Penn State KIZ Innovation Grant Team
I-99 Innovation Network Portal

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Executive Summary

This document forms part of the report on the I99 Corridor Economic Development Project undertaken at Penn State to analyze how the University can enhance its impact on the innovation activity and economic health of the KIZ three county region; Bedford, Blair, and Centre Counties. As a major research university, Penn State is home to significant scientific, technical, engineering, and business knowledge and experience.

We found that there are indeed significant resources available to support entrepreneurs and small businesses in developing and implementing their plans. Despite these significant resources and some successes of new business creation, the region leaves much to be desired in its ability to identify and execute in both attraction and formation of new businesses.
Unfortunately these offices by and large work independently from each other. Indeed, they often view themselves as competitive rather than collaborative which significantly reduces the potential effectiveness of the resources deployed.

A second key problem is that we are located in an area that lacks a solid "entrepreneurial infrastructure" as typified by such regions as Silicon Valley, Boston, and Cambridge, UK. In order to overcome this shortcoming, the Federal and State Governments, the University and private/public entities have invested in a number of offices and facilities aimed at "bootstrapping" economic activity in the Central Region. These include incubator space, "Discovery at Penn State, the Ben Franklin Technology Partnership, Offices of Research, Intellectual Property and Technology Transfer, Economic Development offices, active Chambers of Commerce, University Outreach and the Federal Manufacturing Extension Program. We uncovered a number of initiatives in other areas where the internet is being applied to attack similar challenges. Based on the results of these applications, we propose that the region establishes an "innovation portal" which will enable the existing economic development resources to interact with entrepreneurs and business owners. More importantly, by using specially designed and proven web-tools, these resources can become more effective in creating value for the region through synthesis of knowledge and accessing extended networks in a dynamic rather than static process driven mode.

We are currently seeking funding to implement a pilot for this portal.

Background

Our mission is to assist with economic and marketing assessments of technology commercialization ventures within the university (appendix 4, university spin-offs) and the

199 Corridor region. We began by researching University spin-offs, digital innovation, dynamic knowledge management, and network collaboration. We gathered information and sought to identify, filter, analyze, understand, and articulate the significant cultural and organizational barriers to effective collaboration in this region. In doing so we identified that not only are we lacking in the social capital necessary for effective knowledge transfer, but the systems for effective collaboration are also not yet in place. Independent of the systems and tools, it is a function of trust that will allow the interrelated groups to share knowledge and strive for synergy in their often interrelated ventures. It is networks of relationships which are founded on high levels of trust that are extremely valuable and are an often overlooked resource in the creation and management of knowledge and commercialization of technology. PSU has a tremendous amount of human and structural capital; it is the social capital that is lacking in the community.

Interviews with a number of the existing offices[1] show that the resources listed above operate largely in isolation, with little interchange of information, and sub-optimal cooperation. This results in major shortcomings:

- Any person approaching this "network" for help has difficulty in identifying the appropriate place to go. This may result in them not gaining the help they seek or worse, seriously frustrated with the process.
- The current system is not optimally tailored to meet the unique needs of the many different entrants into the system.
- There is no "co-solving" of the complex problems or "knowledge synthesis" that combines experiences from different persons, or taps into their external networks focused specifically on each individual economic opportunity associated with economic development.
- This commonly results duplication of effort.
- There is no "institutional learning" on which to build.
- The University suffers criticism for not offering "user-friendliness" within an economic development system.
- There is no structured method of accessing extended and powerful knowledge networks and applying them to an opportunity relevantly, dynamically and quickly.
- There is no traceable history of opportunity creation efforts resulting in the inefficient deployment of valuable resources.
- The resources do not easily fit different potential drivers of opportunities such as existing businesses in the area, or individuals or businesses planning a move here, entrepreneurs within the community, investors, research faculty, students, etc.
- Opportunities are undoubtedly missed resulting in lost economic value.

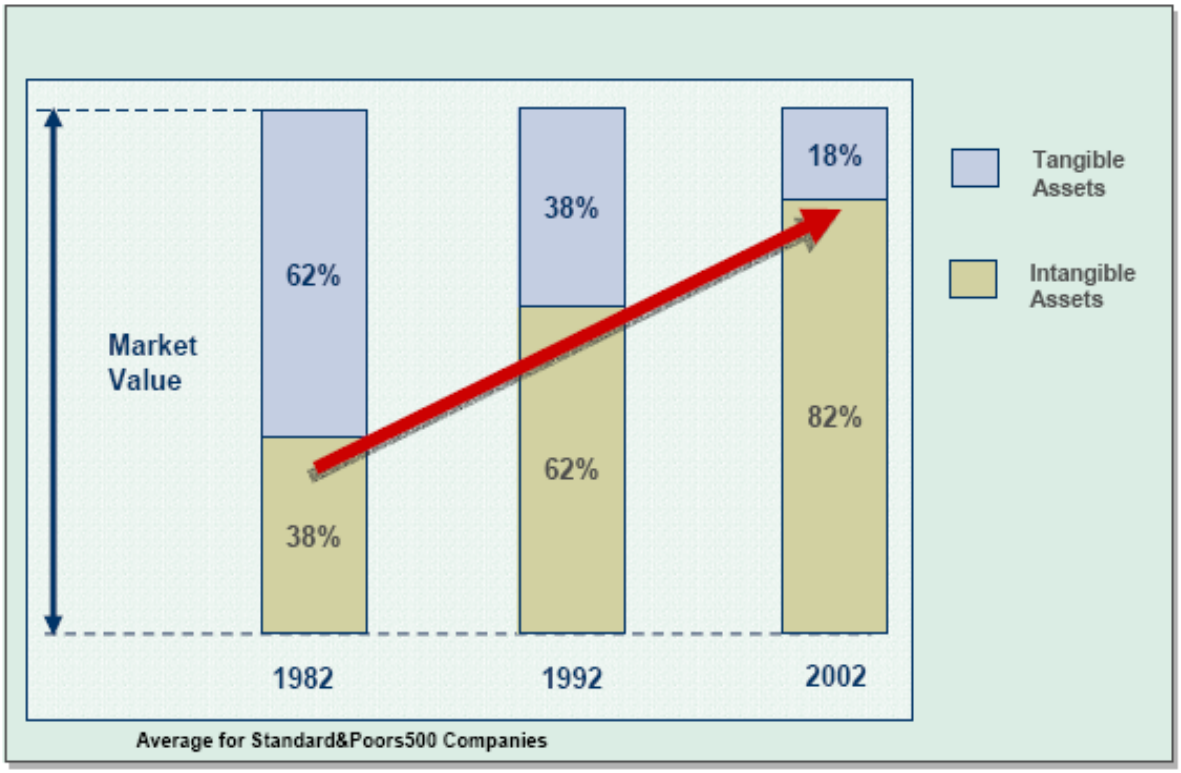
In order to maximize the use of *existing* resources, we propose the creation of a virtual innovation network; the "I99 Corridor Innovation Portal" based on the principals of "dynamic knowledge management" whereby the combined experience and resources of each participating member are applied on a case by case basis in real-time. An understanding of how knowledge is classified and transferred is discussed later as it paramount to justify the

[1] Marty Bradley, Stephen Brawley, Jack Gido,Tim Hurley, Ron Huss, Dave Jordan, Dan Leri, Steve McKnight, Tanna Pugh, Jim Shilenn, Rick Weyer, Paul Hallacher, Craig Weidemann.

initiative. The concepts discussed in this report have been derived from past research within the Farrell Center on innovation management, dynamic knowledge management, stimulation of network effects and their application to economic development.

Tacit and Explicit Knowledge

There has been considerable attention given over the last twenty or so years in the field of knowledge management. As the value of enterprises has shifted largely from fixed to intellectual assets, (see the following chart) attempts have been made to codify and apply the knowledge created by an organization for future use and application.



A number of researchers[2] recognized that it was useful to consider two categories of knowledge – explicit and tacit. Broadly speaking, explicit knowledge can be structured and recorded for the benefit of future users without any interpretation from the creators of the knowledge. Examples might include maps, recipes, operating manuals etc. Tacit knowledge, on the other hand, is more complex and has personal interpretations embedded within such that the value for future users requires access to the implied knowledge and experience of the creator. For example, Kraft manufactures a range of processed cheeses which are noted for their quality, and consistency. Yet they the raw materials are highly variable coming from a range of farms in which the product quality, flavor, texture etc. many depend on a large

[2] "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation" , Ikujiro Nonaka, Hirotaka Takeuchi, OUP, 1995; "Why Organizations Don't 'Know what they know': Cognitive and Motivational Factors Affecting the Transfer of Expertise, P Hinds, Jeffrey Pfeffer, Res Paper 1697, 2001, Stanford University, Graduate School of Business.

number of variables, such as weather, herd management, timing etc. Selection of the mix of raw materials into the manufacturing process is aided by tasters who choose the blend from the warehouse of individual raw materials in order to achieve a consistent output. The selection depends highly on experience, taste, health of the tasters etc. This knowledge is impossible to codify and has a high tacit content.

These two classes require different methods for transmission between individuals and teams wishing to avail themselves of the intellectual content. For example:

- Explicit to Explicit is the simplest transfer challenge exemplified best by web-publishing. There is a wealth of information that is not tailored to the user. If it is structured and codified, then it can be of considerable value. www.webmd.com for example has a wealth of health related information. Often however, it requires the experience and tacit knowledge of a trained physician to interpret and diagnose complex disease states. Current web-sites and brochures targeting economic development are rich in explicit knowledge.
- Explicit to Tacit is typified with a learning environment particularly where the student is required to experiment based on published information developing tacit knowledge for themselves.
- Tacit to Explicit has been the holy grail for many years spawning the field of expert systems. The aim has been to somehow capture the subtleties of tacit knowledge and use computer systems to codify and interpret them for particular future instances – replacing the cheese taster above with a computer program. Apart from very limited domains, this approach has been largely unfruitful.
- Tacit to Tacit is still the most powerful method of knowledge transfer using such techniques as story-telling. Fortunately, now that the internet has developed, we can deploy systems that allow tacit knowledge application without the necessity for direct one-one contact. This is the method that we are proposing here.

Dynamic Knowledge Management

Local innovation and knowledge creation depends on the regions and the local players to establish channels and networks in order to access knowledge from distant nodes of knowledge production. It is obvious that it is not always possible to bring parties together in the same place to share ideas and collaborate towards solution development. This function can be achieved through the development of Dynamic Knowledge Management Systems (DKMS). An effective DKMS captures, builds upon, improves, and challenges knowledge resulting in so-called “heedful interrelating”. This occurs as participants in a social system understand how their interactions in the network and contributions affect the structure, performance, and evolution of the system. This enables each player to optimize his/her efforts for the benefit of the team. DKMSs lead to the increased creation of new knowledge and innovation. We see the most valuable effects of these dynamic systems as:

- *Serendipity* in which cooperation uncovers new opportunities that would remain undiscovered without the existence of an interactive network
- *Synthesis* in which opportunities are expanded through the interaction of network members who build upon each others knowledge, experience and creativity

- *Access to* "Transactive Memory" whereby participants in the network can themselves tap their own external knowledge networks even though they may not themselves have the relevant information. "It's not what you know, but who you know!" For instance, an individual is struggling with a problem in his operation related to ceramics. He happens to get in touch with a colleague who claims "my Danish Uncle is an expert in moldable perovskite ceramics."

A further benefit of a true DKMS is that the output is knowledge that is in an actionable format compared to the format of a Static Knowledge Systems.

Static KM systems are only marginally effective at igniting innovation or solving innovation problems. This is partly because it is hard to incentivize sources to codify their knowledge. When the complex tacit knowledge is in fact codified, it is often undertaken out of context. Even when the knowledge effectively codified, it is difficult to search. Often it is impossible to codify the relevant knowledge and hence tacit knowledge is lost. It is our position that for true breakthrough innovation to occur, serendipity, creativity and synthesis must be fostered. When knowledge is codified, it denies these phenomenon from taking place. In addition, when knowledge is codified it ages and loses relevancy with time.

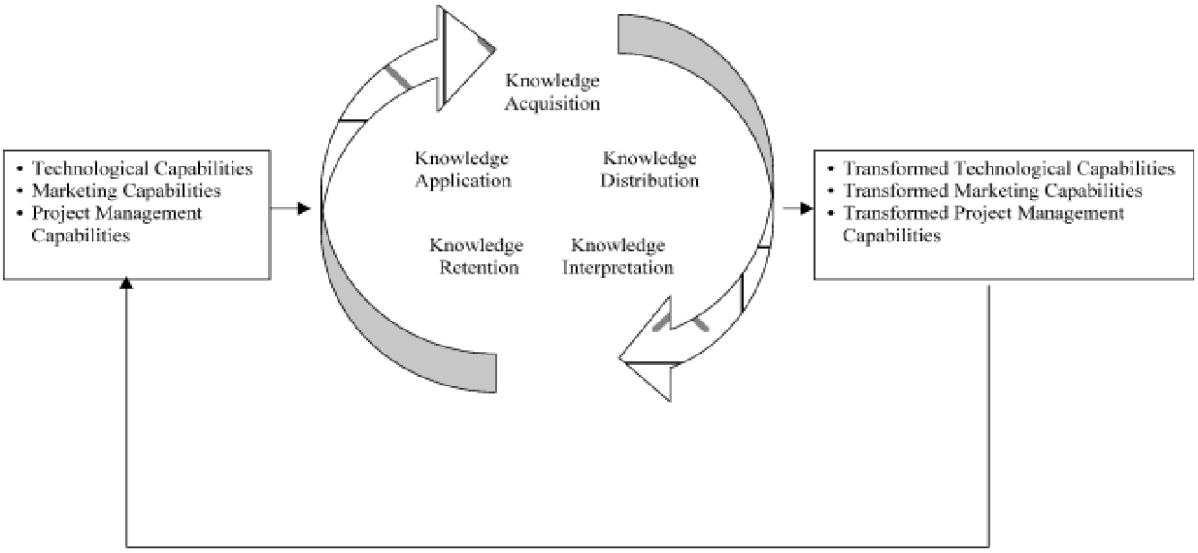
Our proposed action applies an effective and practical use of a DKMS in the sharing of existing knowledge and creation of new knowledge in response to "challenges" within the I99 corridor. It is these problem-based challenges or "opportunities" that provide the most appropriate situations for the use of dynamic systems. In these constantly evolving systems, tacit knowledge can be accessed and built upon through idea synthesis and collaboration. Some examples include; informal communities of practice, discussion databases, Idea Management Systems, KM helpdesks and certain types of focused collaboration tools. Though there are many applications for DKMSs, we will focus on the use of such a system to innovate within the I99 Corridor as we construct an innovation portal designed to solve complex problems and expand embryonic opportunities

Specifically we propose an I99 Corridor Innovation Portal using software that has already been developed and operated by over 150 leading corporations to manage their own innovation processes. To our knowledge, the application of these proven techniques has not yet been applied to regional economic development although there are some embryonic trials underway in Italy and Canada. By adopting these methods we believe that the I99 corridor can become a leader in the use of knowledge networks for the promotion of economic development and, by so doing, act as a major catalyst for growth in the region.

Creating such a knowledge portal has another significant advantage; history is captured and becomes a repository of assets for future access and use. Such a system creates a virtuous circle of intellectual capacity as input into future innovations. This is illustrated in this figure[3].

[3] Source: *Building Dynamic Capabilities in New Product Development through Intertemporal Integration*, Sarah J. Marsh and Gregory N. Stock, Journal of Product Innovation Management, 2003:20:136-148.

Virtuous Knowledge Management Cycles



Penn State would be the "Interaction Catalyst" for this initiative. Knowledge networks of this type are difficult to create and stimulate. One key attribute is that one entity with scale, reputation, integrity and resources takes on ownership and promotes participation. Each of the stakeholding entities will have the ability to launch an opportunity challenge onto the network. This will in turn trigger responses from related functions and thereby build on the experiences and networks of these existing entities. The appropriate actions to build the opportunity emerge during this process and ownership and actions agreed. The software can track the progress and handover the tasks to new resources at the appropriate juncture.

In addition, the site will provide a powerful multi-media learning environment to help entrepreneurs and business executives with valuable business building tools. Knowledge is shared in many unique ways, very commonly groups with similar interests and challenges collaborate to solve problems.

Communities of Practice

"Communities of Practice (CoPs) are usually informal groups of practitioners, experts, and other interested parties formed within a single discipline in order to focus efforts in sharing knowledge, solving problems, or innovative ventures."

It is undeniable that the complexity the technological and global age in which organizations function has been rapidly increasing, so a more multidisciplinary participation provides a benefit in knowledge management and collaboration efforts because of the expanded focus and even wider spectrum of problems that can be addressed.

These communities are much less common than single disciplinary communities of practice, but will continue to grow as enterprise-wide issues that involve multi-dimensional problems continue to challenge executives. These diverse groups are most effective in situations in

which knowledge from one field is unable to advance without congruent contributions from other respective disciplines.

Companies are using two primary approaches to try to implement or leverage these CoPs. Both approaches fall under the Knowledge Management Label, however the artificial creation and formalization of CoPs without the appropriate systems to manage and synthesize the knowledge contained within these networks is wasted effort. Static knowledge repositories and other KM tools have not proven fruitful due to companies failing to see the synergistic relationship that must be realized in an effective innovation network.

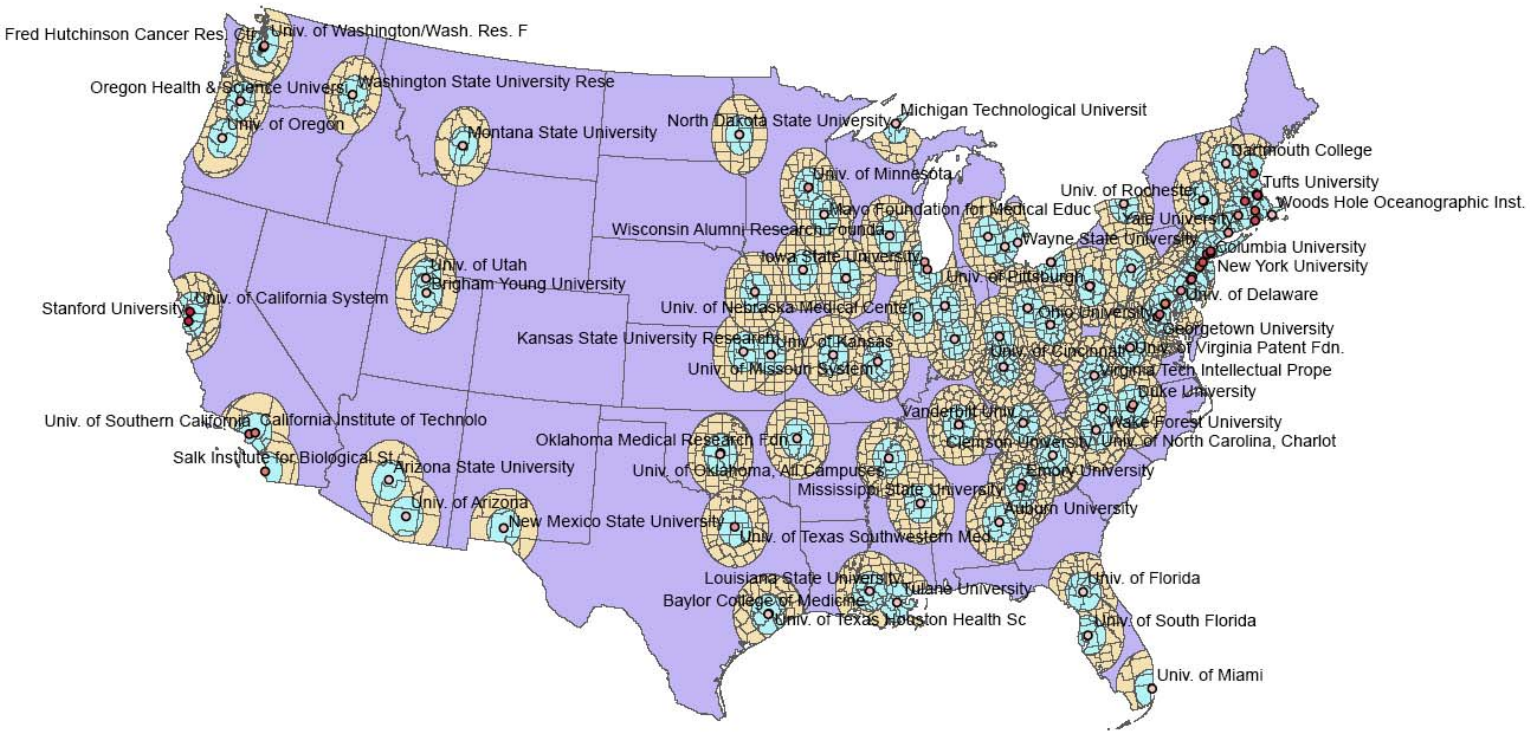
The CoP is closely linked to the concept of the Collaborative Virtual laboratory (VL), which represents a heterogeneous and distributed problem solving environment that enables a group of researchers located in different geographically spread centers to work together, sharing resources (equipments, tools, data and information related to experiments, etc.). (Wikipedia)

Central PA's Entrepreneurial Infrastructure

Recent research on the dependence of University Licensing Offices[4] on the "local entrepreneurial infrastructure" (Warren, Trotzer, Hanke[5]) suggests that our region is at an inherent disadvantage regarding technology transfer and new business development. This is due to our geographical "remoteness" as well as lack of tangible and intangible infrastructures found in more successful regions. The metric that we chose for measuring the strength of such infrastructures was the value of Venture Capital Investments within a fifty mile radius. VC firms have a strong preference for making investments in early stage companies where they can be close and provide help and mentoring. The map shows the density of VC investments for the US within 50 mile radii of the largest research Universities. It is no surprise to see the high densities in California, and along the East Coast, with smaller activity levels in such places as Austin and Minneapolis. The activity around State College, particularly when related to the fact that PSU is among the top five research universities, is much lower. This indicates that, as a region, we must develop methods more suited to our low level of entrepreneurial activity. These characteristics notwithstanding, opportunities still exist to increase the effectiveness of the region's systems in order to avoid the shortcomings of the current "entrepreneurial" environment by understanding and adapting to the critical characteristics of remote region systems.

[4] "Creative Models for University Technology Transfer - Addressing Location Based Obstacles through Resource Consolidation and Third Party Engagement", R Hanke, D. Trotzer & A Warren, Presented at the AUTM/LES conference in May, 2006.

[5] "Models for university technology transfer: resolving conflict between mission and methods and the dependency on geographic location**",** presented at the Cambridge Conference on Economic Development Policies, December,2006



Clusters and Networks

There is considerable literature on clusters. (appendices 1-3) Indeed the Governor's economic development plan considers clusters as a fundamental building block for the future of the State. It is important to differentiate between clusters and networks. Clusters connote geographical linkages. Networks can transcend local regions and often do. In this paper, we are proposing a regional innovation network. However there is no reason why this network is restricted to inputs from outside the region. For example, we could use the network as proposed to tap into the expertise and interest of our alumni. There is reference in the research literature to "virtual clusters" which are similar in many ways to what we are proposing. However we recommend retaining the term cluster to connote cooperation in regions solely. For completeness we provide more information on these concepts in an appendix.

Key Components of Regional Innovation Systems

The most effective regional innovation systems include a significant representation of small firms who are nimble and willing to take risks. These firms are usually highly entrepreneurial and are flexible enough to respond quickly to changing market conditions. The small firms are likely to develop disruptive innovations that provide them with a first mover advantage. It is also critical that the small firms have connections with global markets. The small innovative firms can benefit from lead firms (global corporations) that have established connections to these world markets. Another key component to regional innovation systems are Research Universities that provide the funding and infrastructure for technology commercialization. It

is also essential to have a skilled workforce that is capable of continuously learning and adapting to the rapidly changing technology. (Christopherson, Cornell U)

The conventional view of these systems is that firms are co-located and come together in cooperative networks to share knowledge and skills. However, evidence from US regional innovation systems indicates that firms are adversaries rather than allies and cooperation is the exception rather than the rule. The conventional view also leaves breakthrough innovation in business models to the small firms. We also know that large enterprises are becoming increasingly flexible and are leading the innovation in many arenas where they control the standard. Hence there is competition between large trans-national firms and small firms for the high and medium-skilled labor force. Both large and small firms are also competing for the research and development capacities provided by Universities and the government. In these cases the small firms are at a disadvantage as government sponsored R&D centers predominantly serve the large firms. It is difficult for the small firms to compete for the high and medium skilled labor. (Christopherson, Cornell U)

It is therefore crucial to change the paradigm and dynamics of the imbalance by better understanding the needs of small firms. The small highly innovative firms will need help to meet the labor force needs in order to compete with large companies. It will be a function of policy makers to allow the small firms to influence innovation policy agendas and to place the needs of the small firms ahead of the trans-national corporations. Small firms are also increasingly leveraging IT to level the playing field.

Information Technology Systems & Spatial Proximity

In addition to the political support that is necessary for an effective regional innovation system, there must be an appropriate system for sharing knowledge and collaboration within the system. Local innovation and knowledge creation depends on the regions and the local players to establish channels and networks in order to access knowledge from distant nodes of knowledge production. It is these networks and pipelines that increase the variety of locally available knowledge as firms are inked to multiple knowledge networks and innovation pools. It is obvious that it is not always possible to bring parties together in the same place to share ideas and collaborate towards solution development. Though spatial proximity is often a benefit, it is not necessary for knowledge synthesis. The relational proximity is more important for enabling long distant learning. It has been shown (Nooteboom 2001) that an effect of cognitive distance is optimal when two parties ‘know different things’ but have sufficient affinity and the absorptive capacity to communicate effectively with one another. Learning is normally facilitated when individual and organizational characteristics of the two parties are common. (Local “buzz” and global “pipelines” Owen Smith & Powell 2004; Bathelt et al).

Portals for Economic Development

A quick search of the internet finds a plethora of economic development portals that aim to advertise the attributes of a region to businesses. One is immediately struck by their similarity and inability to offer anything that truly differentiates them from each other. Most importantly they are static and do not allow any "applicant" for help to know exactly why any region is really better. A call to the local economic development office inevitably gets standard information collated in that office and does not tap into the regional resources *"in a tailored way"* for the particular applicant. There is a standard, brochure driven response.

This method suffers in several key ways:

- *Every* new opportunity is inherently different from every other. There is certainly not one size that fits all. For example, in our local region, economic development may be driven by students, a retired executive moving into the area, or local businesses looking to change their business model by adding services for example.
- Often the applicant does not even know themselves which questions should be asked.
- With around a dozen possible "initial contact points" it is highly unlikely in any case that the initial contact is the most appropriate. With no simple method of establishing the correct point of entry, and communicating between entities, opportunities are inevitably lost.
- The most valuable knowledge required to aid economic development is in fact tacit rather than explicit. Static information sources provide no tacit knowledge.

Our proposal is designed to remove all of these shortcomings and provide a dynamic economic development mechanism for Central PA.

Point-to-Point Systems

Almost the entirety of knowledge management systems designed for economic development we have encountered can be classified as point-to point systems. These are often websites or published resources that provide a listing of service providers or support resources and rely on static knowledge depositories. These entities focus on single end-product and basically neglect any opportunity for creative synthesis. Most of these sites use a single entry-point which may lead to wrong resource allocation. These linking systems limit the flow of information, are not tailored for unique needs and provide no tacit knowledge exchange. Often it results in the duplication of efforts and is relatively inefficient. In essence, the point-to-point model does not facilitate or support collaboration and does not promote solution synthesis. These models are also unscalable and do not offer great interoperability with other DKMSs. Some examples of such systems are Eventuring (Kauffman), Business.gov (Federal Government), Willitfly.com, Enterweb.com, and KCSourceLink (U of Missouri, funded by Kauffman). Any viable innovation portal must be scalable and interoperable. It is important to shift the analytical measure for innovation away from products or processes and towards a more regional focused concept that elicits that regions ability to be a leader.

Many large enterprises have invested millions in creating knowledge management systems based on attempts to catalogue knowledge to be searched and applied later. It is now

generally accepted that these investments have been largely unsuccessful. There are several reasons for this. The first group is considered to be a result on the way that humans assimilate cognition:

- Expert knowledge creators, when asked to codify their knowledge, embed significant tacit information using more abstract concepts than novices can comprehend.
- Experts do not remember how THEY learned and hence set expectations too high – novices may then just give up
- Experts tend to emphasize their most recent experiences to the detriment of the earlier supporting knowledge and experience
- Tacit knowledge is inherently difficult to verbalize. (How do you learn to swim?)
- Tacit knowledge is difficult to generalize to other situations. (Is cheese making similar to chocolate blending?)
- There is little incentive for someone to take the time to codify their knowledge for others later benefit.

The second group of barriers is related to motivational limitations:

- Competition can be a disincentive, with participants believing that their personal promotion, status, raises, etc. may be lost if they teach others
- Team cohesion forces may prevent open exchange of valuable knowledge
- The belief that "knowledge is power". (If I am the only one who can blend cheese then my job is secure for ever)
- There can be hierarchical and status barriers to open knowledge exchange
- Reward and incentive systems can counter openness
- Organizational trust can be a barrier (do I trust others NOT to use this knowledge against me?).

It is this second group that we must be cognizant of as we develop a cooperative innovation network.

Over the last few years there have been some developments based on the evolution of the internet that are successful overcoming the inherent shortcomings of static knowledge management . These are generically referred to as "Dynamic KM Systems". They work as follows.

Knowledge it not preemptively codified, but is only requested when there is a need. "Challengers" create a web-request which is then responded to, based on the knowledge and experience of the network. Experts do not work in isolation and responding to a specific need, they are more likely to offer tacit information as well as tapping into their own extended expert networks. The challenge therefore becomes alive as each contributor builds on the knowledge of the others. The environment is collaborative, active, dynamic, and innovative.

The software that we are recommending for this new I99 virtual network is robust and well tested by over 150 major enterprises. It is readily adapted to our specific needs.

Specific Proposals

The most efficient, seamless, and user friendly collaboration model that can be incorporated is one that operates on a virtual platform. In simple terms, we are first proposing a web meeting place where people can share ideas about how to help new ventures succeed. Creating an effective virtual platform for entrepreneurial support will optimize the process of new business development for local businesses, aspiring entrepreneurs, and the University. It can also stimulate a much needed transformation in the business environment for economic developers. By effectively facilitating real collaboration, we can improve productivity and program effectiveness while also generating improved results in creating value and new jobs through local technology commercialization and the development of university spin-offs.

We propose two distinct systems, the first designed to stimulate regional collaboration and the second to offer a wider reach for corporate problem solving employing PSU as the facilitator. The first model, The I99 Corridor Innovation Portal platform allows for efficient navigation of the entrepreneurship network by way of a virtual portal that leads to all functions associated with local entrepreneurship, tech transfer, and community (local, state, national) resources. The portal collects data, offers appropriate entry points into the network, and acts as triage function to diagnose and direct inventors and resources to the most appropriate place. The platform provides for greater visibility within the network and has the potential to standardize some metrics to evaluate the effectiveness of each function. This platform would also provide an avenue for the University Administration to provide additional tactical support to the system.

Participants

The resources available to entrepreneurs and business managers in our area are multifaceted. They include, but are not limited to, the offices of: Research Commercialization, Industrial Research, Intellectual Property, Technology Transfer, Ben Franklin Technology Center, Small Business Development Center, PennTAP, Angel Investor Groups, loan providers, Discovery@PennState, County-based Economic Development, IRC, the Farrell Center, the Garber VC fund, and the tremendous intellectual capital available throughout the University and possibly the alumni. Though many of the university functions are located in close proximity in the Innovation Park complex, there are major opportunities for increased integration and communication among the functions that will be stimulated by the incorporation of the virtual network platform.

External applicants may come from many sources including entrepreneurs, small business owners, faculty, students, persons seeking to locate in Central PA, alumni etc.

Imaginatik – IdeaCentral

We have located a proven innovation management software platform that could be readily adapted to fulfill this function. It is called “IdeaCentral”™. This is a commercial product that has been deployed by over 100 major companies. The initial implementation cost will be under $100K followed by a normal annual maintenance cost. This would include robust external hosting. IdeaCentral was developed by Imaginatik Inc. in Boston. This company is

willing to work with Penn State in adapting their platform for this application. Because of a long and fruitful relationship with PSU, the company is willing to provide development and support at below market prices. Their incentive is to develop a new market application for their software. A cost of around $100K will enable the installation of a beta service in a period of six months. The software would be hosted by Imaginatik.

IdeaCentral is a proven DKMS that in its simplest form is used to solicit ideas from within an organization based on a problem that is posed to the system. The initiators are usually a small team with an opportunity or problem. The team posts the issue, elicits ideas from the larger group, and essentially filters through proposed solutions and new ideas to help them resolve the problem. This has proven successful for companies such as Bristol Meyers Squib, who received more than 5,000 ideas and concepts for one project that supported BMS in introducing a range of diabetes products that improve the quality of life of diabetes patients. Cadbury Schweppes saw over 46% percent of its employees contribute more than 6,000 ideas in one case. Georgia Pacific was able to generate several million dollars worth of tangible cost savings in addition to several million more in generated pipeline value through IdeaCentral.

199 Opportunity Portal

Our vision is an entrepreneurship support system with an interface that invites *Challengers* (entrepreneurs, faculty, SMEs, etc.) to create a simple profile which is then automatically evaluated by an intelligent software system to connect the entrant to a subset of functions to determine which service provider (IP office, ABCD, tech transfer, etc.) is the most appropriate to handle a more detailed assessment of the needs of the opportunity. After the "Gatekeeper" service provider is identified, an embryonic "case" summary in a standard format is completed by the entrepreneur in cooperation with service provider. The software model then delivers the case to a central workspace organized by industry, topic, stage of development etc. The service providers that match the needs of the case are alerted via e-mail to review the profile. Each service provider can add content to the case evaluation and provide perspective and insight (expert commentary) for the entrepreneur in a transparent process. This facilitates innovation through the use of dynamic knowledge management and the power of the entire network. Ownership of the "case" would remain with the original contact until a natural evolution to a more appropriate resource emerged. (The diagrams following illustrate the knowledge flow and change of managing office during the process). Over time, "case management" may migrate as an opportunity matures. The original contact may be required to do a PSU Google search to uncover relevant knowledge within PSU and to determine if there are any faculty members interested in contributing to the opportunity.

Some necessary characteristics of the I99 Innovation Portal platform include education for entrepreneurs at all stages of the process. It is paramount that the Entrepreneur can recognize and subsequently access the type and depth of assistance they need. Entrepreneurs and other players in the network must understand clear guidelines including the purpose of the network, what level of access they are allowed, and the visibility of the activity at different functions in the system. The players within the system will be expected to participate in occasional meetings to provide feedback about the effectiveness of the model and additional support that is needed or modifications that should be made. It will be critical that each member of the network have an understanding of what other functions specialize in. This can be

accomplished as each function explicitly expresses their areas of expertise. The effectiveness of the referral process from one function to the other has been an opportunity in the past, the proposed platform standardizes the process and alleviates frustration entrepreneurs feel from being referred multiple times to different places and eventually giving up. Attached at the end of this document are diagrams showing the gateway participants and knowledge flows/procedures.

We have found an abundance of useful websites that offer a comprehensive listing of references to service providers; however these models do not fully take advantage of the "serendipity" found in effective innovation networks. We seek to transfer the burden in accessing the right support services from the entrepreneur to the service providers. The service providers benefit by being able to "segment" their market and specialize in serving certain type of opportunities. This shifts the focus on quality of service rather than quantity of service.

After discussing a potential collaboration with representatives from KCSourceLink, (partially funded by the Kauffman Foundation) we have determined that the firm's user interface is appropriate for our application. They do not however have platforms developed for our entire proposed application. We are specifically focused on the dynamic development of opportunities through network collaboration. The KCSourceLink "Resource Navigator" model is an online tool that would allow both the "Challengers" and "Gateways" to perform a customized search of available services in the network.

The tool lets the user answer a few quick questions about their business (business stage, industry, location, etc.) and then specify their business need. The database then returns information on providers that would provide the sought after service to a business/entrepreneur which fits the specified demographic profile. In the case that the entrant has questions or concerns, they are directed to call a toll free number which connects them with a telephone operator representative. This representative will then personally evaluate the needs and send an email to a number of service providers or will direct the entrepreneurs to what they consider to be the most appropriate place. This approach is a reasonable starting point, but greatly reduces the potential for a "serendipity effect" or full leverage of the knowledge within the network. We are concerned that this model limits the knowledge mobility of the network to that of the single representative at KCSourceLink. At its current stage, the KCSourceLink system is only a linking model through collaborative relationship building.

We plan to implement the KCSourceLink "Resource Navigator" tool as the user interface to our emerging platform in our respective KIZ. The Resource Navigator is an internet based tool and can be customized without any knowledge of computer programming. A big advantage of adopting this tool is that its developmental costs were paid for by the Kauffman Foundation. Therefore KCSourceLink does not seek to recover these costs. The cost of licensing the tools is based simply on the cost of training and consulting on their use, ongoing technical support and maintenance, as well as future tool upgrades.

We have determined that this software is scalable and is interoperable with most applications as it is built on the suite of Microsoft products. The generic interface is customizable for our regional needs. Initially we will introduce the system to the participating service providers.

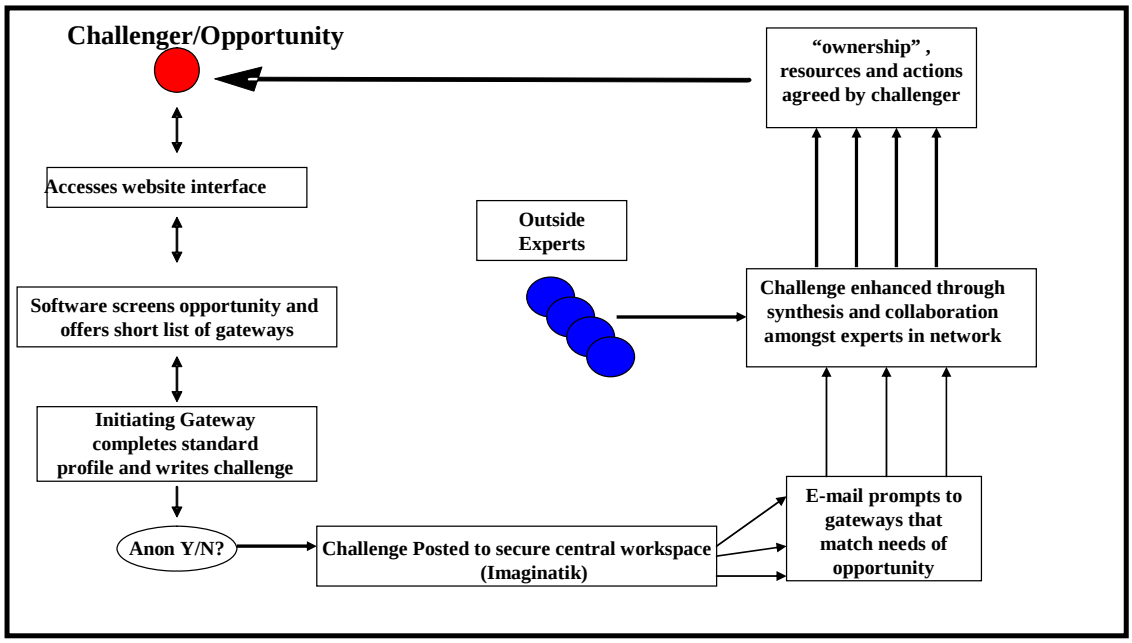
We propose that these service providers will be volunteers based on suggestions made by Steve McKnight and Paul Hallacher. These service providers must agree to participate in the collaborative platform once the back-end software platform is developed. We have researched available software and found that a version of the Imaginatik software is relevant to the back-end requirements. Our next step is to begin integration of the Imaginatik software with the KCSourceLink platform.

KCSourceLink Supplemental Technology platforms:

There are two other technological pieces that are offered through the KCSourceLink service;

- Biz-Trakker - a client management system that provides for tracking of referrals between organizations, electronic surveying of clients and (depending on how we would choose to use the system) anonymously aggregated data.
- Webplate Now! - A customizable website framework specifically designed to communicate available resources in a community of service providers to entrepreneurs/business owners. Member providers can post class offerings and events on calendars, and the business community can find a variety of information on available services.

199 Corridor Innovation Portal Design



Issues to Address

We've identified some potential issues and concerns with the economic development portal platform. These include but are not limited to; budget wars, credit claims, security, confidentiality, mutual trust, and the initial challenge of breaking through the bureaucracy and

other political factors associated with a new system adoption. (see appendix 5) Research and practice show that the success of virtual knowledge networks relies on subtle social psychodynamics. Fortunately, the recommended software has several embedded features that take into account these aspects. The application, developed over years of practice, helps to overcome many of the initial adoption barriers. For example, the issue of building trust is dealt with by a) allowing opt-in alternatives, b) the ability to elect anonymity, c) providing fast feed-back mechanisms to all stake-holders, d) having a hierarchy of security, while enabling transparent knowledge flow.

Innovation Xchange

Our second proposed model "Network On-Demand" is loosely based on the Innovation Xchange (IXC), a model with origins in Australia that is attempting to develop an international network with operations in Australia and the US. The IXC provides commercially neutral Intermediaries to its subscribing members who come from business, universities and publicly funded research organizations. Many fortune 500 companies and major research Universities have enlisted the services of IXC. This initiative is designed to reach well beyond the regional economic development program and offer larger scale and scope of solutions to Fortune 500 companies.

The foundation of the IXC is Intermediaries who work in the member organizations and in conjunction with each other on behalf of their member companies and universities to help them more efficiently and effectively exploit their knowledge and expertise for commercial advantage. The ideal result of the IXC process is the development of new alliances, growth of new markets, access to new technologies, development of new products, or diversification and innovation of products or services.

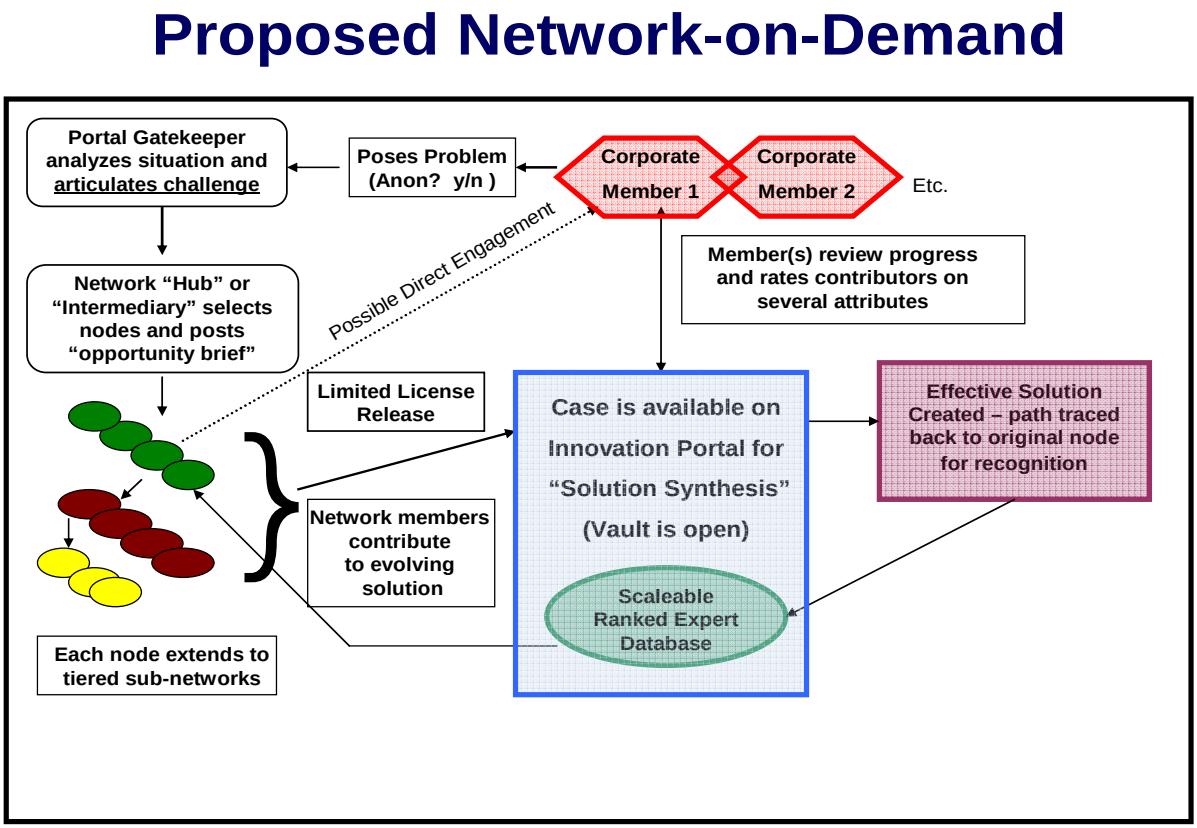
How IXC Works

An Intermediary is strategically placed with a member organization specifically to seek 'Opportunities' within their respective member organization. The Intermediary works as a part-time staff member on a strictly confidential basis bound by rigorously legally binding ethics and non-disclosure agreements that will prevent them from commercially exploiting the knowledge to which they have access. The IXC process hinges upon the principle of neutrality. This design is to promote collaboration amongst the intermediaries, who share confidential or sensitive information through the IXC Knowledge Base (the 'vault'). The goal is the creation and pooling of IP and R+D to create new opportunities, enable new partnerships, and establish connections outside the members' own traditional networks. Opportunities arise when Intermediaries identify a connection between the intentions and/or inventions of two or more parties. The IXC connects members' internal programs to external global networks. IXC Intermediaries stay in regular communication with the other Intermediaries who are in turn seeking opportunities. The process of implementing such a connection is managed by explicit permission and step-wise disclosure between the parties.

The Network-on-Demand Proposal

Though the IXC concept has proven successful for some firms, we believe that a more network-centric model is an effective alternative to the "closed vault" style of the IXC model. We seek to capitalize on the power of a larger network that can offer knowledge synthesis and the "serendipity effect" vital to breakthrough innovation. The model is a problem-driven system that facilitates knowledge synthesis.

With an understanding of the sensitivity of IP and R+D issues, security and confidential must remain paramount in any collaborative innovation model. With this in mind, it is also essential to leverage the knowledge resources that are available outside of the immediate network and offer opportunities for input to be gathered from non-traditional sources. This is where the virtual portal offers access to the next generation of knowledge sharing and idea-synthesis models models.



1) Corporate "Challenger" Addresses NOD system

The new challenger registers with the NOD and completes a detailed profile survey to assist the Gatekeeper in analyzing the opportunity. The challenger also makes decisions and declarations regarding anonymity and confidentiality at this time.

2) Portal "Gatekeeper" analyzes situation and articulates challenge

This initial step of the Virtual Portal can prove to be the most crucial. We have found that the understanding, the articulation, and the presentation of the true problem or opportunity play a paramount role in the development of an effective solution. This Gatekeeper is responsible for interacting with the Challenger and determining the most appropriate course of action to locate or develop a solution. Once the problem is written, it is forwarded to an individual known as the network "Hub" or "Orchestrator" who is responsible for managing the solution network-on-demand throughout the course of the opportunity. The role of the Hub is absolutely vital to the efficiency and effectiveness of the network, as the Hub posts the newly articulated opportunity to a secure central workspace and strategically assembles the primary nodes in a customized network that will receive the opportunity brief for analysis.

3) Extended Networks

Each node has the liberty to communicate the opportunity to its own extended network and search for the most relevant sources of knowledge and insight to offer a solution to the challenger. Any sub-node in the particular network with access to the central workspace may review and contribute to the evolving solution. On occasion an extended network player may have the optimal solution and could contact the corporate challenger directly for review of his/her proposed resolution. Each node and sub-set of tiered nodes will be required to complete a limited license agreement to protect the IP of the corporate challenger.

The Case is available on the Innovation Portal for "Solution Synthesis". One major difference between the IXC and the NOD is that the "vault" is now open for all network members to contribute to the evolving solution. It is important to note that all players in the solution mix need not be experts on the subject; it is the network aspect that makes resourceful individuals valuable to the system.

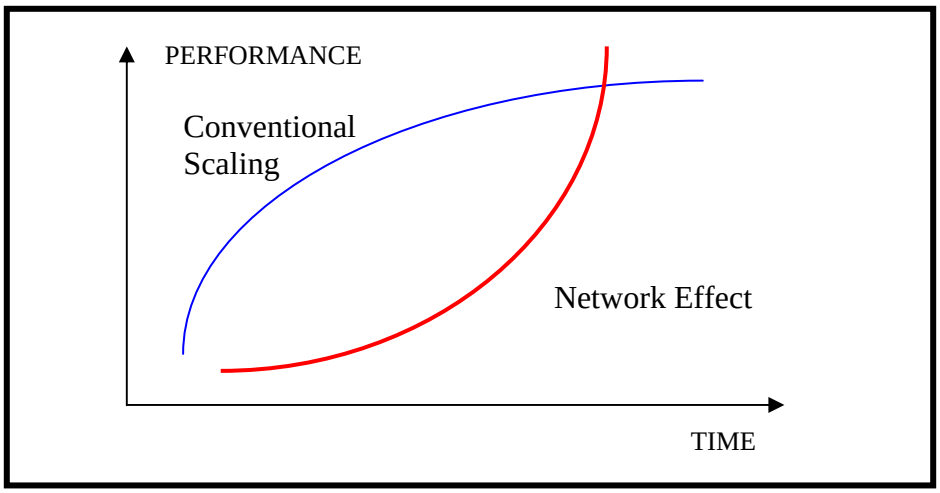
4) Scaleable Ranked Expert Database

A key component of the NOD is the Scaleable Ranked Expert Database. As solutions are developed and proposals made through the central workspace, contributors are rated based on the overall value of their input. The path from successful ideas is traced back to the original node in an effort to provide recognition for those nodes that are able to assemble and extract relevant knowledge from their network. Because the challengers have full visibility of their respective secure workspace, the challengers are able to review the progress and developments in their challenge on a continual basis. This assists them in providing feedback to the ranked database to evaluate the solution proposer's contributors to each opportunity. The Hub will also provide feedback to the database resulting from personal observation and tracing paths through the network. The most valuable nodes will be recognized for their resourcefulness in accessing the appropriate sources of knowledge.

This ranked database is designed to capitalize on the incredibly powerful and rapidly growing social phenomenon of the inverse commons. This principle motivates these solution contributors to help solve problems for the benefit of the system or the "commons'. Many Such models exist and are thriving and include; Wikipedia, Book publishing (Pearson), Linux,

Netflix, eBay, Google Product Development, Global Business Network. In these Inverse Commons examples, the value of the business gets stronger each time the products or services are used. Individuals contribute knowledge or information regarding their preferences which in turn creates more data and adds to the value of the network. Additionally, significant thought is required in developing an efficient and user-friendly interface that expresses the underlying support of the social system.

It is vital that one entity becomes the champion of this new innovation network. Research shows that such networks are in fact harder to instigate than more conventional "bricks and mortar" assets such as incubators to create economies of scale; yet once the network reaches the point of growth inflection, then the scaling benefits accelerate rapidly. This is shown schematically in the next chart. In order to get through the launch phase, therefore, one enterprise needs to give intangible but vital attributes such as credibility, longevity, legitimacy as well as implied and real support resources. This virtual model system greatly accelerates the process of research collaboration, business innovation and product development.



Summary

In addition to stimulating the local economy and realizing a greater return on investment of PSU's resources and the immense annual research budget, we aim to create a more distinct Entrepreneurial culture for Central PA – a culture that recognizes, embraces and celebrates entrepreneurs, developing a unique place where entrepreneurs and investors choose to live and work. We have researched similar initiatives being tested by other regions and talked to experts on stimulation of economic development. From our research we have found no such complete system implemented anywhere, only component parts. Universally we have been told[6] that this portal is unique and would put PSU and Central PA in a world leadership position in the use of IT and virtual networking for promoting economic development. Our goal is to see Penn State set an international standard for university supported entrepreneurial networks.

[6] E.g Erik Pages, CEO of Entreworks, a well-respected consulting firm in economic development and entrepreneurial networks, has indicated that a number of regions are examining such methods, but if the I99 corridor were to implement such a virtual knowledge network, we would be the first, and a model for many other regions.

Appendix 1: Clusters.

Definitions of Clusters

We have found several definitions of cluster in the literature. Two of the more comprehensive are the following:

> An industrial cluster is a socioeconomic entity characterized by a social community of people and a population of economic agents localized in close proximity in a specific geographic region. Within an industrial cluster, a significant part of both the social community and the economic agents work together in economically linked activities, sharing and nurturing a common stock of product, technology and organizational knowledge in order to generate superior products and services in the marketplace.[7]

> A cluster is a geographically proximate group of companies and associated institutions in a particular field, linked by commonalities and complementarities.[8]

Summarizing the many papers and conferences devoted to the issue, a cluster can be defined as a geographical grouping of firms that belong predominantly to one activity sector. Italian *distretti*, with their complex set of social history and institutions would then be specially advanced cases of clusters, characterized by a high degree of voluntary collaborative actions within cluster firms.

The United Nations Industrial Development Organization (UNIDO) defines clusters as:

> …a sectoral and geographical concentration of enterprises that produces and sells a range of related or complementary products and thus face common challenges and opportunities.

A term often confused with "cluster" is "networks." Networks are, instead, "groups of firms that cooperate on a joint development project complementing each other and specializing in order to overcome common problems, achieve collective efficiency and penetrate markets beyond their individual reach." Networks are termed horizontal when formed by small and medium enterprises only, and vertical when large-scale enterprises are involved. UNIDO also describes the relationship between the two terms: networks can develop within or outside of

[7] "Industrial Clusters, Knowledge Integration and Performance", P. Morosini, *World Dev* Vol 32. No. 2 pp 305-326, 2004

[8] "Clusters and the New Economics of Competition,", M.E. Porter, HBR, 1998 Nov-Dec,

clusters. Clusters lead sometimes to the development of networks within them. Also, a network can eventually evolve into a cluster, as it develops business development services providers, enterprise associations and the involvement of public institutions.[9]
There are three conditions for a cluster to be successful:

- The "land" must be fertile, meaning that there must be a capacity of absorption of know-how "seeds," and the availability of labor and space. These conditions were present in Italy after WWII, when some of the workers, who had migrated to the advanced economies of Germany, Switzerland, etc., returned to their home cities bringing new "seeds" of industrial know-how.

- The links that allow know-how transfer such as technical centers, secondary or tertiary learning institutions, etc. must be present. In the case of Italy, labor and space were available, but so was a climate of "cooperation" that allowed the know-how to be shared by many new small firms.

- The "ecology" must grow in variety, producing *differentiation* among its components, as labor division grows when the many suppliers of specific inputs develop, usually as spin offs from existing small companies. Small companies concentrate in a core of well-known competencies, while they outsource components from other small companies. Within a true cluster there is a "capacity for exploration," for experimenting new processes, new products, or new markets. (Bisso, 2003)

There are three reasons for a firm's choice of a given geographical setting:

- the existence of a pool of adequate labor
- the existence of specialized suppliers, and
- the possibility of external spillovers, that is, the rapid transfer of know-how and ideas.

These three conditions tend to be present primarily in clusters. (Bisso, 2003)

A fourth condition that is mentioned is the following:

> While external economies occur in clusters spontaneously, this is, without a voluntary decision by the firms to engage in cooperation with others, it is the *voluntary, planned cooperation* that gives force to the firms located in a given cluster. Example of voluntary cooperation is the joint organization of a presence on a trade fair, aimed to enter a foreign market. From a policy-making point of view, the empirical evidence supports the importance of voluntary cooperation, which implies the need, for clusters containing larger numbers of firms, of institutions that promote, organize and manage that cooperation. This is

[9] "Clusters and Development Strategies: Reflections for a Developing Countries' SME Policy" R. Bisso, 2003

certainly the case of the Italian distretti, where often several institutions handle many of the inter-firm cooperation activities.

Cooperation and Competition within a Cluster:

The functioning of clusters can be understood better by analyzing the cooperation and competition tendencies inside them. Rabelotti[10] has studied the mechanism that firms use when planning cooperative actions, as those of compensation (rewarding mutually beneficial behavior), and exclusion, used to punish opportunistic behavior. Mutually beneficial cooperation is favored by the existence of trust and "social embeddedness."

Cluster cooperation can be further classified as vertical (with suppliers or clients), horizontal (with "colleague" firms), or multilateral (involving not only firms but institutions, which provide business services: consulting, lobbying, training, funding, quality certification, etc.).

A caveat about the natural evolution of clusters: it is far from "natural" that clusters evolve always towards more and more positive (non-collusive) cooperation. Also, there are several examples in Italy where firms move away from a cluster location to be able to exclude cluster competitors from the production-specific advantages they have acquired.

Within the U.S., the data on clusters tend to put all agglomerations of economic activity under a single category. Thus the financial district of NYC is listed with Silicon Valley, Route 128 and “bone valley” in Indiana. Within the context of this study, we felt it was necessary to separate out those clusters that are most relevant. Within these sub-categories several classes are noteworthy:

- The high-tech regions that are centered around one or more research universities in a location that has sufficient social capital to develop. Clear examples are Silicon Valley and Boston. Where the social capital support is weak, the technology economy lags. Clear examples are State College, PA, and College Station, TX. Partial successes are Minneapolis, Ann Arbor, and Gainesville.
- The high-tech clusters that are centered around one or more research universities where additional long-term support infrastructure funding from state governments has promoted the cluster. An excellent example of this type is RTP in North Carolina; another is Silicon Glen in the Edinburgh-Glasgow corridor.
- The manufacturing clusters that have evolved around specific market sectors. Within the U.S. we have selected two for analysis – the orthopedic center in Warsaw, IN, and the golf equipment cluster in Carlsbad, CA.

We also reviewed a recent study commissioned by the Department of Trade and Industry (DTI) (2003) in the U.K. entitled “A Practical Guide to Cluster Development,” as well as the National Governors’ Association’s 2002 report entitled *A Governor’s Guide to Cluster-Based Economic Development.*

[10] “Recovery of a Mexican Cluster: Devaluation Bonanza or Collective Efficiency”, R. Rabelotti, *World Dev.* Vol 27. No. 9, 1571-1585, 1999

Newer rapidly growing clusters tend to be in fast-moving sectors such as specialized software e.g. advertising and design related in NYC, Internet gaming near Edinburgh, Scotland and the well documented "off-shoring" software clusters in Bangalore and Hyderabad in India.

The literature also is ambiguous on the value of clusters, listing their downsides as well as advantages. For example, clusters with their large social infrastructure mean high job mobility. This allows intellectual asset leakage and uncertainty between competitors. Indeed HP moved some of its plants to Oregon to mitigate this problem, which they found endemic in Silicon Valley.

Generally recognized as valuable however, is the networking that exists within a cluster, with help, resources, collaboration opportunities, access to patent lawyers, etc. There is an active debate on whether these networks can be "virtual," that is, enabled through the Internet. Thus the intellectual leakage through job shifts can be mitigated while access to networks maintained.

Appendix 2: Virtual Clusters, Challenging Cluster Conventions

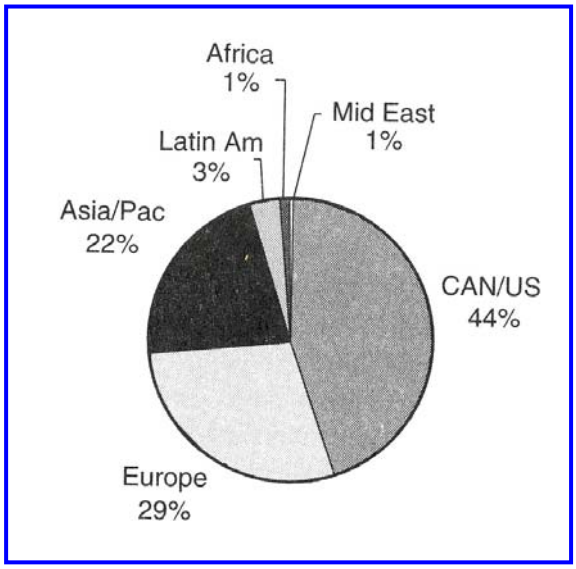
Clusters have historically been conceived as requiring a list of specific criteria with **geography** being the keystone. Research on government-industry partnerships and virtual clusters (also called knowledge networks) however, is shaking this notion, relying instead on more global commonalities with **innovative zeal** as the keystone.

Considering clusters as a function of geography fosters notions of individual country success factors (typically GDP and GDP/capita) rather than global advancement of knowledge and quality of life. If clustering no longer requires geography, achievements and benefits thereby obtained have more global implications, though not completely, owing to the Internet's limited availability in much of the world. (See Figure below.)[11]

In considering success factors for virtual clusters, the analysis of geographic clusters may not shed sufficient light on the requirements. Observing post-facto that a condition existed as a cluster emerged is not necessarily a prerequisite for its emergence. Beyond the emergence of a cluster, its success requires defined purpose, not merely a Petri dish of resources.

[11] Source: Estimates from Cyveillance, an Internet Statistics Firm, www.zakon.org/robert/internet/timeline/ and http://wcp.oclc.org/

Percentage of Population with Access to the Internet (2002)



One of the most interesting examples of virtual clusters that is in use today is the "professional idea exchange forum." Professionals in specialized areas such as "mass spectrometry design," "java-based server programming," and "SAP implementation" use free membership-based online forums to post problem-specific questions. More often than not, industry issues of a more general/philosophical nature are discussed among the members. Professionals share their experiences, opinions and/or proven solutions to the questions posted. Especially in a SME atmosphere where professionals are often the "experts" in their organization, these forums are the most time-efficient way to find answers to problems faced on a daily basis. There is a sense of community in these forums, and just like a "face-to-face" environment, the overall outcome is a learning/networking experience that is akin to what a geographical cluster offers.

An analysis of government-industry partnership success factors shows what elements must be present to accelerate innovation through collaboration, especially in areas of basic research (chemistry, physics, and engineering - areas that are not product-focused) where corporate sponsorship is leaner and government sponsorship is essential:

- *Industry Leadership* - Expertise, experience, and flexibility are essential to establish initial credibility and provide an umbrella capable of fostering collaborative innovation across corporate and geographic boundaries
- *Roadmaps* - Outlining goals is essential for consortia and collaborative partnerships no less than clusters. Establishing relationships among science, technology, and applications provides reference points for researchers, technologists, product managers, suppliers, and users, allowing more effective contribution.
- *Shared Commitment and Costs* - Stake in outcome enhances the commitment of those involved, increasing output and success.

- *Assessment* - Regular and rigorous evaluations and feedback gauge projects' technological and commercial merit as well as contributing to the tacit knowledge accumulated. Diffusion of both successes and failures assists in revising roadmaps.

For a virtual cluster to be effective, these four factors should be in place. Another way of looking at the functionality of a virtual cluster or knowledge network is as a "distributed partnership."

Implications of Porter's Research on Clusters

Michael Porter's research on cluster emergence, while extensive, is a historical analysis of those that have emerged, providing no formula for their creation, duplication, or sustenance in the face of change. He also does not adequately consider the effects of information technologies and the rapidly evolving and maturing knowledge economy. As such, his model is one of twentieth century business practices, not those of the new millennia.

Companies of all sizes, especially, but not only, those in clusters, must continually look outward to identify new opportunities. Success is not merely the efficient operation of an organization; it is the continued evolution of an organization in response to and anticipation of a changing global environment.

There are three dynamics that can cause the failure of a cluster:

- *Technology Shift:* Industries experience constant changes due to technological advancement. Clusters built on expertise in a given technology, but lack the means to constantly scan the field for emerging ideas and resources, bring them into the cluster, and thereby profit are subject to obsolescence and ultimate failure, to the detriment of entire regions. The Warsaw, Indiana medical device cluster is an excellent example. Built on expertise in metals without scanning, adopting, and building competence in new technologies, it may be threatened by being ill-suited to cope with the industry shift to polymers and ceramics.
- *Business Model Shift:* As technology evolves, so too do companies' means of generating revenues and improving their cost structures. Such changes include the adoption of global supply chains, move to product customization models, and the increasing customization of service offerings. One of the reasons that the Electronics Cluster in Columbus, OH failed after peaking in late 1960's was a shift in the business model of the three large companies that dominated the electronics industry in the region, Western Electric, Bell Labs and Accuray (Taratec Corp., 2004).
- *Resources Mismatch*: Clusters are well suited to solve the needs of the present, possessing intellectual and human capital in great abundance. Both become dated without continued improvement in management understanding and business structure, requiring outward examination, recruitment, and acquisition.

As we have seen, traditional industrial clusters are networks of enterprises, large and small; they may encompass universities. Each member adds a distinct product or service value,

which is then added to the value of the local network as a whole. While individual jurisdictions allocate funds to the creation of clusters, they require an appropriate combination of resources and an impetus, a spark, to begin. Allocating funds does not ensure one will emerge, nor is a spark without resources sufficient. Once in motion, clusters can take years to build momentum, and once they do, they are subject to limitation by the very resources that spawned them. Our research finds that companies need a new means of looking outward, not a trait that is encouraged by conventional localized clusters.

The current jurisdictional funding and support focus is intended to cultivate local new businesses with resulting tax revenues. This narrow, geographic focus forces inward-looking strategies and prevents clusters from adapting to industry change. Broadband telecommunications technology continually improves the ability of companies to collaborate with resources outside funded jurisdictions. Outwardness can be greatly accelerated by using emerging "virtual knowledge networks." Such endeavors are already underway in Europe, Canada and Australia, making use of centralized server and peer-to-peer models.

Looking outward is a difficult task. It requires the identification of appropriate resources and proper posing of specific needs for innovation. Large organizations, which pride themselves on innovation as a means of success and survival such as HP, GE, and Siemens, have made outward focus and change part of their modus operandi. Small and medium-sized enterprises (SMEs) are not often in positions favorable to this constant search, and they are the ones most in need of access to innovative talent.

Appendix 3: Additional Research and Experimentation on Virtual Clusters in Italy and Canada

During our research we uncovered a recent publication[12]. Below are notes on the content.

The book discusses the results of an empirical analysis of the new phenomenon of virtual clusters (VCs) and highlights the dynamics of these emerging innovation networks in the digital economy. There is currently no conventional theory of social networks that can be applied.

Nevertheless there is an overview of the most significant theoretical approaches to innovation networks, and their rethinking in the digital economy scenario. Following a neo-Schumpeterian approach, a particular focus is on the opportunity to integrate the economic benefits coming from the geographical proximity, with the advantages related to the "organizational proximity" allowed by the IT networks.

The e-Selanto project is described in which the concepts of establishing a virtual cluster application to enhance an Italian neglected region. Some general implications of the project for theory and practice are also discussed. The architecture and the master plan of two initiatives within the e-Salento project, concerning the agribusiness and tourism sectors are described.

The book also describes:

- A model of leadership, to guide innovation in an organization competing in the digital economy, including both firms and regions.
- Issues concerned with VC growth and regions' economic development processes that are common to both the regional studies and the innovation management literature; the book represents an important empirically grounded contribution to them. Furthermore, several scholars argue that new development models are emerging for firms and regions. There is a lack of published work that provides empirical grounding and/or analytical models of firms' and regions' development processes in the Net Economy.

An interesting experiment is being run in rural Canada to test the application of virtual networking. Key points in the study are:

- Implementation of a new "SuperNet" has the potential to enable the creation of virtual industry clusters (Porter, 1998). Recent research on high tech clusters shows that not all of the Porter conditions need be satisfied for success. Thus, the prospects for virtual clustering at distance are becoming attractive. When 95% of Alberta's rural communities are linked by a high-speed telecommunications backbone, it may be possible to counter the clustering disadvantages that now exist.

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[12] *DIGITAL INNOVATION: Innovation Processes in Virtual Clusters and Digital Regions* edited by Giuseppina Passiante, Valerio Elia & Tommaso Massari (University of Lecce, Italy). Published Sept 2003 ISBN 1-86094-352-7.

- This work will study the e-business impact of SuperNet on rural businesses by conducting in-depth interviews with leaders in internet communication identified during studies of wireless, GPS, and multimedia clusters in Western Canada (ISRN-MCRI) to formulate the identifiable opportunities and techniques for use of video conferencing as a tool for transmission of the tacit knowledge that is exchanged in clusters (Langford, Tyree, and Peace, 2002)
- Constructing scenarios (or models) of how small businesses might use broadband access
- Conducting interviews with Alberta businesses about how to use broadband Internet access to conduct business more effectively and efficiently
- Developing an understanding of how to help rural small businesses use that access in their businesses
- Examining how broadband access to the Internet might allow for the creation of virtual industry clusters -- the working together of several businesses to support each other in their work.
- The study is a natural quasi-experiment in a field setting.
- The experimental or treatment group is the set of Albertan rural communities that will be connected to the SuperNet in the winter of 2002/early 2003 period. The experimental population is all the small businesses that exist in those communities.
- The control group is the set of Albertan rural communities that will be connected to the SuperNet in the year 2004.

Principal Investigators Richard Field, Douglas Cumming, Cooper Langford.

Appendix 4: University Spinoffs

University Spinoff - a new company founded to exploit a piece of intellectual property created in an academic institution. Research suggests that investors found spinoffs after their attempts to market the licenses are unsuccessful. This occurs because the inventor has the tacit knowledge and understands the value of the technology. Spin-offs are a subset of all start-up companies created by the students and employees of academic institutions. There is an inherent underestimation of spinoffs created without the intellectual property being formally licensed from the institution.

There are 3 primary spinoff lead founders;

1. University Inventors
2. Investors who bring together entrepreneurs and technologies
3. Entrepreneurs who come from outside the university

Value of University Spinoffs;

- They enhance local economic development
- They are useful for commercializing University technology
- They help universities with their major mission of research and teaching
- They are disproportionately high performing companies
- They generate more income for universities than licensing to established companies

Economic value of spinoffs;

- Produce innovative products that satisfy consumer wants and needs
- Generate jobs for highly educated people
- Induce investment in the development of university technology
- Highly localized economic impact

The effectiveness of a Licensing office is based on several indicators;

- Level of University Investment
- Level of company formation expertise in the licensing Office
- Network – open door policy with venture capital, developing a network should be in the mission of the office
- Availability and exposure to Entrepreneurial role models….
- Industry funded research as opposed to Gov't ….this relates to more commercial application potential

Variation across industries in creation of spinoffs

- Most common in biomedical – longer time horizons, universities are the locus of expertise in life sciences, customers less worried about cost and more about efficacy, protected by strong patents
    - Specific industry characteristics
        - Strong patents encourage spinoffs
        - Less common in industries that require large amount of complementary assets in manufacturing, marketing, distribution
        - More common in markets that are more segmented
        - Less common in industries with larger average firm size
        - More successful at commercializing technology in industries with more firms – fewer competitor firms with the ability to drive out new firms
        - Less successful in industries where more of value added comes form manufacturing

APPENDIX5

Additional information regarding Innovation Portal:

- Gateways are subject to confidentiality
- Challengers may remain anonymous
- Challengers can access only their folder
- It is not mandatory for Gateways to post challenges OR to respond.
- Responses may direct to other sources of knowledge – contact is at discretion of initiating gateway or challenger.
- Challengers may be faculty, local businesses, businesses seeking to move to central PA, student seeking to start companies, entrepreneurs both locally or exploring relocation etc.
- The software can produce metrics on economic activity on a regular basis which can help in any reports that are due to the State Government.

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