidence of success or usage of portals is either completely anecdotal or is based on Google Analytics—a tool that counts hits on the site and identifies what is searched, but does not offer precise analytics on who uses the portal. Usage tracked by Google Analytics can be linked to broader categories of users - such as industry, public, and personal; however, large numbers of site connections and hits are made from ambiguous physical locations that are hard to qualify or meaningfully track (for example, from hotels or shared networks). Requiring a user login would help measure usage and ROI, but could place a barrier to entry and reduce overall usage. Florida ExpertNet and FuzeHub are the only two portals that feature a login; however, the login is not required to issue a query or search the database.

The lack of return on investment measurements might be a growing obstacle to sustaining web-based portals for searchable researchers as well as for other university assets - such as licensed technology, facilities, and equipment. Annual licensing fees for underlying software and information, staff funding, and the necessity for marketing resources are growing concerns when considering the need to update the portal's platform, keep up-to-date information, and promote the resource to industry users.

Sustainability

Ultimately, there are challenges involved with long-term sustainability of the expert portals. In most cases in our sample, there is no sustainability strategy beyond the "next round of funding," despite the acknowledgement by all interviewees of the value of such a public tool for building collaborations across the state and connecting universities to multiple audiences. In cases where there are sustainability strategy discussions occurring, such deliberations appear to be in very early phases. The relatively high costs of maintaining these expert web portals, coupled with perceived low returns on investment, can

result in cuts in the breadth of services provided by these portals or even their complete elimination. For example, North Carolina's Reach NC and Indiana's INDURE have both been either "simplified" or underfunded recently. Engaging businesses to use expert web portals is yet another challenge; even the longest-established of all expert portals, Florida's ExpertNet, still struggles to market its services to businesses. The issue of low use rates combined with high costs of maintaining web portals and the scarcity of funding sources can seriously impact the viability of these valuable tools. To sustain expert web portals in the long run, some important questions must be answered and creative mechanisms should be developed. Most importantly, it must be determined whether portals should require membership fees or if other mechanisms of revenue generation, such as corporate sponsorship, should be developed and employed. With current evidence, this question is not easy to answer. Currently, none of the portals require a mechanism of revenue generation such as membership fees or any other compensation for use; thus, these portals are largely treated as public goods. Additionally, no evidence exists suggesting that corporate sponsorships can gain traction as a long-term funding possibility.

Another possible sustainability mechanism is the establishment of a board that oversees the future of the portal, its funding sources, and its partnerships. Reach NC established a governance council - made up of research stakeholders and officials from major universities - after its first year on the web. Florida ExpertNet also established an advisory committee with similar roles. MCRN facilitates meetings with its university partners, but those meetings are to address technical rather than sustainability issues. The remainder of our sample portals lacked such committees. Sustainability, like many other facets of web portals, is still considered to be an evolving concern.

All seven selected web portals vary significantly, illustrating different approaches to conceptualizing a product - through a developed tool, mechanisms of funding, and provisions for sustaining the portal - while managing constituencies and relations with different audiences. Four of the selected portals share similar properties, while the remaining three deviated significantly from more typical models. Similarities among ExpertNet, MCRN, ReachNC and InFluent include the use of innovation created in multiple universities or across a statewide university system; orientation towards a broad audience, including private companies; a web-based tool powered by a sophisticated search engine; and positioning or representation of the web portal and its offered services as a public good.

Three other portals, FuzeHub, Arizona Experts, and the University of California system's Tech Transfer, lack some of these common properties and possess several unique characteristics. The University of California system's Tech Transfer portal is dedicated to searching tech transfer licenses across its ten campuses and is similar to a traditional model of university tech transfer offices. However, given the absence of an alternative model for marketing university innovation in California, the statewide nature of this portal and the sophistication of its underlying web tool earned it a place in our study sample. The Arizona Experts web portal is designed, built, and used as a "lean" tool with only the features offered by Elsevier's built-in technical platform. FuzeHub is unique in its strong orientation towards serving small- and medium-sized manufacturing and its use of as database of research experts and innovation as a support tool for the business-level service. The following section examines each web portal, highlighting their distinct features in more detail.

Florida ExpertNet

First launched in 1999, Florida ExpertNet is a web-based platform that connects university faculty and researchers with public, private, and non-profit organizations across the state. ExpertNet's



database includes researcher information from all twelve public research universities in the state and two private research universities (University of Miami and Florida Institute of Technology). The Clearinghouse for Applied Research and Public Service, now called the Center for Information Management and Educational Services (CIMES), at Florida State University (FSU) maintains ExpertNet's database of these resources, which may be broken down into several categories including: experts, funded research projects, centers and institutes, technology licensing opportunities, speakers, and instructional programs. FSU offers access to its portal through a customizable search tool capable of both answering specific queries and allowing users to browse ExpertNet's databases by institutions and disciplines. Each Florida business, non-profit, government agency, or community organization is assigned a unique registration code; this allows the database to offer a customized search experience.

ExpertNet's stated mission is "to connect business, industry, and government with resources and expertise across Florida's universities in order to foster economic opportunities."⁶ Over the past fifteen years, the platform has shown a commitment to that mission, promoting economically viable partnerships across the state that may not have formed otherwise. While the organization recognizes its successes, there are still several opportunities for growth to be explored and structural questions to be answered, such as how CIMES can better connect with industry and locate further avenues of funding.

CIMES operates on a project-based budget and is supported almost exclusively by FSU. This money covers partial salaries for four staff members who divide their time between ExpertNet and other projects at CIMES. A large portion of the remainder of ExpertNet's costs was covered by a two-year grant from the U.S. Commerce Department's Economic Development Agency, which recently expired. While FSU covers ExpertNet's costs right now—recognizing the benefit of providing essentially a public good to both other universities and private businesses—negative trends in state funding for higher education in Florida suggest that the school may not be able to fund ExpertNet for much longer. Previously, ExpertNet had corporate sponsorship through AT&T; while staff would certainly appreciate renewed corporate interest in the organization, no one is actively seeking it at this time.

ExpertNet staff understand the need for innovation, initiating several new ideas since its inception in order to better serve users. The site first focused on ensuring as many government contracts stayed within Florida as possible. The impetus for this initial focus was an instance in which the state government awarded a contract to a researcher in Texas, only to later realize that one of the field's most widely cited and respected experts worked at a public university in Florida. This resulted in an outflow of public dollars

⁶ Florida ExpertNet. *Overview*. Retrieved April 15, 2016, from <http://expertnet.org/index.cfm?fuseaction=about.overview>

to another state - resulting in economic leakage - and caused an internal dialogue which in early 2000 led to an online searchable database of university experts.

In 2006, a greater emphasis was placed on economic development, with a broader vision of the portal connecting innovative resources to businesses in order to create jobs and prosperity in the state. By expanding its reach beyond the purview of servicing state government, ExpertNet opened up the possibility of collaboration between academic researchers and private industry. CIMES realized that private sector participants bring easier access to R&D capital and market-based solutions to the table, both of which can facilitate knowledge transfer and usage.

A few years later, in 2009, experts were granted the capacity to edit and manage public profiles visible to users through a tool called “My ExpertNet.” This option allowed for greater customization and improved service provision for the platform. By including research interests and expertise not explicitly listed on the pages ExpertNet compiled in searches, individual researchers gave businesses and state agencies seeking collaboration and/or advice a better chance at quickly finding who or what they needed. The experience of finding collaborators in an efficient manner made industry users likely to utilize the service again and promote the service among their colleagues and peers.

The launch of the Innovation Exchange search option in 2014 changed how ExpertNet served its users. This new search option targeted business clients within specific industries with automatic updates and news alerts for relevant searches, personalized search dashboards, a more user-friendly interface, and direct messaging services. At each stage of the development, ExpertNet sought to reach as much of their target audience as possible. Innovation Exchange makes it easier to tailor ExpertNet’s tools to meet the individual needs of various public and private constituencies.

Amy Finley, interim director of CIMES, believes that without consistent outreach to their industry audience – which does not utilize ExpertNet on a daily basis — users may forget ExpertNet exists when a problem arises. Project-based industry research is often an iterative process, and finding new partners in academia is not a regular part of that process. Working with established relationships, while not always the most fruitful route, is often an easier, less time-consuming one. ExpertNet’s challenge is to demonstrate to potential users that, given a business’ limited time and other resources, it makes financial sense to run a search on ExpertNet’s database.

One way this is done is by featuring prominent experts in high priority areas such as aerospace, biotechnology, and nanotechnology on a section of ExpertNet’s homepage entitled *Leading Edge*. In doing so, ExpertNet appeals to potential clients in these technological and industrial fields, all of which are among Florida’s most competitive industries. A related strategy employed by ExpertNet is to post successful research stories in the *News* section, allowing potential beneficiaries to immediately see the kind of service and value ExpertNet can offer them.

The site’s technical capabilities lie in both its breadth and depth of information; it hosts 60,000 expert profiles and 20,000 registered users, and is able to maintain 500 concurrent users. With an audience composed of private citizens, government agencies, private investors, and corporations, ExpertNet has the potential to affect a large number of people in the nation’s fourth largest state. ExpertNet serves these

various audiences through engaging individual users, businesses, and organizations (such as regional chambers of commerce). Also important is the wide variety of communication and planning tools offered to ExpertNet's users, including: calendars, web meetings, blog listings, a chat feature, and discussion forums.

Florida's web portal offers advanced user tools like the Innovation Exchange, which includes the option of receiving alerts whenever pertinent information is added to a customizable dashboard, decreasing the need for the sorts of frequent and unfruitful site visits that deter ExpertNet's target audience from using the service over time.

ExpertNet also identifies so-called "super users," i.e. groups that have a significant impact on economic development in Florida. These include economic development organizations and agencies, business incubators, research parks, and municipal and regional chambers of commerce, which provide services and support to groups of businesses. To facilitate the relationship between ExpertNet and these super users, staff from CIMES conduct on-site training on how to use the site, the site's background, and how super users can help to ensure the site's information is getting out to those who need it.

Occasionally, the staff at CIMES will offer business-level, or concierge-style assistance, finding an expert whose qualifications match the needs of a user. This is often as simple as a CIMES staff member contacting university departments or labs with the right questions in order to get an expert's information as quickly and efficiently as possible. To access this resource, users can either call CIMES directly or fill out a search request form. The form promises a response within three days of receipt, and CIMES generally meets this promise.

CIMES is also developing a *push* technology that brings Florida ExpertNet's portal to the websites of these partners via a customizable iFrame plugin featuring ExpertNet's logo. The embedded plugin allow users to search ExpertNet's database directly from whatever site it is they are currently visiting.

ExpertNet has an advisory committee with membership drawn from FSU's Board of Governors (formerly Board of Regents), the Florida Institute for the Commercialization of Public Research, several other university research organizations, a regional planning council, and a management consulting firm. Committee meetings happen on a quarterly basis and serve as guidance and strategy sessions for the ExpertNet staff, with members weighing in on different aspects of the business corresponding to their areas of expertise.

The most significant challenge facing CIMES is publicity - considering it does not have a dedicated marketing budget. Staff is working with economic development agencies, chambers of commerce, and other organizations to spread the word about ExpertNet; however, the reality is that without a concerted marketing effort aimed at a diverse group of potential users, it will become harder to ensure the platform's value, especially without access to a quantitatively rigorous measure of return on investment (ROI).

Although CIMES is able to monitor traffic on ExpertNet's website, including unique hits, user sessions, and logins, Finley said gathering usage data and measuring ROI "is a real challenge for us." There has been

some discussion around a free login username/password combination for all users to better track individual data; however, the staff at ExpertNet is cautious of any potential barriers to use and entry.

Moving forward, ExpertNet will need to secure more funding to continue functioning. As with other organizations, it appears that a lack of budget for marketing and travel lies at the center of many of Florida ExpertNet's problems. Funding for advertising and travel should result in more business interest in the program and would increase the amount of face-to-face interaction between users and staff; this could in turn lead to a larger database and more accurate advice and needs matching. Despite the input of the advisory committee, ExpertNet staff does not feel ready to engage in a discussion about the long-term future of the platform. The Board of Governors, sensitive to state pressure and decreased funding, is in no place to offer large amounts of capital to the organization at this time. The pieces necessary for such work—university personnel, the business community, and CIMES staff—are all present. If the necessary funding for marketing and regular interpersonal interaction is found, ExpertNet can succeed.

North Carolina Reach NC

Reach NC is a web portal that provides information on faculty experts and public resources tied to a consortium of public and private universities in North Carolina. Reach NC's design and robust service long stood as a preferred model for others to study, but that era ended in February 2016 as new leadership at the University of North Carolina system scaled back the portal. Reach NC highlights the importance of taking into consideration external factors that influence long-term sustainability of a portal.

Launched in 2011, Reach NC uses software licensed from Elsevier to compile and search profiles of research faculty at Duke University, RTI International, and 17 University of North Carolina (UNC) campuses. Three years later, the portal added searching capabilities for equipment and labs at Duke University and six more UNC campuses. The portal's targeted audience is fellow researchers, university administrators, the business community and the general public. The portal is well known for tackling the fields of biomedical and life sciences, but also includes engineering, social science, education, and public health. The web portal's former executive director, Sharlini Sankaran, details the history of the Reach NC project in a 2014 white paper.⁷

UNC-Chapel Hill and the Renaissance Computing Institute (RENCI) were the initial partners developing the portal. Funding to build the site came from UNC General Administration, the North Carolina Translational and Clinical Sciences Institute (NC TraCS), and Duke University. NC Biotechnology Center, TUCASI/Research Triangle Foundation, and the Golden LEAF Foundation provided additional funding. The portal is housed and staffed within the University of North Carolina system.

As of today, Reach NC's network of partners and super users has flourished to include 14 major institutions, such as

1. North Carolina State University
2. Duke University
3. The Small Business and Technology Development Center
4. DataBridge, a big data initiative funded by the National Science Foundation
5. Thrive in NC, a statewide economic development partnership
6. The NC Biotechnology Center
7. Industrial Extension Services, an organization within NC State that promotes economic development
8. The Biotechnology Workforce

⁷ Sankaran, S. (2014). *REACH NC: The Research, Engagement, and Capabilities Hub of North Carolina*

9. NCIMED's Women's Business Center of North Carolina
10. RENCI, a collaboration involving UNC Chapel Hill, Duke University, and North Carolina State University to develop advanced technologies to enable research discoveries and practical innovations
11. The Research Triangle Park, the nation's largest research park based in North Carolina.
12. TUCASI, a software company located in RTP and geared toward the education sector.
13. The North Carolina Translational and Clinical Sciences (NC TraCS) Institute
14. UNC Administration

Reach NC has a database of research experts at its core. Reach NC's Elsevier SciVal expert profiling system is updated automatically, and experts are allowed to edit their profiles. The profiling system gathers information for profiles via SCOPUS—a database of about 30,000 peer-reviewed journals—and RAMSeS, UNC's grant database. The portal's resource finder is based on the Eagle-i open-source tool designed at Harvard University.

Reach NC is designed to appeal to various audiences: university staff, researchers in- and outside- of the Reach NC network, businesses of all sizes, and the general public. Reach NC has no user fees and falls well within the category of a public good.

Understandably, not all users may know how to navigate through Reach NC's resources or how to connect with the appropriate people after they have found what they want. To remedy this problem, each university campus provides a point of contact or office to serve as a business-level service under the portal. These offices and officials help users connect to the right researchers on their campus, and they explain why a researcher may not be responding to requests and refer the user to another researcher that might be more available or responsive to an industry professional.

Reach NC leverages two types of super users in its outreach: (1) officials at university campuses in charge of research initiatives or offices of sponsored research and commercialization; and (2) economic development agencies and nonprofit groups interested in economic development.

The portal connects with super users by distributing newsletters regarding changes to the web portal and instructing training webinars. The staff trained librarians on how to use the portal as well.

Reach NC was promoted without an explicit marketing budget to buy materials, sponsor conferences, or advertise in trade magazines; however, there was a travel budget for meeting and reaching out to users and super users. If she could go back in time to Reach NC's launch, Sankaran notes, she would demand a dedicated budget for marketing and outreach. Such an early investment could act as "seed money" for marketing. In the absence of a budget, Reach NC performed targeted marketing toward the entrepreneurial community and business development community by hosting events or being featured at events hosted at the Research Triangle Park.

Until 2016, Reach NC was not its own entity, but rather a program staffed within the University of North Carolina system. Through most of its existence, the portal was managed by an executive director and a

full-time program manager. It is unclear how much the staff has changed since it was scaled back in the beginning of 2016.⁸

Aside from the two-person staff, Reach NC also had two committees helping the website along. One was an operations committee comprised of university officials with different roles at different campuses, such as information technology practitioners, research development officials, librarians, and commercialization officials. With no regular timeline of meetings, they met on an as-needed basis to address technical and programming questions. Reach NC had a consortium of funders between its university and economic development agencies and private non-profit sources. That consortium was vital for keeping the portal sustainable.

Since its inception, Reach NC contracted an outside firm called EvalWorks to perform third-party evaluations of the portal's usage and impact. The first evaluation was completed after the portal's first year in operation, while the second one was completed in 2014. The contractor used visitor and search data from Google Analytics and conducted interviews with super users of the website, conveying success stories and connections made. Although the evaluations lacked a measurement of the portal's return on investment or breakdown of the types of businesses using the portal, the evaluations helped to learn honest feedback from a third party regarding successes and failures of the portal's services and information.

In 2013, Reach NC recorded more than a quarter of a million visitors, according to a 2014 white paper.⁹ About half of those visitors came from within North Carolina and about three-quarters are from within the United States. India, the United Kingdom, China, Canada, and Germany represent the most significant portion of international visitors, according to the white paper.

Voluntary forms submitted when users contacted experts—along with inquiries to Reach NC staff—revealed that the top uses were for researching expert activity in NC, identifying expert speakers or panelists, finding collaborators on grant proposals, projects, or publications, and economic development and business recruiting.

Reach NC formed a governance council after its first year to compose a strategic plan forward and seek funding commitments as well as to try to connect new partners to Reach NC. The Council was comprised of people from UNC Chapel Hill, North Carolina State University, Duke University, the Biotech Center, Department of Commerce, and the foundation behind Research Triangle Park. None of the governance council's long-term plans were implemented by the time UNC's administration changed leadership.

The Reach NC website was scaled down in early February 2016 after Sankaran stepped down. ReachNC.org still maintains a searchable database of only the UNC-Chapel Hill campus, and the website's content and mission has been reduced. Courtney Thornton, associate vice president for research and graduate education for the University of North Carolina and overseer of the portal, declined to be interviewed but said the portal was undergoing a transition at the time and would be "simplified considerably." Reach

⁸ New management of Reach NC declined an interview.

⁹ Sankaran, S. (2014). *REACH NC: The Research, Engagement, and Capabilities Hub of North Carolina*

NC's founding and contraction aligns with the establishment and resignation of UNC's former president, Thomas Ross.

It was the change in UNC's leadership that caused Reach NC to go in a new direction; this offers a clear example of the vulnerabilities a web portal faces when one institution has a heavily weighted influence on its maintenance and sustainability.

Despite the scaled-back state of the current portal, interviewees believe the portal was a success. It started out as a very small pilot idea of a one-stop-shop to search for research experts and find research collaborators across campuses and across scientific fields. At its peak, the portal had 18,000 researchers.

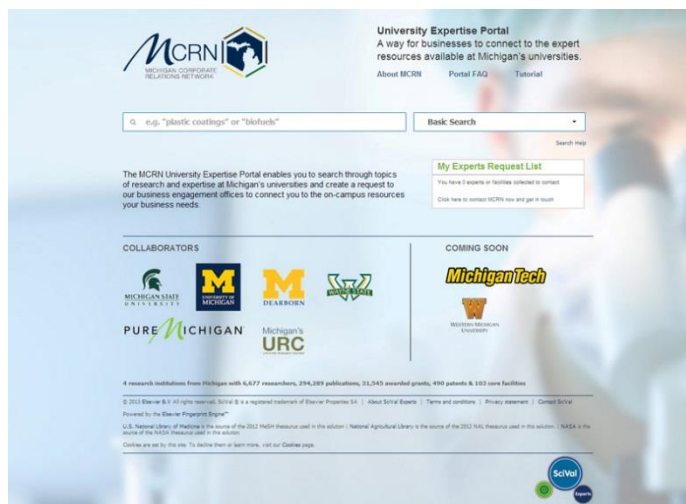
Reach NC's Governance Council did lay out some general milestones for a sustainable path forward. They included analyzing the portal's stakeholders and studying who benefits most from the portal. From there, leadership should make certain those stakeholders are brought on as allies to make the portal's case to funders and secure other partners to contribute to the portal's future. "It's easy to say [the biggest recipients] are business and industry, but it is really the universities and researchers," Sankaran argues.

Moving forward, a decision needs to be made of whether the portal should be seen as a public good or a private tool meant for business development with password protection. In a past, Reach NC was seen as a public good, no membership requirement or revenue generation was pursued. Whether or not private funding or sponsorship can be obtained, public or university funding will always need to be leveraged to keep the portal afloat.

The Michigan Corporate Relations Network (MCRN)

The Michigan Corporate Relations Network (MCRN) is a web portal that proudly advertises itself as the “nation’s first” statewide university-to-business engagement network. Despite honing in on a primary audience targeted for businesses, the use of the portal, in practice, has varied more widely than anticipated. The portal highlights an important question of whether a public good can be successfully tailored to a specific audience.

MCRN was launched in 2011, with initial funding support from the Michigan Economic Development Corporation and the Michigan Strategic Fund Board.



The web portal uses Elsevier-licensed software to search for experts, and it features 10,000 profiles across six public research universities. Those universities include Wayne State University, University of Michigan, University of Michigan-Dearborn, Michigan State University, Michigan Technological University, and Western Michigan University.

Although there are nine other public universities in Michigan which are not part of MCRN—three of which are research universities—the existing coalition currently makes up over 98% of academic research (\$1.8 billion) and 99% of all patent activity in the state, according to MCRN’s website.¹⁰

In addition to searching experts statewide, MCRN was also created to be a “one-stop shop” for student internships and professional development, matching grants, joint research projects, lab/facility access, and technology utilization and commercialization.

The MCRN project is also tied to three economic development programs:

- Small Company Innovation Program (SCIP), which funds individual projects up to \$40,000 in a matching grant.
- Instant Innovation Program, a similar pilot program designed for larger firms.
- Small Company Internship Award (SCIA), which provides matching funding for STEM firms to hire an intern. Each of the six MCRN universities are given \$25,000 annually for the program.

¹⁰ Michigan Corporate Relations Network. (n.d) *About*. <http://michiganocrn.org/about.php>

MCRN stands out from most portals because it has a primary audience, small- and medium-sized businesses, largely because the portal is funded through state economic development grants. At the same time, the portal also serves a public good because it lacks no membership barriers and imposes no direct costs to users.

Time investments cost businesses money, and searching through unfamiliar faculty profiles and academic search terms by oneself can be burdensome for industry members.

That is partly the reason a business-level service is a major component of the portal, and each of the six university campuses have its own business engagement office. Each university absorbs the cost of the center's staff. Some of the centers—such as the one at the University of Michigan— predate MCRN. With 11 staff members, the University of Michigan's Business Engagement Center is MCRN's largest; additionally, it works closely with Michigan's statewide Manufacturing Extension Partnership (MEP), as indicated on the business engagement center's website and in an interview with the official who heads the university's business engagement activities.

"We help sort out where (companies) should go and to which university," said Steven Wilson, Director of Technology Innovation & Commercialization Services at the University of Michigan. "We do the coordinating and hand-holding for anyone new that is working with a university. To help them contract and navigate the various university landscapes." However, small and large firms approach MCRN with different needs, he said.

"If Ford Motor Co., is going in to look for someone, they are looking for some expertise in a very specific area," notes Wilson. "They have lots of facilities and experts of their own. In my opinion, they have a much different mission in mind from where a small company may have a problem and they're going in here (to the portal) to see if someone knows about ceramic crack propagation or ceramic bonding, or some kind of more broad problem they're having and they want someone close to that. I would have to say the larger companies are looking for much more specific targeted help like finding a scientist that has worked with a very specific type bonding formula and type of ceramic material described on a molecular level."

Additionally, the centers' jobs are also to be "translators" between industrial and academic practices and jargon. Wilson said he believes MCRN's web portal could do a better job in translating the two styles of speech for better search results as well as assist companies in searching a university's roster of facilities and equipment.

Moreover, it is not uncommon for companies and entrepreneurs approaching the business engagement center before going to the MCRN portal. Wilson said most new companies to MCRN have a peak interest and want to learn more about the portal. He said he believes a "direct marketing campaign" would increase usage of the portal.

MCRN staff don't use the term "super users;" however, MCRN estimates it has about 8 or 10 long-standing relationships with other organizations that could be considered "super users" for the purposes of this report. Those include business engagement offices at universities, regional and state economic development agencies, and Michigan's University Research Corridor (URC), a non-profit academic research cluster tied between the University of Michigan, Michigan State University, and Wayne State

University. One outreach strategy MRCN has developed with its network of partners is embedding the MCRN portal on their websites with a small widget; this widget allows visitors to type a search word and be transferred to MCRN's expert catalog. The licensor of the search software, Elsevier, doesn't have a problem with MCRN distributing a search widget for other websites to use. Britany Affolter-Caine, a program manager at University Research Corridor – a research cluster that supports MCRN, did one-on-one training with these partners when the widget was launched.

When it comes to reaching out to new business users as a whole, MCRN lacks a dedicated marketing budget and marketing staff. MCRN has invested in the portal technology and employed an “organic approach” to marketing that focuses on building relationships with university partners and super users, notes Affolter-Caine. The portal is promoted by MCRN members through relevant networks—within MCRN members' own marketing programs when relevant—and technology through the utilization of website widgets serving as direct search-based entry points to the portal available to MCRN members and stakeholders.

MCRN requires no membership fees and generates no revenue of its own. Funding is covered entirely by economic development grants and university partners. As of late January 2016, the portal had funding for one and a half years; after that lapses, the University of Michigan needs to reapply for another state economic development grant. At that point, the grant writers and MCRN will have to prove that the portal is making an impact in the business community.

Licensing Elsevier software represents the largest cost of implementation. Each of the universities pay for their own licensing fees. The state economic development grants MCRN receives do not cover marketing, training, or the costs associated with any of the university's business engagement centers. The grants are also tied to funding the portfolio of business assistance programs detailed on MCRN's website.

Michigan's largest university, the University of Michigan, heads the fiduciary role of MCRN in writing the grant proposals. Outside of that, MCRN is managed by its own staff and is partnered with the URC. MCRN staff manages the website and, more importantly, coordinates among Michigan's university partners, all of which are autonomous from one another with no statewide administration overseeing their collaboration.

An advisory committee oversaw the portal during development and for a short time after it was launched; however, it no longer exists. Instead, group within MRCN's partners meets regularly to strategize how to keep the portal sustainable. MCRN staff facilitates meetings on an as-needed basis with technology leaders of each university in order to keep them up-to-date on changes. An example is Elsevier introducing new software platforms and the potential effects such changes might have on each university's researcher database. Evaluating who uses the portal as well as economic return on investment has been challenging for MCRN.

Staff hoped that industry users would use a contact tool on MCRN's website to reach the appropriate business engagement center for further service. That contact tool would help staff keep tallies on firms using the portal. However, MCRN leadership suspects that hasn't happened for two reasons: (1) industry professionals independently contact specific experts or university departments, and (2) industry

professionals approach university business engagement offices directly without using the website's contact tool.

MCRN has instead leveraged data provided by Google Analytics to measure how many users accessed the search tool through a super user widget, as well as index what terms users are searching most. Analytics lack information discerning whether users belong to large or small businesses - and those businesses' industry classifications. Analytics can discern if users are accessing the website via specific company computers; however, it can do very little if an employee or business owner accesses the website with a personal computer.

MCRN has tried breaking down its analytics by industry users and government and university users; the divide between the two was about even. No precise counts were available, however, industry users certainly do make up a significant portion of visitors to the portal. The remainder of users likely are utilizing the portal in service to industry clients. This data doesn't change anything regarding the portal's purpose; its purpose is still geared toward helping small- to medium-size businesses collaborate with the universities that are part of the portal.

According to the portal's management, expectations about the MCRN portal have evolved. The initial idea was that the portal would serve as this one-stop shop to primarily serve users from small- and medium-size businesses in identifying relevant experts, facilities and equipment across multiple universities within a single site. From the portal, business users could directly connect with staff from university business engagement centers for assistance in accessing identified resources. Over time, the portal has served the business community in less direct ways. For instance, businesses have used the portal to identify relevant resource availability and to work directly with faculty or engagement offices without utilizing the connecting features of the portal. MCRN has also gathered anecdotal stories from super users to illustrate that the portal is serving as an effective tool to the business community. Professionals working with businesses from the university and intermediary organizations, particularly economic development agencies, use the portal.

Texas InFluent

Influent, a web portal launched in 2014 by the University of Texas (UT) system and managed and overseen by UT's Office of Strategic Initiatives (OSI), connects researchers at all eight UT academic institutions and six health institutions with one another, as well as with industry professionals and the public. Influent subscribes to the academic publishing company Elsevier's Scopus database of abstracts and citations in order to auto-populate the profiles of more than 15,000 faculty and researchers across the UT system, with a focus on medical and life science research. Influent is a part of the university system's Innovation Framework, which is a strategy designed to create and improve channels that facilitate the transfer and commercialization of academic research from UT's universities and academic health centers to private enterprise.

The original idea behind Influent was as a portal that would help industries find academic researchers at the various UT campuses. While this is still the case, the OSI came to realize that Influent could also be used by researchers to network and work with one another. Texas' large size makes it difficult for researchers working in the same or similar field hundreds of miles away from one another to collaborate on projects in person.

The Board of Regents, the governing body of the entire University of Texas system, controls the Innovation Framework. Additional system support comes from the Offices of Technology Commercialization, Academic Affairs, and Health Affairs. At the heart of Influent is the goal of working in concert with this wide array of organizations to advance, foster, and promote the type of research that can be used to improve people's lives. Despite the portal's newness, it has quickly attracted significant attention and use. OSI staff is already strategizing and planning for the next five to seven years, with an eye on expanding the services Influent offers to its users.

As the site has grown, staff at OSI dedicated more and more of their time to Influent. Annette Royal, assistant director at OSI, indicated that the web portal has two dedicated staff positions, a project manager, and data warehouse developer. Additionally, OSI's communications team has spent a large portion of their time on the graphic design and user interface. Since Influent's launch, the data warehouse developer working under Royal has been repositioned more into an IT support role for the fourteen various UT institutions. This is due to questions arising regarding the intricacies of Elsevier's software *Pure*, a research information aggregator that compiles internal and external sources of data for

display and analysis. All but one of the institutions in the system use *Pure* (one of the six health campuses uses Elsevier Experts, a similar service that mostly deals with healthcare research).

Influent does not have a business-level service nor does it plan to develop this service for users. Instead, there is a section of the website labeled *Tutorials and Help* with links to a handful of PDFs with illustrations of how to conduct searches, read a research profile, and enhance one's own profile, as well as a video on using and searching profiles.

Each individual UT campus has the responsibility of maintaining profile data independently, with OSI taking on a coordination/facilitation role. Although each institution pays a membership fee to Elsevier in order to host their data on the company's servers, OSI covers the cost of these fees.

The UT System Board of Regents is the exclusive source of funds for OSI, and therefore for Influent. Running on a three-year cycle, the UT system appropriated a budget for Influent that will likely be renewed in 2017. For this first round of funding, OSI staff was unsure of how to budget; this led to the creation a general fund, which staff used for various activities and expenses on an as-needed basis. This strategy has proven to be less than ideal, as a combination of budgetary limitations and lack of clear goals has led to an inefficient use of resources.

For instance, at the behest of several researchers at UT, Influent staff attended the 2015 BIO International Convention in Philadelphia, an expensive biotechnology industry conference that required the creation and reproduction of a large amount of promotional material, in addition to the substantial travel costs associated with flying staff halfway across the country. The costs were unexpected and Royal said the conference provided an eye-opening experience of an area OSI had never experienced. This experience generated a better understanding of what it would really take to successfully promote the tool.

With no funding from external grants or membership fees associated with information access, the Influent staff needs to make a case for itself to the university system. Thus far, word of mouth indicates a high level of positive feedback for the site. People are successfully using Influent and are sharing their positive experiences with colleagues and coworkers. While staff experienced some initial pushback from faculty about how much control they would have over their profiles (Elsevier is adding the ability to self-edit researcher profiles in the near future), many researchers have now found Influent to be a useful tool for networking and contacting industry professionals.

Unfortunately, exact figures regarding traffic and usage are hard to gather. OSI uses Google Analytics to track certain metrics; however, the data they receive requires significant processing and is limited in terms of showing who is doing the searching and their location. A voluntary contact form and email field is presented along with search results in order to aid in this kind of data tracking, but users do not use either feature with any degree of frequency.

During its initial rollout phase, Influent was able to make do with the funding it received from UT. OSI leadership want to direct the next budget toward more staff support or a dedicated staff person at each UT institution to manage Influent's documentation and other related responsibilities. Having a point of contact at each location would help streamline this process, which is central to the successful functioning

of InFluuent. Recent research success stories indicate a desire to see portals like InFluuent expand their reach; without the staff and funding to do so, however, offices like OSI are not able to provide the level of service needed.

An additional developing concern for InFluuent is how to handle the research of liberal arts and humanities faculty. Elsevier focuses on STEM fields, and InFluuent has received backlash from non-STEM faculty members who feel their relevant research is not prominently featured in search results. OSI needs to weigh its options to either drop liberal arts and narrow its focus to just STEM fields or to seek out other database management software capable of displaying liberal arts research in an adequate way.

Moving forward, there are two areas of expansion for InFluuent that OSI feels confident will help grow its user base, demonstrate a positive return on investment, and help it provide a necessary service to the research economy in the state of Texas. Some of the individual institutions in the UT system have set up a tool called i-Labs to allow individuals and companies to reserve university facilities, laboratories, and equipment for their own research and development work. OSI staff would like to bring that service to all fourteen locations, folding it into InFluuent to streamline the process. The second feature to add to InFluuent is the ability to search patent and grant information currently missing from *Pure's* services.

With other universities in Texas and some Texas legislators looking to InFluuent as a potential model for similar systems, the stakes are high. Although there are still technical and structural changes that should be made to the system and better results monitoring is needed, InFluuent has already begun to make a positive impact on the research results of the UT system.

New York FuzeHub

New York State is taking up a unique web-based strategy for connecting companies with university expertise. Instead of publicly indexing and pushing all of the information about university resources to a portal for web users to search and explore, a single platform has been created, FuzeHub, where users can describe their issue and be connected with whomever might best serve their needs.

After a user submits a request, a consultant on FuzeHub's staff connects the user to the appropriate resource location. That resource location's staff is responsible for connecting with the user within 48 hours. The makers of the platform deliberately steered away from a supply-oriented portal model because they believed it to be unsustainable.

FuzeHub was formed in 2013, spinning off from a grant from the National Institute of Standards and Technology (NIST). The web portal's structure conforms to a unique and pre-existing relationship between New York's economic development organizations and the state's network of public and private universities. The web portal does not contain a public database for users to search and find research experts; however, it does provide a form tool for users to describe issues or request help.

"We didn't want to go down that road," said Executive Director Elena Garuc. "We've seen too many portals have challenges approaching the "look up directory" model. And the ones that are successful require a huge amount of investment to keep up that information and make sure it grows. So we are building an internal database for the state partners to use. We have profiles, but they're all in an internal resource for us."

FuzeHub evolved from a series of state-hosted events called Solution Fairs. Designed not simply to disseminate resources and information to guests, these fairs helped firms understand how to use these resources by facilitating one-on-one tech assessments between manufacturers and available resources. They also helped regional manufacturing extension partnership (MEP) centers and universities gain access to manufacturing companies, according to Garuc.

The idea of an online portal was conceived so that manufacturing companies could access that service 24 hours a day, 7 days a week. Garuc indicates that because the state MEP center is a government department, which matches NIST funds and contracts services out to 10 regional centers, a new nonprofit—with 504c4 tax-exempt status – was contracted specifically to build and manage the web



portal. FuzeHub still organizes Solution Fairs, but has reduced the frequency from 10 to four per year and has redesigned them to be more topics based and less geographically based.

The portal's audience is narrowly tailored to small- and mid-sized manufacturers; this is because its funding comes directly from NIST and a matching sum from New York State's MEP Empire State Development. With no costs for a manufacturer to use the portal, FuzeHub can be defined as a merit good—a good that is subsidized or provided free depending on the ability of a consumer to pay for it.

"We created this one-stop shop to make it really easy for manufacturers to go somewhere without having to think 'where am I located and what am I looking for?'" Garuc notes. "'Do I need to speak with a university? Do I need to speak with someone from the industry? Do I need to speak with an economic development professional? Do I need to speak with an engineering service?' We have all of those as our partners. They put a request into our system, and they tell us what they need; and then we have boots-on-the-ground matching specialists, if you will who search our research network and make those connections and referrals."

FuzeHub focuses on connecting industry to state- and federal-funded resources, namely the 70 Centers for Advanced Research, Centers for Advanced Technology, & Centers of Excellence scattered across public and private universities statewide. The state also has 10 regional MEP centers, and companies are sometimes referred to them. FuzeHub is also looking to expand their network of resources into the private sector because the 70 current centers do not cover all issues. In addition, FuzeHub's internal database does not break down individual profiles of university experts statewide. It is focused more on what kind of expertise and assets each center offers to best address different industries and different problems. Each of these university-affiliated centers cooperates with FuzeHub and shares information, because they all receive annual funding from the same entity as FuzeHub, Empire State Development--the statewide MEP center. Another reason for their collaboration is because the centers and universities want to engage with manufacturing companies and build relationships for future research and development initiatives.

According to Garuc, the group's new marketing initiative plans to collaborate with super users, and they already have been contacted by regional economic development agencies to give presentations. One challenge with leveraging groups such as chambers of commerce is that small manufacturers typically exist outside those groups.

FuzeHub does not train staff at the university centers on how to use FuzeHub, but it does enforce specific policies and procedures for when a user is being referred to a center.

Universities do not market their respective centers in their branding campaigns, and it is not feasible for the state to market individual centers. To address this challenge, FuzeHub has marketed itself as a one-stop-shop for companies looking to connect to the state's 70 different centers. Manufacturers often are unaware of what centers exist in their state, Garuc notes, or even what centers exist in their home cities.

FuzeHub is exclusively funded through the state MEP and federal NIST programs. In January 2016, FuzeHub was awarded as an official statewide MEP center, providing it with a \$1 million annual budget for five years. As of February 2016, FuzeHub included an executive director, a marketing director, a marketing assistant, an office manager, a full-time matching specialist, and a part-time solutions manager.

The last two positions share similar roles, but the solutions manager focuses on more in-depth conversations with companies. Given their recent boost in funding this year, the organization may “scale up” its staffing.

Five hundred requests were made in FuzeHub’s first two years; however, activity slowed down afterward because, as Garuc notes, the not for profit was pursuing additional funding sources.

Measurement of return on investment is currently in early phases. The project’s first phase didn’t include the ability to do deep analysis, but did include data on how many requests were received and what kind of requests were made – such as help with funding, engineering, or innovation.

FuzeHub continues to stay in touch with firms after a connection is made with a resource center; ultimately, however, it is the center’s responsibility to report the results back to FuzeHub. Garuc notes that FuzeHub is planning to revamp their ticketing system to be more “robust” and include “some metrics and analytics” in the future.

FuzeHub will need to take a more active role in measuring a return on investment now that it is a designated MEP center. FuzeHub intends to improve profiling more than just a company’s needs, also recording industry type and firm size for future analysis.

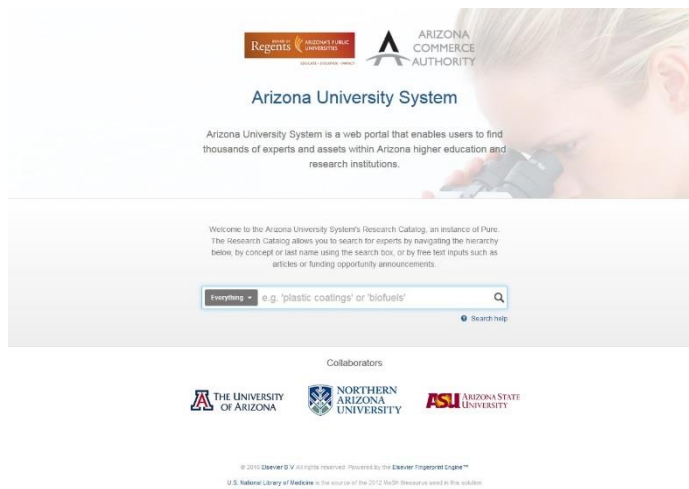
Recording these stats may prove practical, because the FuzeHub portal automatically creates a profile for firms when they submit requests. Login information is e-mailed to firms in case they ever wish to submit additional requests or provide more information about their firms in their profiles. They can also log in to check the progress of submitted requests and to learn if and where it has been referred. Hopefully, the new record keeping can encourage more business-to-business connections and help the state of New York to better serve small- and medium-size manufacturing firms.

To keep the site sustainable, Garuc is pursuing additional sources of funding; “right now, there’s no business model for this,” she notes. “We don’t charge manufacturers, we don’t charge the resources, and it is fully-funded under a grant. That is obviously a sustainability challenge. We were just awarded funding for five years, which is great and that will keep us going. But we don’t want to rest just on that.” Establishing a referral fee to impacted centers was discussed as an option of building revenue. However, membership fees imposed on manufacturers are not a viable option, since many companies are already struggling financially.

FuzeHub is also capable of providing services to these centers beyond referrals. FuzeHub’s mission is very broad, “helping companies grow in New York State,” but the charter is really managed by their grant. Everything FuzeHub does is aligned to their funding, so any services it creates would need support from a partnering institution. This may allow for more flexible and wider means of sharing revenue with the universities and their centers and a stronger, more sustainable future.

Arizona Experts

Professionals involved in higher education and economic development at all three of Arizona's public universities (Northern Arizona University, University of Arizona, and Arizona State University) are continuing to refine a low-cost model and vision for Arizona Experts, their shared university research faculty portal. Each university has subscription-based access to an individual Elsevier-powered portal in addition to a joint portal, which contains more than 4,500 faculty profiles.



The shared portal, established¹¹ a few years after Arizona State University's (ASU) launch of its own portal in 2013, has seen little change; this is due in part to Arizona Experts maintaining a lean budget in the face of uncertain year-to-year funding.

The portal was the brainchild of George Raudenbush, executive director of Research Analytics at the Office of Knowledge Enterprise Development at Arizona State University, who takes on the responsibility of submitting the portal's funding proposals every year. The primary driver behind the formation of a statewide expert portal, Raudenbush said, was to connect faculty researchers across Arizona in order to secure more competitive grants and projects. There was also growing interest among state lawmakers to "have the resources at the universities become more a part of the greater ecosystem."

Some time after ASU launched its own expert portal, Raudenbush encouraged the other two universities and the state to launch a statewide web portal. Arizona Experts is designed to serve a broad audience and accomplish objectives such as breaking down silos between individual university departments, encouraging cross-campus collaboration to win larger national grants, helping media organizations find experts for stories, helping students find mentors, and serving policymakers on issues discussed in the legislature. With a broad targeted audience in mind and no barriers for usage, Arizona Experts is envisioned as a public good.

The portal utilizes Elsevier's latest platform and does not provide business-level service to company owners or entrepreneurs. The portal has no dedicated staff members who can provide help to portal visitors; therefore, it is at the discretion of each of the three universities whether or how they follow up with portal users.

¹¹ Source:

<https://azregents.asu.edu/resources/trif/TRIF%20Public%20Docs/FY2013%20TRIF%20Annual%20Report.pdf>

Two state agencies, the Arizona Commerce Authority (ACA) and the Arizona Board of Regents (ABOR), co-fund the state portal. ACA staff use Arizona Experts to match companies with university experts and to promote a tax credit program associated with university-industry research and development,¹² said Nick Stanbury, Associate Vice President of University Engagement at Arizona Commerce Authority. “We don’t want to just push research. We want to start with what problems the companies are experiencing and in their product development issues,” Stanbury said. “We want to use a pull model.”

Beyond the universities, the ACA and ABOR, the portal does not include a formal network of super users or organizations that are committed to pushing the portal to targeted audiences. The funding of the portal also does not include any financial support to fund promotion or training related to the portal; however, Raudenbush held training seminars with newcomers of the portal in the early stages of its development, and the portal has been presented to every chamber of commerce in the state at multiple events. The portal has never had an appropriated budget for marketing, and strategies for exposure have been limited to word-of-mouth references and formal presentations. Raudenbush said he believes the portal is not well known among its intended audience.

In 2016, ASU plans to launch a campaign to encourage more of its faculty to get involved in the portal. The timing of this campaign is meant to roughly coincide with the portal securing the ability of faculty to edit their profiles on the portal. More accurate information about faculty and their innovative activities will increase the quality of information delivered in search results and could potentially lead to broader usage of the portal.

Every year, the funding of the portal is equally split between a grant issued by the Arizona Commerce Authority and a grant issued by the Arizona Board of Regents. The source of funding for the web portal comes from a \$1 million Regents Innovation Fund. The total grant covers only the software licensing of the program with no overhead or any salary staff coverage; this means upkeep of the website is shared between the existing staff of the three universities. “It is indicative of Arizona that we run thin here,” said Chad Sampson, vice president for Strategic Planning and Initiatives for the Arizona Board of Regents. “There’s not a lot of overhead, there’s not a lot of unnecessary redundancy. ... What is interesting, if you interview each of our institutions - ASU, University of Arizona and Northern Arizona University - they would all give a very different response in how they are developing [Arizona Experts] and using it.”

With that type of independence in mind, Raudenbush and his counterparts at the two other universities meet regularly to discuss various university research issues, including progress of the portal. Together, they serve as an informal committee overseeing the portal. Every year, Raudenbush is responsible for filing proposals to the ACA and ABOR, while Stanbury and Sampson present those proposals at their respective agencies and support them to earn continued funding.

No committee has yet been formed to strategize the long-term sustainability of Arizona’s portal. Although the governor and the Board of Regents are in support of keeping the portal funded, its future appears vulnerable if it loses either of its two funders. There is no strategy yet to address concerns such

¹² Source: <http://www.azcommerce.com/incentives/research-development>

as growing licensing costs from Elsevier, changes in political leadership, potential budget unavailability, or the overall long-term sustainability of the portal. Raudenbush said he has “real concerns” over Arizona Experts’ long-term future. However, if the state or the Board of Regents were to cease funding, he believes ASU would come up with its own budget to maintain its share of the searchable database and possibly revert back to its own one-university web portal. It cannot be said with any degree of confidence that the other two universities would do the same.

If Arizona Experts was able to start over, one thing Raudenbush would do differently would be to pursue greater top-down support from the state and Arizona Board of Regents so that more could be done to enhance the portal and keep it thriving. “Given how much money and time we’re putting on this thing, we’re getting far more out of it than we are investing into it,” Raudenbush said. “And we didn’t have a whole host of lofty expectations. It was just a ‘This is better than nothing. We’re going forward with this and it will improve.’ I think if we started it out with a colossus of goals for each constituency, it would have been a failure no matter what. It wouldn’t leave the launch pad.”

Although the portal keeps data on site visits via Google Analytics, no formal reporting has been done evaluating usage and search data for the portal. Stanbury and Sampson said that this is something they would like to pursue in the future; at the moment, however, the portal is seen as still being in its initial phase.

University of California Technology Transfer

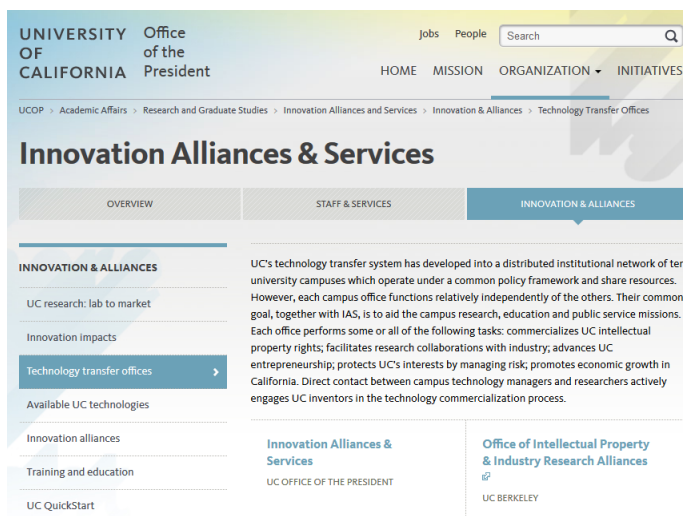
The University of California (UC) system, one of two public university systems in California, maintains a web-based knowledge exchange called UC Tech Transfer. Tech Transfer's database focuses narrowly on licensable technologies originating from any of UC's 10 campuses. The site is managed by Innovation Alliances & Services (IAS), which is housed in the UC system's Office of the President's Academic Affairs division.

Although the goal of Tech Transfer is to connect researchers and industry professionals with one another in order to facilitate the application of academic research to economically viable enterprises, an interview conducted with IAS's Executive Director and Director of Innovation Impact revealed that the site has not achieved that goal. Instead, groups such as media organizations, corporations, university faculty and staff, and others use this technology to meet their own particular needs. As a result, IAS has been challenged to articulate a strategy for growth or ways to measure the site's successes. The unfortunate consequence of this situation is that IAS has not been able to secure a steady funding source, either internally through the UC system or externally through grant funding. IAS recognizes the value in this service; however, they are still grappling with the question of where that value lies and who can most effectively use the exchange.

IAS initially focused on attracting industry users who needed assistance locating contact information for researchers who had relevant expertise. However, it quickly became clear that Tech Transfer was not the preferred system for connecting these two groups; instead, industry staff would rely on soft networks, such as networking at conferences and pre-existing working relationships with faculty.

These private sector individuals would often be representatives of large corporations with long histories of collaboration with particular researchers or research labs, long lists of potential contacts, or established presences at industry trade shows and research conferences. Occasionally, small- and medium-sized businesses would seek out researchers at universities; however, the nature of these businesses is such that they have very limited resources, particularly in terms of time, to spend tracking down potential partners in the UC system. Additionally, searches using Tech Transfer appear to be topic driven, rather than driven by a desire to contact a particular researcher. These challenges have led IAS to reconsider how it can serve companies that, by virtue of their various sizes, have different needs and uses for Tech Transfer.

Related to the question of how these businesses are served is that of existing infrastructure and services. Currently, different people at various UC campuses update their school's respective Tech Transfer technology profile; each campus has its own set of concerns, focal areas, and established processes. Even



at the level of a single university, there is a lack of adequate information-sharing protocols between different offices such as Human Resources, Financial Aid, and research labs when a company wants to collaborate with a university. In addition to making it extremely difficult to coordinate something like a business-level service, the siloing of information has the additional effect of disincentivizing change. Also, staff members at individual universities are reluctant to adopt a university system-wide expert portal when their university's individual portals appear to work sufficiently. Moreover, the return on investment of those individual portals may still need time to fully materialize; changing to a new portal would diminish that return on investment. While understandable in the context of staff time and training, the prospect of creating a uniform, searchable database of all relevant research across all ten universities is still far from becoming a reality.

IAS has considered scraping data using Elsevier's Scopus database, but given the current financial climate of higher education in California, this is unlikely. The staff looked at one of Elsevier's earliest platforms, which would have cost an estimated \$1.25 million annually for the system for 25,000 researchers. Broken down, this figure equates to roughly \$4.16 per researcher per month. Taken all together, it is a large financial burden UC's administration is not willing to take on. While some UC school systems use Elsevier's tools in limited capacities, its adoption is by no means comprehensive.

Health, biotech, and similar fields are well represented by Elsevier, but other academic disciplines— notably the humanities and fine arts—are not. Both in theory and practice, this has led to lower faculty participation rates of those opting in to electronic bibliography services like Tech Transfer. The experiences of IAS indicate that tools used in the pursuit of bibliographic data in STEM and tech-centric fields may be ill suited for fields like sociology and art history.

As it has elsewhere, this imbalance has caused IAS to reevaluate its value proposition. IAS has continually questioned the value of incorporating researchers from the humanities into the database, especially since most of the system's focus is on users within the STEM fields and practical research connections with business/industry partners. IAS feels that a better solution might involve focusing more upon these disciplines, which traditionally generate quantitative research and have greater applicability to business.

One way STEM fields are already being targeted in university-industry collaboration is through the Clinical Translational Science Awards (CTSA) program. In order to participate in the CTSA program, researchers at UC San Francisco were required to add their information to a portal created by CTSA using a modified version of Harvard University's Profile platform. Without something like the CTSA creating a benefit for those who input their information into the system, rates of self-selection will likely remain underwhelming.

Data scraping tools employed by platforms like Elsevier are not sufficiently developed at this time to effectively collect and display all relevant data; with information being displayed across a variety of platforms (e.g. LinkedIn, Google Scholar, PubMed, etc.), these tools still need several years of additional development to reach a point where they can provide better information.

During the authors' interview with staff at IAS, the main alternative to the use of services like Tech Transfer was the use of interpersonal social networks to locate potential research partners, funders, and other

collaborators. Although these sorts of networks suffer from issues stemming from imperfect or incomplete information, they do present a very low-cost alternative to the Elsevier's Scopus database solution. Graduate students, former classmates, coworkers, and mentors were pinpointed as good examples of contacts that could be used across a system like UC's to find solutions to research questions. When asked what IAS would do, given a budget to create a more advanced university-industry portal, Executive Director William Tucker said, "we don't need it to be the be-all and end-all of everything for everybody. We want to be able to find what we can buy that will allow us to answer some strategic questions about research capabilities and research competencies and so we can compare ourselves with other universities, because that is what executive leadership would like to know. It's less about showcasing every professor and their research to anyone on the planet with an Internet connection."

This may entail purchasing access to Elsevier or a similar service offered by companies such as Thompson Reuters, but only for a limited time. During this window, IAS would try to foster more integration among the UC institutions - coordinating with HR departments, pulling metadata, and waiting for the technology to develop to the point where they could implement their own interdisciplinary system. Such a solution could effectively serve the entire system, resulting in more fruitful collaboration and coordination among the active participants in the industry-academic ecosystem.

PUBLIC POLICY RECOMMENDATIONS

Analysis of the ecosystems of these seven portals from across the country indicated that a number of determinations should be made before the inception of the Ohio Innovation Exchange (OIEx). In order to help assure the sustainability of this technical resource network tool, it must be determined and clearly defined (1) what the main goal of creating the innovation exchange is; (2) whether it is envisioned as a public good; (3) who the primary audience is; (4) who the key beneficiaries of the information deposited to the network tool are; and (5) what the long-term strategy is to sustain it. Answers to these five fundamental questions will assist in building an appropriate ecosystem for a newly incepted innovation exchange and will inform technical decisions and plans for its development and operation. Such decisions and plans should include budgets for creating and sustaining the OIEx, appropriate designs in regard to main beneficiaries, physical and intangible infrastructure, and set procedures for acquiring and updating data.

Once OIEx's goal has been decided, creating a strategy focused on assuring the long-term sustainability of the project should take place. The current funding environment for state-level initiatives is volatile nationwide; without proper funding and careful budgeting, many portals cannot reliably afford the costs associated with maintenance. Decisions regarding the operation, development, and promotion of a OIEx should be made by committee; as more stakeholders become involved in the advising and operations of the exchange, they will become more vested in ensuring its continued success and prosperity. Additionally, web portals benefit from the different skillsets and strengths various committee members—including university administration, researchers, economic development intermediaries and industry executives—can bring to the table. Once committees are formed, it is imperative to determine and clearly identify which members and employees are responsible for various aspects of running the OIEx: funding, operations, updates on higher-level decisions affecting the portal, sustainability strategies, etc.

Another important element to consider concerns the data OIEx is going to utilize. Type of data, the data ownership, the types of hardware and software the exchange is going to utilize, who is responsible for data support and troubleshooting: these are all questions which should have definitive answers very early in its development. If OIEx is designed to operate with internal staffing, decisions regarding the staff should realistically reflect the amount of work project developers feel will be required to ensure adequate attention is paid to portal operation and maintenance. Based on the Center's analysis of existing portals, between two and five full-time employees appears to be a reasonable range (depending on the portal's anticipated size and reach).

If these factors are kept in mind, sustaining a portal beyond an initial round of funding is much more probable—especially if early successes lead to expansions to other research universities within a state, increasing the size and scope of the underlying database.

If OIEx wants industry as its primary audience and small- and medium-sized manufacturers as main beneficiaries, it should model itself in a way that takes into consideration the successes of New York's FuzeHub, the portal that bears the greatest resemblance to what OIEx wants to achieve. While other

portals supply information on university faculty experts to users, FuzeHub's users submit requests with explanations of their needs and their contact information through the portal's website. From there, staff members—acting as a business-level service—connect the company with the appropriate university resources in their network, which could be a specific faculty member, a research center, or an individual affiliated with the university in some other capacity.

If an agency is designing a portal to be used initially by both university and industry, the Center recommends tailoring the search function for inter- and intra-university research collaboration. If done sequentially, the searchable database could be broadened for university and business usage; however, by starting with the university side of the equation, OIEx will be better prepared to lexiconically bridge the technical language differences between academia and industry.

Beyond programming the innovation exchange itself, those users who will be using it regularly should undergo training during the development process. These super users should be trained on how to screen requests by their constituent companies and provide help directly if it is available. At the same time, industry-facing staff must be trained to become familiar with OIEx's network of resources and protocols for responding to requests efficiently and effectively. In addition, appropriate protocols for business-level services should be developed to best serve users with different resources.

At an individual level, staff at university tech transfer offices, research centers or library offices should be trained on how to use this resource. University staff should draw inspiration from MCRN's model, developing a pattern of active engagement with businesses and offering follow-up services to users after inquiries have been filed.

While no single staffing structure in our sample stands out as singularly effective, decisions regarding which staff should provide business-level services would best be based on anticipated workload dispersal, budget constraints, and the portal's overall long-term strategy.

After a model organizing the OIEx's ecosystem becomes clear and decisions regarding the makeup of advisory and operating committees are made, the involved parties should turn their collective attention to the task of deciding on how to evaluate the portal itself.

Beyond recording anecdotal success stories and measuring website hits via Google Analytics, no best practices for evaluation have been found among existing web portals. The Center recommends designating a separate line item in the OIEx's budget to conduct annual evaluations—including both quantitative and qualitative components. The qualitative component of the evaluation should primarily consist of interviews with small- and medium-sized manufacturing companies identified as likely users. Quantitative analysis should focus on determining level and nature of use through aggregated search data and follow-up services. Google Analytics, which provides an admittedly incomplete picture of how sites are used, may serve as a good starting point for analysis, but development of additional quantitative protocols, such as a survey tool, would significantly deepen the usage statistics.

One of the most notable impediments to success for the existing portals has been the lack of a clearly defined marketing strategy, including a dedicated budget. The Center recommends that a consistent and adaptable marketing program for OIEx should go online within the first two years of operation (as early

as possible given the realities of the existing timeline). This budget should include provisions for necessary staff, marketing strategies and transportation costs that are responsive to changes in overall project funding.

The marketing strategy should target events whose attendees or theme correspond to the portal's primary audience and goals, such as conferences, professional meetings, and training workshops. Staff should also consider the possibility of hosting their own events related to industry-university collaboration in order to attract potential partners and new users.

In order to separate OIEx from the individual universities and their tech transfer offices, it should have a clearly separate identity. To that end, OIEx should be marketed as a statewide web tool of university-based innovation. Additionally, it is important to consider marketing the OIEx to out-of-state users with similar needs, because only a handful of states have these types of tools.

Super users can also play a vital role in the portal's outreach to targeted audiences. After the portal has been launched, staff should develop a widget tool for OIEx's search engine which could be embedded on the webpages of super users. In addition to the widget, promotional and training videos could be added to the super users' websites.

Regional MEP centers can play a particularly important role in screening requests from small- and medium-sized manufacturing companies in order to assist firsthand when applicable. Their existing expertise and collaborations with university members provide them with an existing knowledge and contact base to ease the process of matching industry users with their desired university counterparts.

Beyond engaging small and medium-sized manufacturers, OIEx staff should also try to target business entrepreneurs. Entrepreneurs and their companies often lack dedicated technical staffing and may not know what kind of help they are seeking—or that they need help at all. A tool featuring accurate, responsive, and effective business-level services could help entrepreneurs find their desired aid packages. The importance of targeting entrepreneurs to foster regional growth necessitates forming super-user relationships with economic development intermediaries.

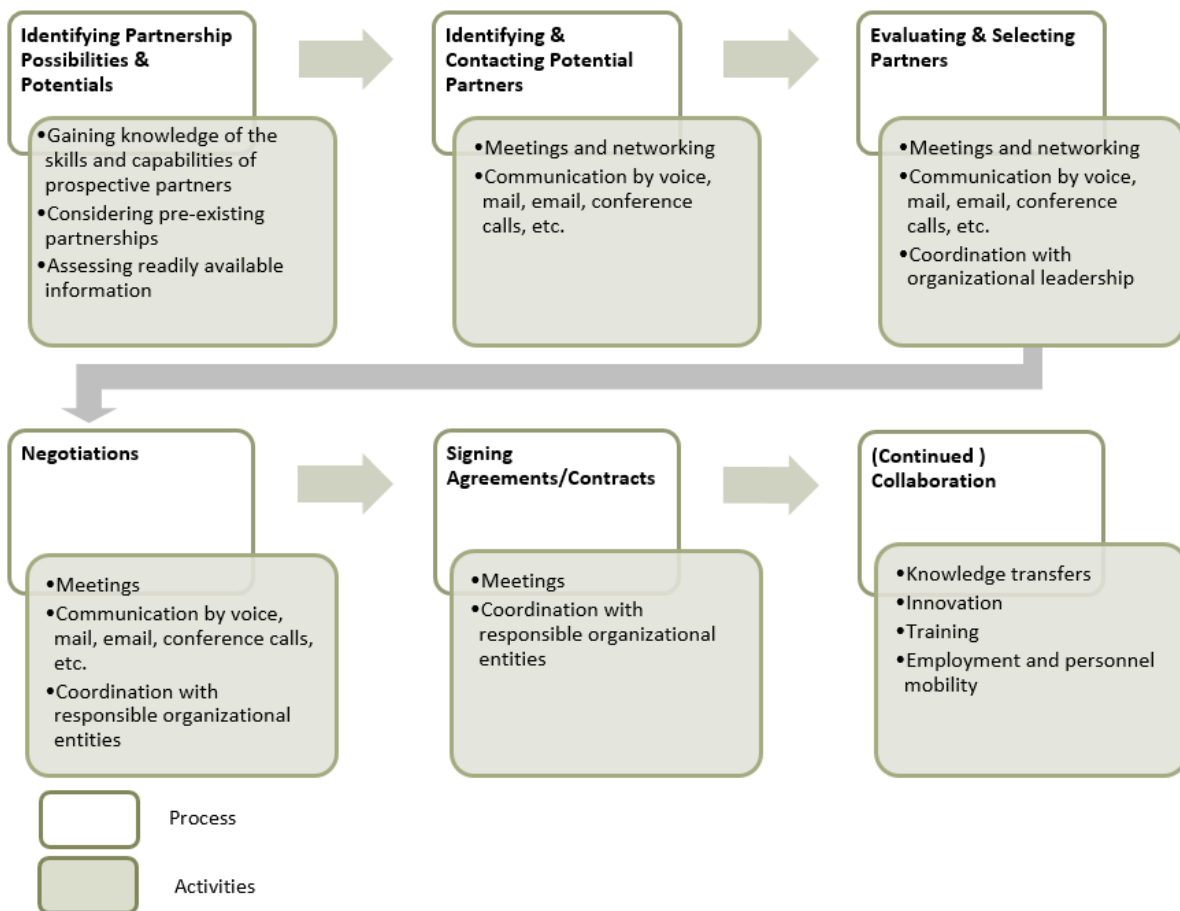
OIEx staff should be aware of and leverage the human networks embedded in their catalog of faculty researchers; this should include research and other support staff. Existing portals and social media platforms do not capture this level of human network. To that end, OIEx could build a human network diagram of their researchers to help provide additional information to users and other faculty members involved in the OIEx.

Finally, it is the Center's recommendation that the OIEx designate a budget for workshops and roundtable seminars with industry leaders, researchers, and management teams of similar portals across the country in order to discuss further development of such tools and to share best practices. Maintaining a collective dialogue about the innovation exchange, both in academia and in industry, will establish national thought leadership in this area. Without such dialogue, OIEx and others like it will likely stagnate, suffering from a lack of monetary, temporal, and intellectual investment. Just like the industries the OIEx portal is meant to support, dynamism is the key ingredient that will make this effort a success.

APPENDIX 1: REVIEW OF ACADEMIC LITERATURE

Since the 1980s, university-industry collaboration (UIC) has become an interesting and important social experiment fostering knowledge and innovation exchange in the United States and internationally (Fontana, Geuna, & Matt, 2006; Lee, 2000). Accordingly, the literature has flourished with studies focusing on different aspects of UIC (Appendix, Figure 1). Studies in this field can be generally categorized into five major types: 1) Motivations for collaborations and innovation exchange, 2) Private and public gains and expectations from UIC; 3) Process, activities and outcomes of UIC; 4) Impediments to UIC and challenges involved in the process; and 5) Determinants of UIC success and Best Management Practices (BMPs). This section discusses major findings and implications offered by the literature and sets a framework for further analysis.

Appendix Figure 1. University-Industry Collaboration Formation Process and Activities



*Based on Ankrah and Tabbaa’s systematic review of the literature (2015)

Private and Public Gains from University-Industry Collaboration

The most cited benefit of UIC is knowledge transfer linked to innovation (see, for example, Ankrah, Burgess and Shaw, 2012; Bercovitz and Feldmann, 2006; Lee, 2000; Mansfield, 1998). However, benefits from UIC often have different dimensions, and motives may differ on the academic and industry sides. Additionally, benefits may differ based on the type or organizational forms of UIC. For instance, benefits expected from formal research contracts may significantly differ from personal informal relationships. Understanding the expected gains—from both academic and industry perspectives—is important and interesting as it can help to formulate measures and mechanisms to facilitate UIC. Generally speaking, benefits from UIC can take three forms: 1) financial or economic benefits; 2) organizational benefits; and 3) social or community benefits. In this section, we discuss all three of these types.

Financial or economic benefits: Both actors expect financial or economic benefits from UIC. These benefits are also meant to extend beyond the organizations involved in UIC and result in community or societal economic gains. For universities an often-cited expected benefit from UIC is revenues generated that alleviate their increasing financial pressures (see, for example, Welsh et al., 2008; Yusuf, 2008). Typically, funds and support for university research comes from both public and private sources. In recent decades, government funding cuts in higher education and research coupled with expanding opportunities in technology platforms (e.g. computer science) has intensified the importance of UIC for universities (Bercovitz and Feldmann, 2006; Geuna, 1998). In addition to supported research, universities can generate income from licensing and patenting of technology transfers. From the standpoint of industries, production and financial gains have increasingly become dependent on scientific and technical innovations linked to academic research and knowledge. Industries are typically interested in commercializing university-based research for financial gain (Siegel et al., 2003). Additional benefits for industries include improved sales, R&D productivity and patenting activities (Motohashi, 2005). Ultimately, stimulating university-technology transfers leads to improving economic returns on publically funded research (Bercovitz and Feldmann, 2006; Geuna, 1998). These examples show how financial or economic benefits vary across actors.

Organizational benefits: Universities and industries complement each other in terms of organizational strengths and capacities (Mueller, 2006; Siegel et al., 2003). Maintaining an ongoing relationship and network is important for both actors. Through UIC, faculty members gain insight for teaching and learn about practical problems or practical uses of their research (Jong, 2008; Lee, 2000). Simultaneously, UIC furthers universities' outreach mission and creates opportunities for student internships and job placement of alumni (Lee, 2000; Tether and Tajar, 2008). From the standpoint of industries, universities offer extensive research expertise, access to cutting-edge research infrastructure and technologies. These resources can potentially shorten product life cycles (Yusuf, 2008) and bring about competitive advantage. Firms can also benefit from university resources for existing projects rather than starting something new (Cohen et al., 2002). UIC also provides legitimacy to research findings for industries (Jain et al., 2009) and legitimacy of product for universities (Santoro and Betts, 2002).

Social or community benefits: Universities are pressured by the society to become entrepreneurial and more involved in the community and the economy of their regions (Ankrah, Burgess and Shaw, 2012).

Through UIC, universities develop their networks and provide service to the community (Bramwell and Wolfe, 2008; Wright et al., 2008). Firms may also benefit from contributing to their communities and improving their image. Additionally, if UIC involves networking events, such as workshops, trade shows, fairs and exhibitions, the broader community can also benefit.

Other Motivational Factors Encouraging UIC: In addition to the aforementioned benefits, there are a number of other motivational factors that encourage UIC. Vaidya and Charkha (2008) identify a number of key motivational factors: 1) growing and globalizing economy; 2) shrinking product or services life cycle; 3) increasing R&D investments; 4) improving quality and efficiency of research by outsourcing it; and 5) global improvements in intellectual property (IP) rights.

Impediments and Challenges

Despite evidence suggesting that UIC can create a lot of value for all of the stakeholders involved and beyond, there are a number of challenges and impediments limiting the scope or success of these collaborations. In order to develop measures to enhance the chances of UIC success, understanding these challenges is crucial. The majority of impediments to UIC come from intrinsic differences between universities and industries. Primarily, there are four types of barriers discussed in the literature (see, for example, Bruneel, J., D'Este, P., and Salter, A., 2010; Florida, 1999; and Vaidya and Charkha, 2008):

- 1) Barriers related to distinct research orientation
 - Academia may favor basic research, whereas industries are interested in applied research
- 2) Difference in goals, priorities and procedures serving as a hindrance to collaboration
 - Industry focuses on cost-effectiveness and delivery speed; whereas academia focuses on teaching, contribution to the field, dissemination of findings with peers and the broader community.
 - Confidentiality requirements of the industry and the tendency of academia to share findings through peer-reviews, publications and presentations.
- 3) Communication difficulties, transaction costs and legal barriers
 - Information to be communicated is dependent on dynamic (i.e. fast-changing) industrial scenario that deals with customers, markets, etc.
 - University and/or firm administrative rules may require involvement of various parties (e.g. university research office, departments, firm labs, headquarters, etc.) slowing down the communication process and increasing costs.
 - Requirements are influenced by business strategy, customers and other confidential factors.
 - Distance can render communication ineffective especially when site visits or on-site supervision are limited or impossible.
- 4) Commercialization issues and distributional conflicts
 - Universities may be deemed weak in the area of intellectual property rights (IPR).
 - Conflicts may arise between universities and industries over which entity should capture formal IP, and by extension, financial gain.

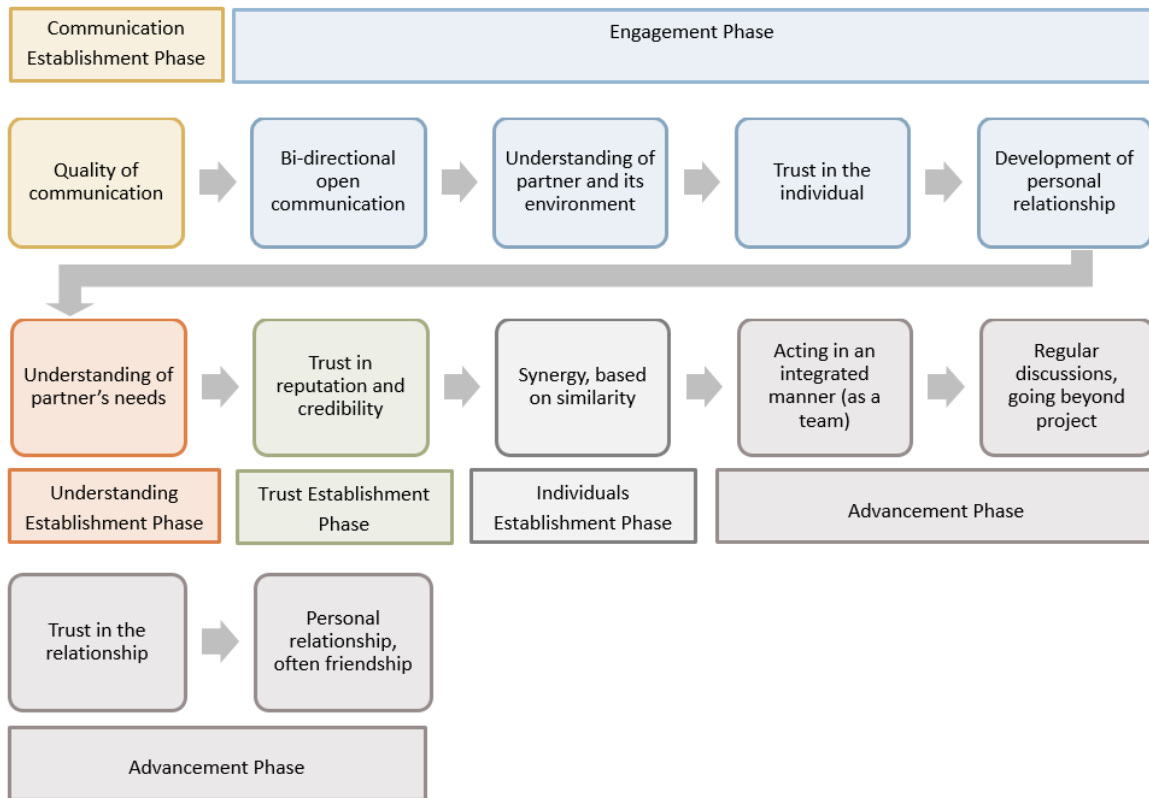
Process, Activities and Outcomes

The literature provides a number of models on the process through which UICs are formed (e.g. Tuten and Urban, 2001; and Mitsuhashi, 2002). During the collaboration process, from identification of potential partners to signing contracts and beyond, involved entities take different actions and get involved in various activities. The dynamics of these procedures and activities are directly linked to the outcome of UIC. Based on a systematic review of the literature on UIC, Ankrah and Tabbaa (2015) present a simple model of UIC formation that involves five stages: 1) partnership identification; 2) making contact; 3) partner evaluation and selection; 4) negotiations; and 5) signing a contract. The authors divide activities during the collaboration process into five groups: 1) meetings and networking; 2) communication; 3) training; 4) personnel mobility; and 5) employment. The first two types of activities often involve face-to-face interactions between the parties. Meetings and networking involve different activities beyond formal meetings, such as conferences, workshops, expositions, trade shows, fairs, exhibitions, and informal gatherings (Ankrah, S., Burgess, T., Grimshaw, P., & Shaw, N., 2012). According to Plewa et al. (2013), the establishment phase of UIC demands extensive face-to-face communication to ensure understanding between the parties early on in the engagement process. The authors also found that face-to-face meetings were the common mode of communication across the university-industry linkages in their study; however, e-mail and telephone conversations appeared frequently especially during the engagement process. The key is to ensure that there is an effective and efficient way to deal with challenges as they arise. Integrating high-level personal and frequent interactions is a significant trait in building relationships. Appendix Figure 1 illustrates the UIC formation process and common activities during UIC.

Determinants of Success and Best Management Practices (BMPs)

After learning about motivational factors encouraging UIC and the dynamics of UIC formation and activities, we would like to focus on measures to minimize the barriers involved in this process and ways to maximize chances of success. Appendix Figure 2 illustrates dimensions of success drivers for university-industry linkages across relationship phases. As illustrated in Figure 2, quality of communications is key to UIC success. The literature stresses the importance of communication in trust building and developing a lasting relationship between universities and industries. (Integrate the face-to-face interaction part from next pages here).

Appendix Figure 2. Dimensions of Success Drivers for University-Industry Linkages across Relationship Phases



*Based on Plewa et al. 2013

In a recent report, Greitzer, Pertuze, Calder, and Lucas (2010) identified seven key BMPs to UIC success from the standpoint of industries. These BMPs are:

- 1) Outline the project's strategic context when assessing and selecting potential partners and projects
- 2) Consider three important attributes for project managers involved in UIC
 - a. Deep understanding of technology needs within the field
 - b. Enthusiasm and ability to network across functional and organizational boundaries
 - c. Skills to identify the links between research projects and product implications
- 3) Develop a clear vision of how UIC can contribute to the company and share it with academic partners. This will add transparency, and will ensure stakeholders have a clear understanding of the project.
- 4) Invest in long-term relationships through multi-year collaboration projects.
- 5) Create a strong communication linkage with the academic partners through regular face-to-face meetings, establishing a communication routine beyond meetings, and promoting extended personnel exchange.
- 6) Enhance awareness of the project within the broader functional areas of the company through:

- a. Extending university team interactions beyond the project and across various functions of the company
 - b. Providing feedback to the university partners regarding alignment of the project with company needs.
- 7) Support the project internally beyond the official contract time frame and until the project yields outcomes.

Conclusions and Pathways to Future Research

This brief review and framework for the success of UIC throughout the different phases of the process provides an insight to the current state of the literature. One major observation is that the benefits and by extension the success criteria for UIC differs from the standpoint of universities and industries. Additionally, these benefits and determinants of success are dependent to the specific context under study, such as the specific type of UIC or its relationship with the broader economy or community. These dynamics contribute to the complexity of UIC processes and outcomes—making identification and clearing of barriers difficult. As a result of this complexity, specific aspects of UIC and its success have been overlooked by the literature. One major limitation is related to the practical tools and techniques used to foster UIC. For example, while the literature has focused on the importance of communications in UIC development and success, none of the reviewed studies have offered practical guidelines to benefit from technological advancements in communications. This report offers insight into specific online tools that can facilitate UIC.

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