Barriers to Knowledge Acquisition, Transfer and Management in Regional Knowledge Economy Development

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Abstract

A key characteristic of a knowledge economy is the shift from an economy dominated by tangible assets to one that is based on intangible, knowledge-based assets, which consist primarily of human capital and innovation. The success of a regional knowledge economy is, in turn, measured by its ability to attract and retain companies that focus on the production, dissemination and application of knowledge, and on the provision of services that involve the efforts of knowledge workers. Two factors that are linked to a thriving regional knowledge economy that is capable of both continuous learning and innovation are the sustainability of human capital for a knowledge workforce and the sustainability of inter-organizational knowledge transfers. As such, a research program was undertaken to identify and analyze the challenges for human capital and inter-organizational knowledge transfer in service to learning and innovation, towards the goal of regional economic development.

1. Introduction

A key characteristic of a knowledge economy is the shift from a tangible, asset-based economy to one that is dominated by intangible, knowledge-based assets which consist primarily of human capital and innovation [6]. The knowledge economy of a region, state or country is characterized by an emphasis on attracting and retaining companies that focus on the production, dissemination and application of knowledge, and on the provision of services that involve the efforts of knowledge workers [34].

Drucker [8], [9] characterized a post-capitalist society in which knowledge is the key resource. According to Drucker the decisive factor of production is neither capital nor land nor labor; it is knowledge. Replacing the land owner and farm laborer of the agricultural era, and the capitalist and factory worker of the industrial era is today’s knowledge worker. Wealth in the knowledge economy does not come so much from extraction, farming or manufacturing as it does from the application of knowledge to productivity and innovation.

Similarly, Bell [4] proclaimed a post-industrial society in which knowledge replaces capital as the key resource, much as capital had replaced land, the key resource of the agricultural society. Bell identified five key dimensions of this knowledge society: 1) the change from a goods-producing to a service economy; 2) the pre-eminence of the professional and technical class; 3) the centrality of theoretical knowledge as the source of innovation; 4) the control of technology and technological assessment; and 5) the creation of new “intellectual technology.”

A closely related concept is that of the information economy. While these concepts are sometimes equated, the information economy is actually part of the foundation upon which the knowledge economy is built. The information economy (or information sector) encompasses the work and workers engaged in the processing of information and the production of information tools. Hence, through the production of information processing and communication hardware, the creation of computer software, and the provision of information services, the outputs of the knowledge economy – knowledge, education, innovation -- are enabled [38].

But whereas regional economic development during the last quarter of the twentieth century was often focused on the creation of information economies (such as those in Silicon Valley, Boston and Ireland), the economic success stories of the twenty-first century are deriving from regions containing companies engaged in the broader, knowledge economy.
Nevertheless, there is a strong link between the information economy and the knowledge economy. Because the latter is essentially concerned with knowledge diffusion, it depends upon the availability of sophisticated ICT tools. In sum, the knowledge economy focuses on continuous learning and innovation in companies and industries [18]. Success in this knowledge economy depends, in turn, upon the availability of information systems, innovations systems, and institutional and human resources [47].

Since regions develop through people, institutions and infrastructures, efforts to create or enhance knowledge economies depend upon similar resources. This paper reports on a multiyear investigation of barriers to knowledge economy development in an economically depressed region of Pennsylvania. The research questions guiding this effort are: 1) what are the barriers to human capital development for a sustainable knowledge economy? and 2) what are the barriers to inter-organizational knowledge transfer for a sustainable knowledge economy? A logic model of this research program is shown below.

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2. Method

This research program focuses on the issues of knowledge acquisition, production, transfer and management at individual, organizational and inter-organizational levels of analysis. Hence, it is concerned with individual knowledge deployment (knowledge worker skills), organizational knowledge generation (innovation); and inter-organizational knowledge management (knowledge transfer).

Three methods of data collection (see Appendix 1) were employed between 2006 and 2011 to identify barriers to human capital development and inter-organizational knowledge transfer in an economically depressed region that endeavors to develop a sustainable knowledge economy as a means of economic development.

Eight focus groups were conducted in 2006 and 2007 with regional stakeholders. These included representatives from local corporate employers, economic development organizations, government entities and educational institutions. The purpose was to identify issues for the sustainability of knowledge-economy work in the region that were related to human capital development of knowledge workers, and inter-organizational knowledge transfer involving local industry clusters and universities.

The focus groups, in turn, served as a recruitment vehicle for individual interviews. A total of 31 individuals were interviewed between 2006 and 2009. The majority of participants were from local industry with a few representatives of higher education and economic development organizations. The themes explored in these open-ended interviews included: knowledge-economy skills gap; recruitment and retention of qualified knowledge workers; the needs and goals of industry clusters; innovation challenges for legacy industrial era companies; and barriers to effective knowledge exchange between industry and a university.

Finally, the interview and focus group participants in conjunction with membership lists for the various regional industry partnerships were used to recruit participation in a survey that was administered to members of industry in the region. The purpose was to gain broader reach in identifying issues and expectations of firms in the region with respect to the recruitment and retention of knowledge workers. The survey was sent to 154 companies in the region. Thirty-four individuals completed the survey (22% response rate) representing industry clusters that varied in the extent to which they were knowledge-intensive: education; chemicals/rubber/plastics manufacturing; building and construction; food processing; and logistics and transportation. The lower than desired response rate was consistent with the uneven enthusiasm for the project in the two sub regions that were surveyed. The “eastern sub region” had a more cohesive business community that was leveraged to maintain interest and participation in the data collection effort; in the “western sub region” the business community was much less cohesive, hence the participation level was lower.

3. Barriers to Human Capital Development

The explicit knowledge creation sector -- the information and communication technology (ICT) sector -- is a modest component of Pennsylvania’s employment profile. In 2005 the information and communications services sector employed only
200,000 members (4%) of Pennsylvania’s workforce [44]. However, this number is deceptive in that it only represents those industries whose output is information, knowledge and communication goods and services, what Porat [30] called the primary information sector. It does not count the size of the workforce engaged in ICT and knowledge work consumption for internal use, what Porat called the secondary information sector. Nevertheless, the state lags behind other states in knowledge economy employment. This is particularly the case in the central region of the state, excluding three urban regions -- Pittsburgh, Harrisburg and Philadelphia -- where higher education, high tech research, health care and government employment is a considerable component of the labor force. In the central region of the state, the economic development objective is to transition companies and the workforce from twentieth century industrial work to twenty-first century knowledge-intensive work. Hence, key among the factors of interest to regional economic development in this region is the availability of an information technology talent pool.

Research into the development of knowledge-intensive and technology-enabled economies of this country and others has highlighted two factors contributing to the sustainability of a human infrastructure to support knowledge work. One is the attraction and retention of an appropriately educated workforce. The other is the development and maintenance of a local culture that is compatible with a workforce that needs to function in a highly diverse environment. Richard Florida’s work on the creative class [16] [17] presents the conundrum facing regions such as central Pennsylvania. The creative labor force of the knowledge economy is attracted to locations with restaurants, an arts and entertainment infrastructure, and population churning and diversity. Further, employers are interested in locating in places that already contain an educated knowledge workforce. But without the companies and the employment there isn’t the local wealth to sustain the cultural amenities and other characteristics that would help to attract and retain a local knowledge workforce.

Thus, this research program recognized that a two-pronged approach to knowledge workforce development was needed. On the one hand, it was necessary to examine issues related to the education and retraining of a workforce qualified to conduct knowledge work. But simultaneously, it was necessary to examine issues related to the retention of the existing knowledge workforce in the region.

Two themes emerged from the data (see [23] [43] for further elaboration). The first theme is barriers to an appropriately educated workforce for a knowledge economy. The findings reinforced the results of prior research (e.g. [2]). Technical skills were further classified into: general technical skills and deep technical skills. The former referred to a well-rounded understanding of the technology and its applications in the company. This knowledge was perceived to be easily attainable in the current workforce. In contrast, the deep technical skills referred to more specialized and narrower skills. The specialization could refer to either a type of technology (e.g. programming language) or an application domain (e.g. health care). Respondents said they found it difficult to identify knowledge workers who possessed deep technical skills that were also domain relevant.

Human skills identified as necessary to technology-intensive knowledge work related to: communication, teamwork, project leadership, self-directed behavior, and understanding of the business context. Communications skills related to client interaction were seen as crucial. Teamwork, project leadership and self-directed behavior skills were seen as necessary for successful participation on project teams. This includes an understanding of one’s role and responsibility as well as the ability to negotiate with others on the team. In one of the focus groups an industry participant observed that a barrier to hiring new college graduates is their lack of experience working on teams. Skills related to understanding the business context referred to financial understanding related to budgets, but also a larger understanding of the relationship of one’s work to the overall bottom line of the business.

The second theme is cultural barriers to the sustainability of an appropriately educated knowledge workforce. This theme has two subthemes. The first is about having a local culture that values continuous learning. Respondents recognized that formal education is key to the success of knowledge workers and that continuous learning is a professional requirement. They also viewed continuous learning as the responsibility of worker not employers. But, in their view, this attitude conflicts with an “older culture” in Pennsylvania that is not a culture of education. These respondents included managing one’s own career as part of continuous learning. It is noteworthy that these sentiments were shared in 2006 and 2007, before the economic recession that further eroded the industrial era economy of the state.

The second subtheme is about having a local culture that can recruit from outside the area and also retain qualified knowledge workers regardless of gender, race, ethnicity or other identity characteristics. The link between economic development and workforce diversity is that insofar as a knowledge economy depends upon a sufficient supply of knowledge workers in order to attract and retain knowledge-sector
companies, it cannot afford to exclude individuals on the basis of identity characteristics. Further, research by Florida [12] [13] [14] [15] [16] [17] has shown that even majority members of the creative class (i.e. white males) are most likely to be found in locations that possess a tolerance for ethnic, cultural and social diversity.

Another intended outcome of this aspect of the research, beyond data collection, was to increase awareness and understanding within the local business communities about: 1) the connection between diversity and economic development in the region; and 2) the barriers to greater workforce diversity that exist in this region. That is, by raising questions about workforce diversity and exclusion in focus groups and interviews awareness was being cultivated among the members of local industry.

The themes that arose in the focus groups and interviews about the value of diversity in a knowledge economy focused on: 1) overcoming barriers to achieving greater regional diversity in support of a knowledge economy; 2) stakeholder responsibility for recruitment and retention of diverse talent; and 3) the role of educational interventions for developing labor force diversity in a knowledge economy [42].

Failure to appreciate the connection between labor force diversity and a vibrant knowledge economy was found to be related to negative stereotypes about members of underrepresented groups. The existence of these negative stereotypes, in turn, appeared to derive from a homogeneous region in which there is little direct experience to serve as a basis for challenging them. Comments ranged from an executive who had lived in the area for 17 years but still felt like and outsider, to the sense of foreboding expressed by participants as they acknowledged the inevitability of “people from the outside” coming to the region. For these reasons, participants recognized that it was difficult to attract people to the area and to retain those with knowledge economy credentials.

Another theme was about responsibility for attracting and retaining diverse talent. The consensus was that a multi-faceted approach is necessary. But employers representing small and medium enterprises (SMEs), felt ill equipped to tackle this issue alone. They expressed a need for help from local political leaders, church groups, the school system, and workforce and economic development organizations. While educational institutions were viewed as a vehicle for increasing awareness and sensitivity about workforce diversity, the low university degree completion rate (just above 10% of the population) means that this intervention is not available to the majority of the local workforce. Hence, participants identified corporate diversity training as an alternative.

Participants believed that hands-on pedagogical approaches such as problem-based learning and case studies would make workplace diversity issues more real and relevant to those attending such training.

4. Barriers to Knowledge Transfer

The economic challenges in Pennsylvania reflect the fundamental change in the global competitive landscape [44]. Accompanying the globalization of the economy and the global redistribution of commodity production to low wage countries, comes the pressure on advanced industrialized societies to identify new sources of competitive advantage. Thus, policy makers and industrialists alike are increasingly turning to innovation for the economic answer. Since competitive advantage increasingly derives from the ability to engage in continuous innovation, understanding the nature of innovation, how to encourage it, and how to leverage it, have become topics that are vital to a society’s economic wellbeing [8] [14] [15] [21]. As a consequence, all sectors of society have become stakeholders in the effort to enhance innovation and the knowledge that is related to it.

Ironically, just as innovation is being recognized as the essential ingredient to the economic health of a society, corporations are retreating from a model of innovation that has supported it for generations. Economic pressures are forcing companies to close their research and development laboratories that have been staffed by the quintessential knowledge workers: bright and highly educated individuals whose sole responsibility is to develop new ideas for later deployment by industry.

In place of these in-house labs, companies are searching for other models and sources of innovation throughout the corporation, and beyond it [24] [46]. The motivation is, in part, economic necessity. Particularly since the 2008 recession, many firms can no longer afford large, dedicated R&D staffs. But the motivation is also competitive necessity. To look beyond the bounds of the R&D lab is to open up the possibility for more -- and perhaps better -- sources of innovation. Given this competitive pressure, two forms of inter-organizational knowledge transfer have emerged as mechanisms to further innovation in support of sustainable knowledge sectors. They are industry clusters and university-industry partnerships.

With respect to the first type of inter-organizational knowledge transfer, Porter’s theory of industry clusters [31] [32] [33] provided the theoretical basis for the research. His argument is that regional economic development is enhanced through geographical
proximity of related firms. These groups of interrelated firms in an industry would then be leveraged by governments and policy makers to attract new business, thereby achieving greater competitive advantage. According to Porter [33] such a cluster of suppliers, service providers and associated institutions comprise the specialized knowledge and skills which nations and regions desire to leverage for economic development. He argues that a cluster of firms with geographic, cultural and institutional proximity has an economic advantage over geographically dispersed firms because the cluster facilitates knowledge transfer. Consequently, this part of the research program sought to identify barriers to industry clusters.

While Porter’s theory of knowledge transfer has been shown to be successful for some kinds of knowledge work, this research found it to be problematic for ICT work in Pennsylvania. The reason is that the cluster concept assumes that all work activities are only carried out in a single industry. An example is the lumber industry which produces wood products. However, when it comes to information and communications work in Pennsylvania, this assumption does not apply. As Porat [30] explained, information processing activities are enacted not only in ICT industry firms such as Google or IBM, but also in companies in other industries such as banking, manufacturing or health care. This is especially the case in Pennsylvania where roughly 75% of the ICT jobs are not in companies that are part of the ICT industry [43]. Rather, these ICT workers are employed in government, banking or manufacturing [44].

This research showed that the conception of an ICT industry cluster concept for inter-organizational knowledge transfer was, itself, a barrier to knowledge sharing. In response to this finding, the alternative concept of “ICT occupational partnership” replaced the “ICT industry cluster” concept as the research progressed [43]. Among the types of knowledge that were found to be exchanged among members of the occupational partnership was knowledge about the skills and knowledge needed from the ICT labor force and how to develop this human capital. The role of the university members of this partnership was to transfer formal knowledge to students, incorporate industry feedback into curricula, and to help local companies recruit and retain suitable knowledge workers from among its graduates.

The second form of inter-organizational knowledge transfer examined in this research is the reciprocal flow of knowledge between the university and local industry. A grant from the National Science Foundation funded a selected number of companies in the region to engage in a partnership in which they were linked to university researchers. Knowledge in the form of innovation flowed from the university laboratories to companies. And knowledge in the form of feedback about the effectiveness of the research and the education of students flowed from companies to the university. An additional part of this NSF project was to identify and analyze barriers to effective knowledge transfer between universities and legacy, industrial era companies.

This inter-organizational knowledge-sharing relationship is consistent with the mission of land grant universities to support local industry [19][28][29][37]. In the 21st century, it has been argued, these institutions must facilitate economic growth through innovation in the emerging knowledge economy [39]. Consequently, universities are engaging in regional development collaborations with industry to support economic growth through innovation [31] so as to impact both the regional economy and the health and sustainability of the university [11].

There is a considerable body of research on the topic of university-industry relationships with respect to technology transfer, knowledge exchange, and open innovation (e.g. [1][3][27][35][36]). However, much less is written about the interpersonal interactions that occur in university-industry partnerships while reciprocal knowledge exchanges are being enacted. These types of relationships present different challenges and issues than laboratory research that is subsequently transferred from a university to a company. In this regards, four themes were explored: 1) effectiveness of academic-industry partnerships; 2) communication between the academy and industry members; 3) barriers to the flow of scientific knowledge; and 4) barriers to workforce diversity.

The theory that was chosen to guide the investigation is Social Exchange Theory [22]. This theory grew out of the intersection of economics, psychology and sociology, focusing on the exchange relationship between specific actors. According to Homans [20], the theory was developed to understand the social behavior of humans in economic behavioral undertakings. Social exchange theory consists of four constructs. Reciprocity refers to the mutual exchange that results from the need to reciprocate the benefits received. Cohesion refers to the “gravity” that holds actors in the exchange within the same orbit, in the presence of conflicts. Balance refers to the equilibrium or equality in the distribution of benefits due to mutual dependence between each of the actors in an exchange. Finally, power refers to the amount of monetary influence one actor can exercise over the other. Although modern social exchange theory exists in many forms, what remains constant is the central concept of actors voluntarily exchanging resources via a social relationship [6]. Emerson [10] suggested that
there were social exchange attributes which were highly applicable to transactional style or partnership-style relationships and believed that such exchange attributes evolved through mutually satisfying interactions, thereby increasing confidence in the relationship.

The research results indicate that communication and culture are two key factors that hold potential barriers to successful industry-academic relationships. This investigation showed that an important factor for productive exchange relationships is both maintenance and the awareness of mutual and balanced dependency (i.e., cohesion) between exchange partners. This can be facilitated by maintaining open communication channels that reinforce a perception of reciprocity and minimize perceptions of power and dominance among exchange partners [41].

Balance was in evidence at a company which used university labs for product testing and, in exchange, provided internship sites for university students. Cohesion could be seen in the dependence of one company -- which had eliminated its internal R&D facility -- upon the university research labs. The university, in turn, depended upon such activities to enact its outreach mission, something that is particularly important to document during annual state budget hearings. Both positive and negative examples of reciprocity emerged from the research. Positive reciprocity existed with one company that had built up social capital with the university through a prior history of positive working relationships. This led to successful communication and cooperation in which both parties maintained a consistent understanding of the problem and the goals of the industry-university partnership project that would address it. But another company had no social capital upon which to draw to sustain communication and cooperation during a period of significant organizational change in response to the economic recession. As a result, a communication gap widened as new corporate representatives entered the partnership and replaced those who possessed the original understanding of the project’s goals. Finally, power in the theory’s intended sense of monetary influence was not in evidence. This is because the project grant obviated the need for industry payment for services; the industry partners were receiving innovation assistance from the university without charge. Hence, neither member of the partnership was in a position to exert economic domination over the other. However, the university as a significant employer in the region is in a position to exert power in regional and state policy making. On the other hand, the university depends upon such companies to hire its graduates and to support its claims in state funding requests.

In addition to barriers that were identified via the application of Social Exchange Theory, an additional barrier to effective industry-university knowledge transfer was a cultural barrier emanating from the very different organizational cultures of academic and corporate organizations. Significant differences were identified with respect to the mission of each type of organization, the time horizon for solving a research problem, and the reward systems for doing so.

5. Discussion

The barriers to knowledge economy development that resulted from this study are summarized in Appendix 2. The findings reveal the existence of barriers with respect to both human capital development and inter-organizational knowledge transfer. While some of these barriers have been identified elsewhere in the literature, the contribution of this analysis is twofold. First, this assessment brings together two aspects of knowledge development that are not typically considered in a single study: knowledge possessed by human capital and knowledge exchanged among organizational entities. In doing so, it demonstrates the value of adopting a broader, systems approach to the analysis of knowledge economy issues. Second, workforce diversity is not widely recognized as an integral feature of a knowledge economy. Hence, this research provides further evidence to support arguments about the linkage between diversity and innovation.

As a qualitative, interpretive research project, alternatives to the positivist measures of reliability and validity were employed. Two accepted evaluative criteria in qualitative IS research are triangulation and replication. Triangulation refers to checking inferences drawn from one set of data with those collected from another set [38, p. 392]. Triangulation in this study was achieved through the multiple methods of data collection that were employed. Through replication across cases, findings are shown to be generalizable beyond a single case [40, p. 69]. In this study, the barriers that emerged from the analysis were found in multiple sites.

However, one limitation of such research is the inability to assert population generalizations. Rather, the generalizability in this research is generalization to theory [25]. Nevertheless, at a sufficient level of abstraction it is possible to claim that in the presence of similar conditions, similar results can be expected (see, for example, the findings presented in [38]). But future research could focus on quantitative testing of the logic
model employed in this research in order to develop population generalizations.

6. Conclusion

In the globally competitive, twenty-first century the economic viability of regions, states and countries is increasingly linked to the viability of their knowledge-intensive economic sectors. In this new economy, agriculture and commodity production are being replaced by an emphasis on the development and sustainability of intangible, knowledge-based assets. The measure of success in the knowledge economy is innovation. The indicator of likely success is continuous learning. Regional knowledge economies are being evaluated by their ability to attract and retain companies that focus on the production, dissemination and application of knowledge, and on the provision of services that involve the efforts of knowledge workers. Therefore, two factors that are linked to a thriving regional knowledge economy are the sustainability of human capital for a knowledge workforce and the sustainability of inter-organizational knowledge transfers about innovation.

Hence, the goal of this research program was to identify and analyze two factors that are essential to the development and sustainability of a regional knowledge economy in Pennsylvania: human capital for a knowledge workforce and the development of inter-organizational knowledge transfers. These two dimensions serve the continuous learning and innovation criteria of a knowledge economy. In the knowledge economy several forms of knowledge are the currency: the knowledge possessed by the knowledge workers, knowledge about human capital management, innovative knowledge, and knowledge about the effective deployment of innovation. Not unlike other forms of currency, this knowledge needs to be acquired, transferred and managed.

The analysis of human capital for a regional knowledge economy produced two important themes. First, the research results reinforced the continuous learning dimension of a knowledge economy. The results of the data collection revealed industry’s need for both broad business/contextual knowledge and deep, specific technical knowledge. But as application contexts and business needs change, the former must be updated. Similarly, as new technologies emerge there is a need for constant reeducation. Hence, no matter how good the post-secondary education one receives, an educated workforce for a knowledge economy requires individual responsibility for continuous learning. The second theme was the need to have a local culture that is able to both recruit from outside the area and retain qualified knowledge workers. This challenge is particularly acute in isolated rural areas with little population in-migration.

The examination of inter-organizational knowledge transfer yielded two important findings. One was that the concept of industry clusters for inter-organizational knowledge transfer is problematic when considering the ICT sector. For this reason, the term “ICT industry cluster” was replaced with “ICT occupational cluster” to acknowledge that ICT work is carried out in both the primary and the secondary ICT sectors. The second finding was that industry-academic knowledge transfer requires a clear understanding of the reciprocal nature of the exchange and the benefits intended to accrue to each partner. A derivative finding is that organizational cultural differences can impede the efforts to achieve mutual benefits. The benefit of knowledge transfer, whether among members of an industry cluster or as part of a university-industry partnership is to better manage innovation knowledge and the knowledge about how to manage this knowledge.

7. Acknowledgements

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8. References


Appendix 1: Data Collection

Focus Group Items

Focus groups discussed the mission of state universities to contribute to the local economy through: 1) educating the future workforce; and 2) conducting academic research that can be leveraged for greater industrial innovation.

- The current skills possessed by the local labor pool and skills considered to be necessary to compete for technology-intensive, knowledge sector jobs.
- Importance of workforce diversity in a knowledge economy
- Barriers to the recruitment and retention of underrepresented members of a workforce (based on ethnicity, gender, nationality, etc.)
- University research on human infrastructure that could address barriers to increased diversity in the region’s companies
- Industrial growth issues that companies in this region are experiencing with respect to the transfer of scientific knowledge from the university to the workplace.
- A role that this university could or currently does play in addressing these issues
- Barriers to greater business innovation that could be addressed by better leveraging of information technology.

Interview Items

Representatives from local industry and the university were interviewed about barriers to knowledge transfer.

Need for academic-industry partnership

- Information & knowledge barriers to business growth
- Opportunities for universities to address knowledge barriers
- Barriers to leveraging IT resources to enhance knowledge access and transfer
- Opportunities for universities to address role of IT in knowledge barriers
Effectiveness of academic-industry partnership

- Agreement on goals
- Tangible and intangible outcomes
- Barriers to productive partnership
- Impact of external economic conditions on partnership

Communication between academic and business communities

- Differences in communication styles and modes
- Frequency of communication with partners
- Receptivity to knowledge / expertise exchange between partners
- Institutional culture differences (i.e. academic vs. industrial) regarding research (e.g. basic vs. applied)

Human resource barriers

- Workforce education barriers
- Knowledge workforce skills gaps
- Challenges of recruiting and retaining knowledge workers to legacy industrial era regions
- Issues regarding the recruitment and retention of talented people with certain demographic characteristics (e.g. race, gender, nationality)?
- Importance of human resource diversity in the industry
- Opportunities for universities to help address human resource diversity issues

Survey Items

- Company (size, industry, etc.) and respondent (e.g. CEO, CIO, HR manager, etc.) characteristics
- Roles and responsibilities of different types of IT workers in the company
- IT activities most difficult to replace
- Most common entry-level IT position for which the company hires
- Importance of “soft” skills required of IT workers in the company
- Skills & knowledge expectations of IT workers used in hiring decisions
- Satisfaction with the skills & knowledge possessed by recent IT graduates
- Existence of in-house training program

Appendix 2: Barriers to Knowledge Economy Development

I. Barriers to Human Capital Development
1. Recruiting appropriately educated workforce
   a. Technical: low availability of context-relevant, deep technical skills
   b. Human: low teamwork skills of university graduates
2. Cultural barriers to knowledge workforce retention
   a. Culture not supporting continuous learning
      i. Not a culture of education
      ii. Training not viewed as continuous
   b. Cultural incompatibilities with diverse workforce
      i. Homogeneous population
      ii. Failure to recognize connection between workforce diversity and vibrant knowledge economy
      iii. SMEs not equipped to manage workforce diversity issues alone
      iv. Low university completion rate

II. Barriers to Inter-organizational Knowledge Transfer
1. Industry clusters for knowledge sharing: absence of critical mass for ICT industry cluster
2. Reciprocal knowledge flows between university and industry
   a. Absence of social capital to sustain communication and cooperation during organizational upheavals
   b. Inconsistent understanding of goals
   c. Power asymmetry
   d. Differing institutional cultures
      i. Incompatible missions
      ii. Incompatible time horizons for project completion
      iii. Incompatible reward systems