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# On Conceptual Models of Collaborative Partnerships and the Infusion of Knowledge Workers in the Local IT Sector

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## Abstract

Academic-industry partnerships have attracted global attention in recent years. These partnerships are particularly relevant in areas where technological changes take place rapidly. There is a need based on the development and utilization of knowledge infusion to create avenues for a close academia and information technology industry interaction. This paper presents two conceptual models of collaborative partnerships between academic disciplines and local information technology industry and business. The models represent a synergistic partnership that is built upon skills, talents, opportunities, and experiences of the local information technology industry and academia institutions. The first model presented induces an expansion of our ongoing research to include the dynamics of knowledge worker infusion at each critical stage of economic development. The transfer of knowledge from academia to the information technology industry must be strategically aligned for continuous information technology sector expansion. This transition includes the relationship of knowledge worker infusion into current information technology skill requirements and future entrepreneurial possibilities. The second model builds on this infusion of knowledge workers into the information technology sector within the local community, and illustrates our findings at the community level of economic development. It presents four stages of economic development that require knowledge worker infusion. This abstract model also requires expanded entrepreneurial involvement and support from the key community stakeholders. Each of the key stakeholders provides a support role for growth which comes from a desire to help the local community and a job creation mechanism built on the synergies gained from the academic-industry partnerships.

**Keywords:** collaborative partnerships, conceptual models, entrepreneurship, information technology (sector), knowledge workers, research and development, sustainable development.

## 1. INTRODUCTION

This paper is based on our current findings as part of our research (Mhlanga 2009) within the context of the West Texas Coalition for Innovation and Commercialization (WTCIC) initiative (<http://www.wtcic.org>), which was spawned out of Texas Governor Rick Perry's 2004 vision

of building the future economy of Texas. As we conducted our research it became very apparent that a key driver for innovation and commercialization within a framework of future economic growth requires a partnership between the information technology (IT) industry, academia and the local community. Our initial research resulted in the creation of a

model showing the IT sector within a framework of growth based on a collaborative partnership with academia. This partnership begins with the innovation process utilizing the strengths of the IT industry and academia through a strategic focus towards economic development for the local community. Our current research builds on this and looks more closely at a key outcome of these partnerships that result in the preparation and development of knowledge workers and the infusion of such workers into the local IT sector. This research develops an expanded model discussed in section 4 that presents four stages of economic development that requires a high level of knowledge worker infusion at each level. The initial methodology as illustrated in our first model discussed in section 3 was developed using practical experience, research findings and a collaborative understanding of IT and Industry alignment that support economic development at the local community level.

The model highlighted in this research was developed utilizing a methodology process that focused on identifying key stages of knowledge worker infusion and utilization. The process also utilized an assessment analysis that built on our previous model as discussed in section 3 and through this assessment analysis we have illustrated an expanded model as discussed in section 4. The assessment analysis approached each stage of knowledge worker infusion with the following steps; (1) identify key points of infusion, (2) illustrated the infusion impact and (3) formulate a process for understanding economic growth opportunities through a collaborative effort. Additional model development will include an assessment loop that looks at a process of refining the outcomes to seek the synergies and opportunities to build on successful knowledge worker infusion.

This paper is organized as follows. In Section 2, we show an extensive literature review outlining several collaborative partnerships, including collaborative partnerships between academia and industry and community economic development initiatives. In Section 3, we present the expanded model of our earlier work (Mhlanga 2007 and Mhlanga 2009) on an abstract model of IT within a collaborative framework for growth. Our expanded model illustrates an emphasis on the inclusion of knowledge workers at each stage of collaboration and growth. This inclusion specifically looks at the involvement of knowledge workers

in the areas of innovation, strategic alignment and economic development. A key product or outcome of the collaboration between the IT sector and academia is the preparation of knowledge workers that can be utilized by the local community throughout all phases of economic development activities. In Section 4, we present our second model that looks at the infusion of knowledge workers into the IT sector within the local community. The model depicts four stages of economic development that require knowledge worker infusion throughout the whole process. Finally, Section 5 concludes the paper with possible next steps and direction for utilizing our research findings based on the collaborative partnerships identified in each model.

## 2. LITERATURE REVIEW

Partnerships between academia and industry, and their relevance to economic development, have attracted a global attention in recent years. Indeed, academia and industry complement each other in having knowledge and skills of great value to economic development. While academia is looking at industry as an avenue for growth and enhancement of the educational services it provides, industry is also looking to universities to help in educating its workforce and solve business challenges. For academia, collaboration with industry is one of the major avenues through which scientific innovations can be transformed into goods and services that benefit society.

In his presentation at the Center for Research on Information Technology and Organizations, Rieger (2008) presented four primary academic-driven partnership models for academic-industry partnerships, employed mainly in the US over the last 10 years. The four models focus on (i) academic-based case study or survey research approaches oriented toward strategic issues within industry, and the dissemination of results to as broad a base as possible, in order to attract sponsoring companies or grants, (ii) direct placement of students into industry positions utilizing a combination of industry-specific education, and internships with sponsoring companies, (iii) programs, events, and partnerships oriented toward showcasing the specific expertise of the researcher or research center, with the intent of attracting sponsoring companies, and (iv) maximum membership of industry companies at varying levels of sponsorship fees in order

to fund research activities of the professor or research center.

The local economic development environment generally influences the types of academic-industry partnerships. Case studies conducted by the Local Innovation Systems Project at MIT (Lester and Piore, 2004) examined different innovation strategies, of new product and service development (cell phones, medical devices, and blue jeans), that were employed by some of the US economy's most dynamic sectors. This project noted that different patterns of partnerships could be instantiated and be more appropriate for different local economic development needs. The four patterns of partnerships, also denoted pathways, that could be instantiated, were encapsulated by Hughes (2006) to have the following areas of emphasis: (i) entrepreneurial development, at both the university and the local community level, through leading-edge scientific and engineering R&D, (ii) aligning university curricula to meet the human and technical resource needs of locally declining industries and businesses, (iii) bridging emerging technological niches and skills gaps that result from diversification of local industry strategies, and (iv) employing best practices to upgrade existing local industries.

The *science park phenomenon* is a collection of businesses and academic organizations that typically focus on product advancement and innovation. (Some of the synonyms for "Science Park" include *Research Park*, *Technology Park*, *science and technology (S&T) park* and *technopolis*.) Science parks are generally associated with and operated by higher education institutions in collaboration with private companies and in many cases government as well. They provide a support structure for entrepreneurship and a facility where new businesses can be "spun out" from a university or company. They provide a facility for sustainable development through technological generation (or unpacking), adaptation, and transfer. They have been in existence since the early 1950's and continue to evolve to respond to R&D trends. The report (Battelle Memorial Institute, 2007) prepared by Battelle Memorial Institute (BMI) gives an accounting of how North American science parks progress by providing facilities that respond to current R&D trends. The BMI success is attributable to: (i) seeking out strategic partnerships with companies, universities, and federal laboratories rather than depending on internal R&D to gener-

ate innovative ideas; (ii) seeking out an industry interested in advanced research who are in proximity of a particular research institute especially an institution that is interdisciplinary and with multiple locations, often across multiple institutions, and an industry who seeks proximity to the research institute; and (iii) recognizing that a state or region can compete for technological growth like a science park. And, realize that an attractive physical environment will stimulate both industry and university interaction.

Science parks are generally widespread around the world with dominance in developed countries. For example, the Association of University Research Parks (AURP) promotes the development and operations of research parks that foster innovation, commercialization and economic competitiveness through collaboration among universities, industry and governments in North America (<http://www.aurp.net/more/mission.cfm>). One United Kingdom (UK) counterpart of AURP is the UK Science Parks Association (UKSPA), which has continued to create an environment that supports both the creation and growth of technology-based businesses for two decades (<http://www.ukspa.org.uk>). In Portugal, Taguspark is Lisboa's S&T Park which, in partnership with some leading universities, is comprised of several R&D laboratories and business incubators in various areas of technology including IT (<http://en.wikipedia.org/wiki/Taguspark>). In Asia, The Kanagawa Science Park (KPS) was the first science park established in Japan in 1989 through a cooperative effort between the national government and private sector companies which promote R&D. The KPS provides sophisticated test measurement services, and facilitate the distribution and utilization of patented technologies ([www.ksp.or.jp/english/index.html](http://www.ksp.or.jp/english/index.html)). Developed countries have continued to show an interest in science parks and how they may benefit from the science park model (Quintas et al., 1992). Each of these consortiums continues to compare notes on different science park models that exist in the world today (Vedovello, 2000).

Developing countries are strategically linking their technological research to both commerce and industry. The result, they have discovered, is that technology leads to commercial spin-offs. But, they have also found out that forging academia-industry partnerships re-

quires careful consideration. They have discovered that an appropriate partnership model that considers the diverse local environment is the most successful (Sirat, 2007). For example, the BUILD (Boosting University-Industry Links for Development) project in Palestine is highly successful because it supports a best practice policy for managing academic-industry partnerships. BUILD equips Palestinian universities with the knowledge and skills to (i) understand the importance of academic-industry links, and (ii) promotes academic-industry partnerships within the local community ([http://www.ua.es/en/internacional/internacionalizacion/build/pdf/report\\_build\\_seminar.pdf](http://www.ua.es/en/internacional/internacionalizacion/build/pdf/report_build_seminar.pdf)). One of Thailand's higher education funding reforms is to cut public spending in order to stimulate academic-industry links (Schiller, 2007). Kruss (2005) South African research revealed that several dynamics between academia and industry exist especially in high-technology areas like IT, biotechnology, and new materials development. This, she found, is characterized by the obstacles of fragmentation, inequalities, and unevenness. Zimbabwe seeks to align education to the economy by exploring partnerships between industry and academia, with desire to harness the country's wealth, create jobs, and support further university research (Mhlanga, 2001).

Mhlanga, Vardiman and Reames (2010) present an academic process, based upon practitioners' research, which explores how collaborative partnerships between academia and industry in West Texas would benefit one another in the WTCIC cluster of information and computer technology (I&CT). This work towards an abstract model of collaborative partnerships sets the stage in support of knowledge creation and investigates the dynamics of the knowledge worker infusion at each critical stage of economic development. The transfer of knowledge from academia to the IT industry, where it is applied, must be strategically aligned for continuous IT sector expansion.

### **3. IT WITHIN THE COLLABORATIVE FRAMEWORK FOR ECONOMIC DEVELOPMENT WITHIN THE LOCAL COMMUNITY**

Academia and industry complement each other in having knowledge and skills of great value to economic development. While academia is looking at industry as an avenue for growth and enhancement of the educational services it provides, industry is also looking to universities to help in educating its workforce and solve business challenges. For academia, collaboration with industry is one of the major avenues through which scientific innovations can be transformed into goods and services that benefit society. As Siegel points out (Siegel 2006), the partnerships are also particularly relevant in marketplaces such as IT, where new technologies quickly become old technologies and new knowledge quickly becomes old knowledge, and where the best professionals are those who continually update their skills. Establishments such as Microsoft IT Academy and the Oracle Academy Initiative in higher education institutions develops platforms for academia to offer programs that give students hands-on experience with industry products and that lead to certification in these products (Narayan 2009).

The inference between academia and the IT industry is clear. For academia, technology development amounts to conceptualization and execution coupled with validation at the laboratory level. For the IT industry, the interest lies in translating the laboratory concept into a commercial outcome. The question becomes, how do communities provide mechanisms to foster interaction between academia and the IT industry that will promote economic development? We must move beyond the traditional thoughts of partnerships that are built on collaborative design teams that look at the laboratory concept to a true partnership of establishing and sustaining a synergistic approach built on the skills, talents, opportunities, and experiences of both the current IT industry and available local academia resources.

Figure 1 as listed in the appendix shows an expansion of our research reported in (Mhlanga 2009) with the preparation and development of knowledge workers and the infusion of such workers into the local IT sector. The collaborative framework for knowledge worker infusion focuses on developing a strategic alignment of the partnership between industry and academ-

ic support. This partnership marks the beginning point of knowledge worker infusion into the economic development process and captures the innovative offering of both parties through a strategic alignment for growth at the local economic level.

The innovative approach provided by the partnership gives attention to the necessary skills and knowledge workers needed by the local IT industry. It is also attuned to the current trends and technology changes taking place in both the local and global landscape. In addition to developing future knowledge workers, the partnership is created with the intent of linking all efforts of collaboration towards a highly trained workforce and an entrepreneurial approach to economic growth.

As part of the entrepreneurial growth process additional partnerships and support systems will need to be utilized from local community funding agencies, management development opportunities and new business ventures that are supported by local talent and capital investments. Opportunity recognition can include both local and global business demand and expansion. The sustaining of a strong partnership between industry and academia requires a strong effort by both parties and one that promotes a constant ongoing review of the process (Fegan 2006).

#### **4. FOSTERING ECONOMIC DEVELOPMENT WITHIN THE LOCAL IT COMMUNITY THROUGH KNOWLEDGE WORKER INFUSION**

As noted above, Figure 1 marks the beginning stage for infusing knowledge workers into the economic development cycle. The combination of synergies and talents from both the local IT industry and academia begins with a period of innovation and upward growth. This lays the foundation for new and exciting possibilities for utilizing available resources and fostering economic development that is strategically aligned to building a strong response to community needs.

Figure 2 as shown in the appendix builds on this infusion of knowledge workers into the IT sector within the local community, and presents our second model which illustrates our research findings at the community level of economic development. It presents four stages of economic development that require knowledge worker infusion throughout the whole process. The development, utilization,

retention and growth of knowledge worker activity are critical to creating a positive trending direction for the IT sector growth and economic development at the local level. This conceptual model expansion also requires expanded entrepreneurial involvement and support from the key stakeholders within the community. Each of the key stakeholders provides a support role for growth which comes from a desire to help the local community and a job creation mechanism built on the synergies gained from the IT industry and academic partnerships as illustrated in Figure 1.

The four stages of knowledge worker infusion as identified in Figure 2 begin by showing the initial collaboration of knowledge workers that exist in the IT industry and academic institutions for the development of new knowledge workers that lead to local talent utilization as an outcome of knowledge worker development. This same preparation and utilization is expanded in stage 3 to include future entrepreneurial activities that builds on the IT knowledge in combination with entrepreneurial application and finally in stage 4 the community support for on-going economic growth as an outcome of knowledge and utilization synergies. Each of these stages takes the infusion of knowledge workers and shows the potential of positive local level impact for the community and organizations that require a high level of skill and knowledge to support the IT sector needs.

Stage 1 starts with the partnership that was illustrated in more detail in Figure 1 between the IT industry and local academia. It is at this point the initial infusion of knowledge workers begin and from the foundation of this partnership the synergic strengths of each entity can flow through each economic development cycle. The IT industry provides both on hands skill development and a platform for skill application. Academia provides a foundation of core IT knowledge and understanding that can be transferred directly to the IT sector through skill utilization and research. This stage is critical to the overall growth and development of the local IT sector and requires a concentrated effort to secure a viable partnership. A sphere of influence exists between both entities which allows for theoretical interaction between each of these domains. They include basic research for knowledge creation, the IT industry's participation in technological development which involves exploratory work, academic intervention to solve specific IT industry problems, IT

industry and academic lab utilization, and continuing education. The dynamics of industry-academic links set the stage to support the creation of knowledge, and to ensure that scientific and technological advances made possible by research institutions find their way into the private sector.

Stage 2 illustrates the utilization of IT talent as prepared by the local academic institutions and infuses this talent into the current needs of the local IT sector. It is at this point that the partnership between the IT industry and academia begins to positively impact the local economy. The academia and industry interface is the interactive and collaborative arrangement between academic institutions and business corporations for the achievement of certain mutually inclusive goals and objectives (Rizvi 2005). Ultimately, the goal of the partnerships is to lay a foundation for a sustainable growth. Key to this stage (and stage 3 discussed in the next paragraph) is the ability of local talent to possess an innovative approach to opportunity recognition and to expand their abilities to drive improvement through research and development (R&D). It identifies the need for job creation and continued employment opportunities, and addresses the need for immediate talent to meet local job demand. The importance of maintaining a sustainable development of talent and R&D efforts is critical to the ongoing success of the local IT Sector. Befitting sustainable development, local talent (or knowledge workers) will have the capacity to unpack, adapt, generate, and transfer technologies within the local community. In addition to supporting current IT initiatives, the R&D activity can also foster the efforts of new entrepreneurial ventures. As identified by Byers, Dorf and Nelson (2011), the following principles are fundamental for creation of successful technology ventures:

- An innovation strategy builds on creativity, invention, and technologies, acting within a value network, to effectively commercialize new products and services for customers.
- Knowledge acquired, shared, and used is a powerful tool for the entrepreneur to build a learning organization that can design innovative products and grow effectively.
- Many kinds of sources for investment capital for a new and growing enterprise exist and should be compared and managed carefully.

Stage 3 is a very critical stage for the launch of new economic opportunities. It is at this stage that the community experiences economic expansion and lays the foundation for business incubation and launch. This stage builds on the utilization of local IT talent through the entrepreneurial initiatives of individual and group efforts. It begins with the technical focus of teaching students the skills of innovation, idea generation, and business model development in order to create new product/service initiatives with high potential for growth and economic success. This stage is particularly suited for IT startup initiatives and gives the framework for both community support as identified in stage 4 and the entrepreneurial prowess needed to successfully launch a new venture initiative.

The combination of skill sets and core academic requirements found in business development disciplines are fundamental to the success of any modern business venture. It is at this stage that the need for community support is also identified through the introduction of business angels, venture capitalists, and community entrepreneurs. The convergence of these individuals or groups are fundamental to launching commercially viable products (and/or services) that come out of the research phase, to systems and product design and testing, to business plan development, to venture capital funding, and finally to business startup. Ongoing research that looks at the expanded partnership for community support for local IT initiatives that truly foster economic development need to be conducted to further investigate the expanded growth potential. This expanded partnership both from the early entrepreneurial opportunities beginning at the incubator stage to the long term scalability of successful entrepreneurial growth ventures can provide key support models for successful business start-ups.

Stage 4 takes the total community partnership from individual initiatives to a community involvement for both economic growth and long term sustainability. This stage continues to build on the entrepreneurial efforts and fosters the connections between the budding entrepreneur and community support identified in stage 3.

As noted in the top section of Figure 2, within the local community additional needs for talent and business support will be met by educating and preparing knowledge workers that are

equipped to handle the rapidly changing technologies required for today's new business markets. The economic impact is completed by promoting additional growth within the community and the overall industry sector by generating additional profits through an increase in local spending and business growth as a result of new innovations and business development opportunities. In addition to promoting the partnership of academia and industry it is also important to consider the overall community support and impact additional initiatives would have on the local economy. Some of these additional support areas could come from the engagement of professional/government associations and/or non-profit organizations through inter-agency collaboration (Roberts 2008). This in turn will require additional academic resources to keep in step with the knowledge needs of a constantly changing workforce shaped by the technological advances from new innovation and increased need for even newer innovations and challenges faced by expanding industries.

## 5. CONCLUDING REMARKS

As noted in our paper the second model illustrated in this research was developed utilizing a methodology process that focused on identifying key stages of knowledge worker infusion and utilization. The process also utilized an assessment analysis approach to each stage of knowledge worker infusion with the following steps; (1) identify key points of infusion, (2) illustrated the infusion impact and (3) formulate a process for understanding economic growth opportunities through a collaborative effort. Additional model development will include an assessment loop that looks at a process of refining the outcomes to seek the synergies and opportunities to build on successful knowledge worker infusion.

One of the major challenges faced by organizations, particularly those engaged in high technological processes, is to develop a highly skilled workforce competent to meet the needs of the organizations. Another challenge is to ensure that individual goals are aligned to organizational goals and that skill formation addresses individual and organizational needs. Academia has knowledge and skills of great value to business and industry. The enormous expertise within academic institutions can be made available to resolve problems or help to exploit opportunities and to provide innovative solutions. Academic-industry partnerships are

particularly relevant in areas such as IT, where technological changes take place rapidly, and where the best practitioners are those who keep abreast of rapid change.

Academia and industry complement each other in having knowledge and skills of great value to economic development. While academia is looking at industry as an avenue for growth and enhancement of the educational services it provides, industry is also looking to universities to help in educating its workforce and solve business challenges. For academia, collaboration with industry is one of the major avenues through which scientific innovations can be transformed into goods and services that benefit society.

This paper has presented two conceptual models of collaborative partnerships between academic disciplines and local IT industry and business. The models represent a synergistic partnership that is built upon skills, talents, opportunities, and experiences of the local information technology industry and local academic institutions within a community of resources. The first model advocates knowledge worker infusion at each critical stage of economic development within the collaborative framework for growth. Permeation of academia into industry assists in value addition through technology generation, unpacking, adaptation and transfer. This results in sustainable development within the local community, and subsequently to local employment and growth opportunities. The second model builds on the first with a characterization of the stages of economic development that require knowledge worker infusion throughout the whole process.

The conceptual models presented in this paper can also be adapted to other target industry clusters other than IT. The application of these models leads to the need for expanded research that focuses on the specific outcomes and potential economic impact for the local community. The potential for driving economic growth at the local level is great and begins with a strong partnership between the IT industry and academia.

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APPENDIX

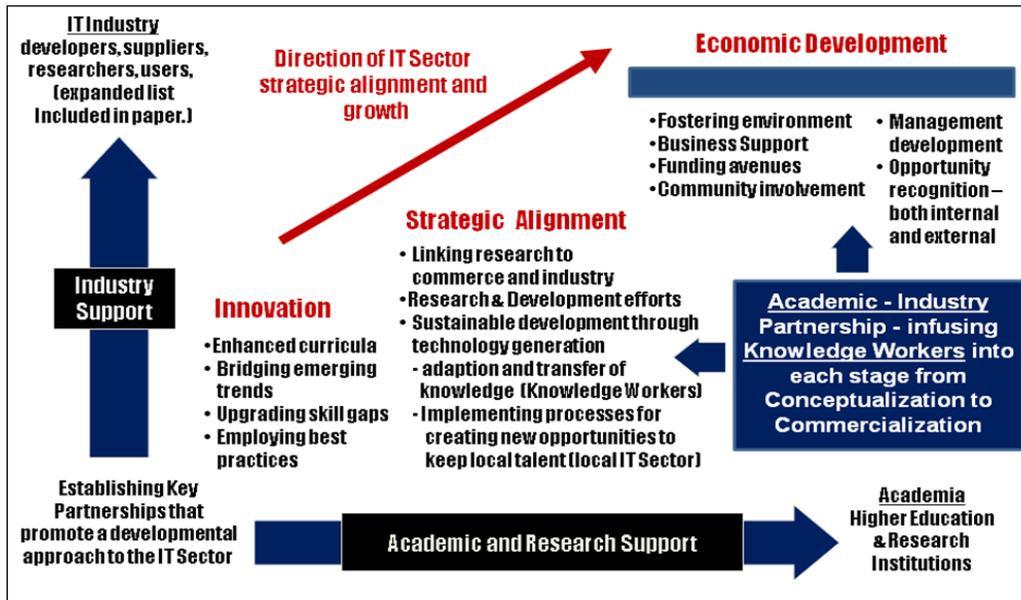


Figure 1: IT within the expanded collaborative framework for growth

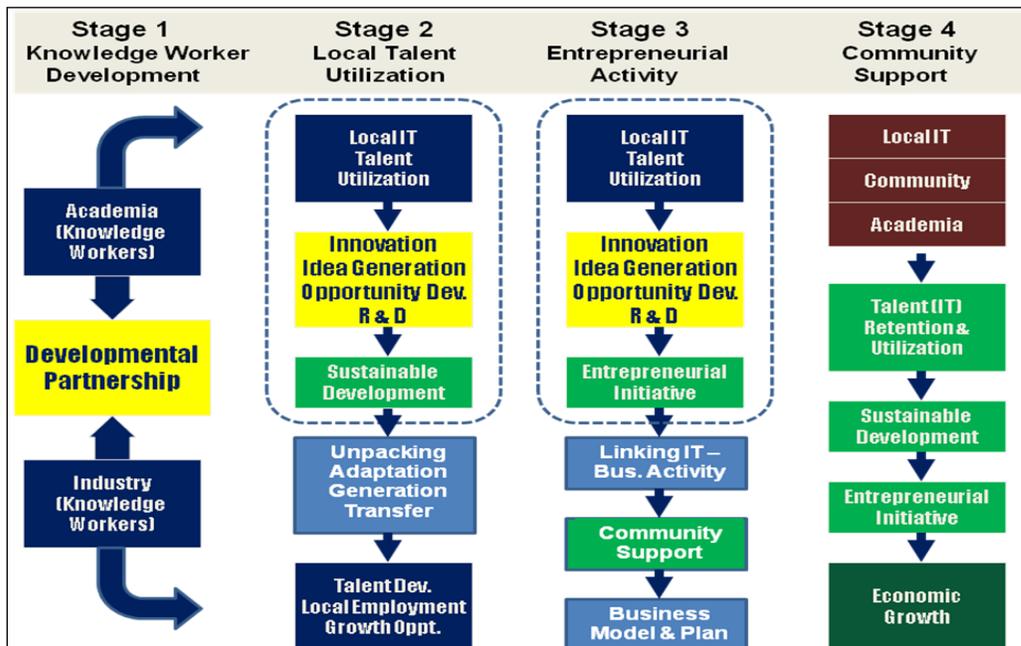


Figure 2: Four Stages of Knowledge Worker Infusion