A Regional IT Occupational Partnership
for Economic Development

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ABSTRACT

Increasingly, the economic viability of regions, states and countries is being linked to the viability of technology-enabled, knowledge-intensive economic sectors. Hence, among the factors of interest in regional economic development is the availability of an information technology (IT) talent pool. There is a growing need to understand the regional supply and demand dynamics of appropriately educated IT professionals. Consequently, an action research project was undertaken in Berks County, Pennsylvania in order to better understand the IT skill and knowledge requirements of the local labor force. An occupational partnership representing three constituencies – academe, local industry and government – joined forces in order to develop a sustainable mechanism for ensuring the continuance of a qualified IT labor force.

Categories and Subject Descriptors

H.1 Models and Principles; K.7 The Computing Profession; K.4 Computers and Society

General Terms

Management, Human Factors, Theory

Keywords

Action research, cultural influences, diversity, economic development, information economy, information technology sectors, IT labor force, IT professional, IT skills, IT workforce

1. INTRODUCTION

At the dawn of the twenty-first century, the transition from agrarian and traditional industrial economies to knowledge-intensive, technology-enabled economies is well under way. Increasingly, the overall economic viability of regions, states and countries is directly linked to the viability of these technology-enabled economic sectors. Economic development is a global phenomenon that occurs locally. Regions develop through people, institutions and infrastructures.

In order to ensure the long term viability of a technology-enabled economic sector one of the significant considerations must be the development and sustainability of the talent pool, the human infrastructure for this sector. In order for this to occur an analysis of the capability of a region to create and sustain such a talent pool is necessary.

Prior research has shown that a sustainable human infrastructure to support technology-enabled work has several requirements [22]. First, an appropriately educated workforce must be developed. Second, there must be a culture that understands the importance of continuous learning and that supports it. Third, in order to reap the return on the educational investment, it is necessary to retain the educated workforce in the region.

An appropriately educated workforce is drawn from two distinct talent pools. One is the existing workforce in the region that is retrained for knowledge-intensive, technology-enabled work. This workforce is composed of workers who have been displaced from agrarian and traditional industrial work. The second talent pool is the potential workforce that is composed of young people. These individuals will be prepared for work in this sector through the traditional educational pipeline of high school and post secondary education. These two talent pools have different characteristics and needs and represent different opportunities for the economic development of the region. These differences must be taken into account during the analysis and development of the workforce.

The development of an appropriately educated workforce requires more than the existence of universities and post-secondary training facilities, however. While it is necessary to have educational institutions prepared to educate people, what is also required for long term viability of a knowledge-intensive economy is to have a culture that respects and values lifelong education. While it might be possible to determine the educational needs of the present, it is impossible to predict the educational needs that will accompany the opportunities and competitive challenges of the future. Hence, a fundamental challenge for government, economic development, industry and educational institutions is to work together to align the educational preparation of the workforce with the current and potential employment opportunities and challenges of a particular region [23][24].

In an increasingly competitive global economy innovation and knowledge can be identified as key components of strategic advantage. This is particularly the case for the knowledge-intensive, technology-enabled sectors. Understanding the factors that contribute to sustainable innovation becomes all the more

important as service economies replace industrial and agrarian economies.

Among the regions of the United States that are suffering the effects of the migration from industrial to post-industrial employment is Pennsylvania. Recent studies have documented out-migration of the young, educated work force as the state's industrial economy declined in the latter part of the last century [3].

Thus, a key component of economic development in Pennsylvania is a sustainable technology-enabled human infrastructure made possible through the retention of the young educated workforce. As the population demographics of Pennsylvania shows, turning the tide of the 'brain drain' is of paramount importance for this state. In order to retain the educated workforce, however, there must not only be jobs but also career paths for these well educated IT professionals.

One component of ensuring career paths is to understand the employment needs of Pennsylvania. As previous research has shown, the success of the technology-enabled sector must involve ongoing assessment of the fit between the employment opportunities of a region and the educational preparation of its workforce. That is, there must be a permeable boundary between those who develop the IT skills and knowledge of the potential labor force and those who employ the result of that effort. Thus, it has been argued that ensuring a sustainable human infrastructure for economic development through technology-enabled work requires the joint effort of government, industry and academe [25]. This paper reports on an action research project involving an industry-academic partnership that was created to facilitate human capital development for a sustainable technology-enabled economic sector in Berks County Pennsylvania.

2. BACKGROUND
There is a long literature of research undertaken in order to better understand the educational preparation of the future IT workforce. During the 1990s a number of studies considered the emerging needs of industry and the educational preparation of IT professionals. A consistent conclusion was that both technical and organizational or context skills were needed.

The first author led a joint academic/industry collaboration in New England in order to consider the skills and knowledge requirements of IT professionals and their fit with contemporary academic preparation. At the conclusion of the project the group found that information systems professionals needed "skills in technology, business operations, management, and interpersonal skills to lead organizational integration and process reengineering activities" (p. 313) [8]. Further, this study argued that the information technology industry was changing to one with multiple career tracks that had differing emphases with respect to knowledge and skills and therefore a "generic curriculum to meet the educational needs of all future IS professionals is obsolete." (p. 314) [8]. The group concluded that a multidisciplinary approach was needed to properly educate information technology professionals.

One specific goal of the study with respect to the identification of skills and knowledge was to compare the IT skills and knowledge required by industry with the curricular emphases of information systems educational programs in the region. In doing so, their

research revealed an 'expectation gap' between industry expectations regarding workplace needs and academic preparation of future IT professionals with respect to information technology skills. The authors concluded that universities needed to place more emphasis on the "integration of technologies, applications, data, and business functions…" (p. 293) [26] and that "firms need to send consistent messages to universities about their expectations…for career education and not training" (p. 293) [26].

Tye et al. [29] considered the situation for Hong Kong and concluded that the scope of skills for information technology professionals would broaden towards the end of the decade. Their list of necessary skills included interpersonal, business, analysis and design, and programming skill. They also found a match between the skills being taught and those needed by industry at the time of the study. However they were concerned that contemporary curricula were not prepared to meet the skills needed for future success.

Building upon the earlier research into skills assessment and an academic/industry gap, Burn and Ma [4] described the development of an "innovative program to cultivate the hybrid business and information systems manager who can play a major role in strategy formulation for effective use of information technology" (p. 114). This program description was an early effort on the part of academia to address the skills gap.

Sawyer et al. [21] applied the approach of Trauth and Lee's work to a single company by examining the IT skills needed at that time and three years into the future. They also found that conceptual skills and non-IT skills were needed in 1998 and were projected to be even more necessary in 2001. In addition, this study reinforced earlier findings that IT roles were growing more numerous and specialized and that IT professionals would increasingly work in teams and need to adapt to rapid change.

At the dawn of the new century the research on the development of IT skills branched out into several directions. Some studies explored the configuration of contemporary academic programs. Others examined the recruitment of students into IS/IT programs of study. Still others considered additions to the basic skill sets that were identified in the 1990s. Finally, some researchers introduced the concept of human diversity into discussions of the preparation of the IT professional.

Trauth and Hafner [27] described a new interdisciplinary curriculum in information science to fill the IT education gap. Such a program would draw from such disciplines as computer science, business, and behavioral sciences in order to offer students a balanced curriculum that addressed the technical, functional, and human dimensions of the IT field. They also noted the continuing shortage of qualified information technology professionals in the industry. Roddick and Nieuwenhuis [19] concurred with this assessment by examining the application trends. They found that growth had shifted from more traditional computer science degrees to newer programs that focused on the application of information technology.

Several authors have investigated the issue of recruitment into IT programs of study. Litecky et al.'s [9] examination of the IT job market emphasized the shortfall of qualified professionals. Myers and Beise's [11] investigation of factors that attracted as well as

discouraged student interest in IT careers found that media images of IT jobs were likely to attract young people while discouraging non-traditional age students. The portrayals of IT students as nerds and geeks, discouraged a wide array of people from applying. Bailey and Stefaniak [1] found that the shortage of qualified professionals came not from a lack of applicants but rather a lack of individuals with adequate skills. They attributed part of the reason to an over emphasis on short training and certification programs at the expense of university education. Mahatanankoon [10] viewed the issue of declining enrollment as a gap between students' career orientations and IT related courses. It was noted that such a gap has diminished motivation to fulfill degree requirements.

The identification of changing skills needs continued in Bailey and Stefaniak [1] where highly valued interpersonal skills were expanded to include listening, teamwork, adaptability to technology changes, time management, conceptualization, verbal communication, and multi-tasking abilities. Again, the need for greater collaboration between industry and academia was called for to narrow the continued gap between what is taught and what is needed.

Reich and Nelson [18] sought the insights of CIOs regarding changes driving in-house IT groups. They found that information technology skills need to move even closer towards the strategic center of the company, requiring increased business knowledge, improved ability to negotiate, and improved ability to create value. Shortly after the publication of this call for moving closer to the center of the company, Cash et al. [5] and Niederman [12] examined the ways that the rise in e-commerce further altered the competency requirements of information technology professionals. Both studies found, once again, that technical, business, relationship, and conceptual skills were necessary in order for IT professionals to ensure that information technologies work effectively. Thus, at present, an even greater range of skills is being included in the skill set of IT professionals given their increased roles and responsibilities.

Finally, a body of research endeavored to address the skills gap by identifying under represented groups in the IT field and attempted to explain the barriers these groups faced to working in the industry. For example, von Hellens et al. [30] considered professional women's perceptions of the skills required in IT with respect to skills that women typically bring to IT work. They found that the ability to switch between hard and soft skills, and to adapt to different environments contributed to career progression for women. They also found that the ability to switch technical skills as new technologies developed contributed to career success for women. However, they believed that the misrepresentation of specializations available in IT was a factor contributing to the gender gap in higher managerial levels of information technology jobs. Later work [13] found a dualism in the way women IT professionals discussed their work versus the way they actually lived their lives.

Randall et al. [17] noted that despite the increasing demand for IT professionals the number of women in the computer science field was decreasing. These authors claimed that most research on women had been done on women in computer science programs, but many people entering the field of information technology come from programs in information technology and information systems. Such programs place more emphasis on the applications of information technology, something they claimed made these programs more attractive to women. As evidence, they cited the larger number of women IS and IT programs than in computer science programs.

In yet another attempt to understand the gender gap in IT, Gallivan [6] examined the challenge of adapting to technological change in information technology departments by comparing the change processes employed in different organizations. He then compared different attributes such as personality and gender in adapting to change. He found that information technology professionals that could tolerate higher levels of ambiguity and higher levels of openness to new experiences had better job satisfaction in the face of technological change. The women in his study reported higher levels of stress in the face of change but did not report lower levels of job satisfaction.

As this review of the literature has shown, the same mix of technical and interpersonal skills continues to be identified as important. Yet it appears that there is a continued need to bridge a communications gap between industry and academe with respect to the preparation of IT professionals. For this reason, an action research project was undertaken in Berks County, Pennsylvania. While the immediate goal was to foster an ongoing connection between the academic and practitioner communities, the ultimate goal was to develop a better fit between the expectations of industry and academic preparation in furtherance of economic development efforts.

3. ACTION RESEARCH PROJECT: AN IT OCCUPATIONAL PARTNERSHIP

A seed grant from the outreach office of Penn State University was awarded in 2006 to develop a community-based pilot project that would support economic development efforts in Berks County, Pennsylvania. The action research team was comprised of a university researcher (first author), a Ph.D. student (second author) and a representative from the continuing education office of the Penn State, Berks campus (third author). The purpose of this pilot partnership was fourfold: 1) to explore the IT skills gap in this region; 2) to relate it to local employment needs; 3) to explore possible cultural barriers to IT employment in the region; and 4) to establish a framework for proactive and ongoing collaboration. The researchers worked with three constituencies in this effort. The academic constituency consisted of representatives from the Reading Area Community College and from the Berks campus of Penn State University. The government constituency consisted of representatives from the local workforce development organizations. The industry constituency was represented by representatives from local industry.

Action research was chosen as the methodology for this project because, upon review of possible methods, it was determined that action research best fit the needs of this endeavor. This is because the objective was to solve a current, practical problem while at the same time expanding scholarly knowledge. With other research methods the researcher does not attempt to change the phenomenon that is studied; in action research that is not the case. The action researcher is concerned with solving a practical problem while at the same time adding to theoretical knowledge [2].

At the outset of this project a stakeholder committee was established that represented the three constituencies. The purpose of this committee was to guide the research design, facilitate fieldwork and provide feedback on interim results. The project began with a stakeholder meeting. This and subsequent meetings were structured to enable the attendees to get to know the researchers and to exchange ideas with them. Below, are the findings that resulted from this pilot partnership.

3.1 Local IT Employment Needs

In recent years a renewed vitality has come to the economic development efforts in the Berks region. Many of the recent efforts of various community and economic development organizations have begun to gain traction and provide real benefits to those living and working in the area in and around Reading, PA. Many of these developments are focused on building the technology infrastructure in the region. While new construction projects and highway improvements may be more visible signs of a growing economy, the underlying technology that supports a region has become a primary concern for firms in many, if not most, industries. This concern also extends to the workforce who will be using that technology. For while it is clear that this region remains an important part of the technological landscape of this part of the state, it was not as clear whether the region has the skilled workforce necessary to sustain its position.

A recent newcomer to Berks County is a firm focused on providing a number of IT services including secure data transport and backup, applications management, collocation services, and IT services outsourcing. This firm hopes to bring in approximately 1,500 IT jobs to the area by 2010. The company has also received a substantial development package from the state that includes training funds. The continuing education office has been assisting the company in developing training plans for employees it hopes to hire. The company's choice of this location as a headquarters highlights the area's importance in terms of technology.

Another initiative has been an effort to approach economic development in the Berks region in a more systematic way. One of the goals has been to focus economic development efforts on three specific industry clusters: entertainment, hospitality and tourism; food processing; and managed and shared services. This latter cluster is of particular relevance to information technology employment. Some hold a vision of this region becoming a hub for back-office operations of large companies in the metropolitan areas of: New York City, Philadelphia, Baltimore and Washington, D.C. However, a concern arises when consideration is given to the current IT skill level of workers in the region. There is a growing concern that while the region may be ready for the future in terms of its physical IT infrastructure, but it may not be ready to support those initiatives in terms of a well-trained human infrastructure. Anecdotal evidence to support this concern comes from the fact that one startup firm in the area has reluctantly decided to move its operations out of the state in search of a pool of employees with the technology skills needed to grow its firm.

As the manufacturing firms that used to be the lifeblood of this area disappear, the region may be left with a workforce lacking the skills needed in a business world immersed in technology. Thus, a technologically skilled workforce is a necessary

component of a sustainable economic development effort in this region. For this reason, the industry constituency was motivated to participate in an industry-academic partnership that would investigate the region's workforce IT skills gap in order to better develop demand-driven education and training programs. This effort would help to insure the continued success of regional economic development efforts and would help make the region an attractive alternative to firms looking to do business in Pennsylvania. It was also anticipated that the project would serve as the initial step in developing an IT industry cluster in the region, something that could then serve as the intermediary for applying for continued funding through an enlarged state-funded Industry Partnership program.

The specific activities of the action research project that was enacted in order to achieve these goals involved several methods of data collection. Members of the partnership engaged in: group meetings, individual interviews, and group feedback sessions. At the outset of this project an initial meeting was held with potential members of the partnership. The partnership was convened by the third author. The purpose of this meeting was to present the scope of the partnership. Below are the objectives that were discussed at this meeting:

- Facilitate bringing corporate stakeholders, economic development organizations, government entities and educational providers together to discuss current IT workforce development needs and resources currently available.

- Gather data necessary to support the creation of an IT industry cluster and assess its impact on the region.

- Recruit initial partners to this IT industry consortium.

- Consider the cross-industry importance of IT workforce skills in order to begin to aggregate demand among workers and employers to coordinate needs assessment, training and education for high demand technical occupations in information and communications, business and financial services, or the bio-medical cluster.

- Consider the development and strengthening of IT career ladders and upward mobility opportunities for IT workers in the region.

- Collect and analyze data that would allow for setting priorities among regional training needs.

3.2 Exploring the IT Skills Gap

During this meeting participation was sought for the next phase of the project: individual interviews with members of local industry that were conducted by the second author. While the interview logistics were being arranged by the third author, the first and second author developed the interview protocol. Twelve representatives of four local companies were interviewed – three individuals at each company. Two of these companies are in the primary IT sector, meaning that their output consisted of hardware, software or IT services.

The other two companies were in the secondary IT sector. That is, the output of the firm would be something other than IT (such as health care, food, etc.) and the IT workers of the firm work to

support that effort.[1] At each company, participants were enrolled who filled the following roles: chief information officer (CIO), vice president of information technology, IT manager, applications manager, and head of human resources. The individuals interviewed had extensive experience ranging from five to 30 years in their roles.

Ten of the respondents are male; two are female. We engaged in purpose sampling so that various perspectives on IT skills could be obtained in the interviews. Hence we chose individuals representing the executive, director or managerial and human resources levels in order to triangulate information across different parts of the company. In this way we helped to ensure that we received rich insights in each company.

Two sources were used to inform the interviews. The first was input from the initial partnership meeting about the economic goals of the region with respect to IT employment. The second source was the results of prior research by the first author on IT skills (i.e., [23][8]). The interviews explored four topics in open-ended format. First, context was explored through questions about the firm and the participant. Firm information included the size of firm, its revenue, the size of the IT staff, and its industry. Participant information included the individual's position in the firm, education level, and number of years in the IT field. Second, skills questions were concerned with areas of hiring expectations, satisfaction with current or recent hires, skills assessment, and suggestions for preparation. Third, career information included questions concerning recruiting, educational opportunities, and career advancement. Finally, interviewees were asked to discuss cultural barriers related to continuous education and diversity that might affect the development of a sustainable and appropriately educated IT workforce in the region.

Two themes emerged from these interviews. The first theme related to the meaning of an appropriately educated workforce. The second theme related to cultural barriers that would affect the sustainability of an appropriately educated workforce. The themes that emerged from the individual interviews were presented back to the partnership members at a second focus group meeting. At this meeting the first author situated the findings of the interviews within the larger context of similar economic development research she and others have conducted.

3.2.1 An Appropriately Educated Workforce

This topic was explored through discussion of the current skills possessed by the local IT labor pool in contrast to those considered to be necessary for an appropriately educated IT workforce. These skills are categorized into technical and human skills.

3.2.1.1 Technical Skills

Technical skills were defined as those skills necessary to design, install, and maintain information and communications technologies. What emerged from the interviews is a classification of these technical skills into two types: general technical skills and deep technical skills. General skills referred to a well-rounded understanding of the technology and its applications being used in the company. While a number of metaphors were used by the respondents, what these authors found worthy of note is that on several occasions a football analogy was used to describe these skills as "basic blocking and tackling" skills.

The respondents felt that these general technical skills could easily be found. One respondent from a secondary sector firm noted that these general IT skills are typically outsourced. The rationale is that as the needs of the company change or as technologies change, people with these general IT skills don't need to be retrained. If one consulting firm can't handle the changing needs then another firm can take their place. Hence, the only technical skills this firm keeps in-house are proprietary technical skills for systems that they developed themselves.

Whereas the general technical skills were considered to be broad in scope and relatively shallow, the deep technical skills referred to more specialized and narrower skills. This specialization could mean either technical specialization, as in a particular programming language. It could also refer to a particular application domain, as in health systems or a particular type of manufacturing system. One of the problems raised by the respondents was the challenge of finding deep skills that were also domain relevant. For example, a company might be able to find someone with skills in a particular programming language but, then, he or she might not know anything about the domain in which these skills would be applied. For people with deep technical skills, training is an issue. As these deep skills change over time with changing technologies, the people who possess them often need to change. As one interviewee commented:

> The greats of the punch card era were not the greats of the early stored program era and the greats of the early stored program era were not the greats of the early interactive computing era.

The general consensus was that there was an adequate labor pool of individuals with general technical skills. An exception came from a person working in a primary IT sector firm who discussed a lack of candidates with very deep and specific technical skills for specific domains. He discussed outsourcing for these skills because there wasn't an adequate pool of candidates to hire in-house.

Interestingly, during the interviews, most individuals spoke only briefly about technology skills and then moved on to discussing human skills. While there was general consensus that the local labor pool possessed sufficient technical skills, there was also general consensus that the local labor pool did not possess the necessary human skills to be successful as IT professionals. One interviewee spoke with considerable passion about this topic.

> If we take for granted that people in the industry have the technical capability, the technical skills, have been trained, have been certified... let's start from there.

He then went on to spend the rest of the interview discussing human skills. His level of frustration was clear in his voice. He couldn't understand why human skills were so lacking in the people he interviewed and employed. Hence, he felt that many IT professionals currently working in his company lacked these skills as well.

3.2.1.2 Human Skills

Human skills were broadly defined by the interviewees to cover a wide array of skills including teamwork, communication skills,

and business skills. Teamwork skills related to behavior on a team or as part of a project. Necessary skills included understanding the role that one is playing on a project or in a team and the responsibilities that accompany the role. As an interviewee noted:

The solutions that our customers demand are increasingly difficult and complex, so to solve a problem you need both broad and deep skills, typically which is beyond the skills that can exist in one person. So, the number one skill probably is to effectively work as a member of a team, to recognize the attributes of leadership and 'followership' and project management and interaction with teams.

He also identified the need for a related ability to change roles from project to project:

Sometimes people can play different roles on different teams. We often see that one of the challenges is to get into the right role for the project.

Communications skill was defined as listening and explanatory skills. It is crucial to be able to listen to the requirements and expectations of a client, whether internal or external. Explanatory skills were also identified as important and were discussed in terms of the ability to share the results of a completed project with the client. An example was given of an IT person who completed the expected project for the clients but never actually told them the results. Instead, the individual simply began to implement changes based on these results!

One of the problems we run into is that we have very capable technical people who do very good work and they don't know how to hand it to the customer. They don't know how to show the customer the value. Even some of the IT managers . . . in client accounts. . . are great, they just can't communicate what they're able to do. . . [They need][2] understanding that just because they did something, everybody doesn't know they did it.

He then went on to offer a specific example:

I just had a meeting with the customer and he blasted me. He said, "You're supposed to do an assessment for me but I have not seen the assessment." I said, "Well I'll check into that."

After the meeting I met with the engineer and said, "Did you do the assessment?"

"Yeah, I did it."

"Where is it?"

"I have it."

I said, "Did you give it to the customer?"

He said, "Well no."

Business skills were defined as financial skills related to budgets, and profit and loss statements. They were also defined as understanding the impact of IT work on the business. One interviewee explained:

We have to hire highly skilled technical people. When you hire highly skilled technical people in a consulting

firm, you would hope they have some business acumen. It's lacking. No it's not lacking, it's nonexistent. You've got a really good technical guy and all he can think about are bits and bytes. He doesn't think about the fact that if he pulls that cord out, he's going to shut down the business for ten minutes which means maybe they lose one-hundred thousand dollars.

3.2.2 Cultural Barriers to a Sustainable IT Workforce

In addition to the supply of personnel with technical and human skills needed by the IT profession, interviews about the skills gap also examined cultural barriers. Two themes about cultural barriers that could affect the sustainability of a technology-enabled work force were explored. One theme was having a local culture that recognized the value of and supported continuous learning. The second theme was having a local culture that was able to both recruit and retain qualified personnel regardless of gender, race, ethnicity or other diversity markers.

3.2.2.1 Continuous Learning

Many of the respondents discussed education as a key success factor for an IT professional. They also recognized that an IT professional culture required continual education. In this respect, they viewed IT as perhaps different from other fields in that job training is primarily the responsibility of the employee rather than the employer. Whereas employers are willing to help employees update their knowledge and skills, it is ultimately up to the individual motivation. As one respondent commented:

The one thing about IT that is hard for some people to come to grips with is that it's more than a forty hour per week job because you can't know everything you need to know [in that time]. The employer isn't going to train you on everything that you need to know. If you want to be at the top of your game, and there are people that really don't care if they're at the top of their game, you must invest in yourself outside eight to five, Monday to Friday. Those that can't or won't do this won't be successful in the industry. There's too much to know and too much change.

But one of the respondents articulated the cultural barriers that exist. She explained that Pennsylvania is an "older culture without a culture of education." She believes that this cultural barrier is certainly a drawback to IT in the state.

Along with explicit discussions of continuous learning, another expression of this factor arose in discussions of the ability to continually change. For example, one respondent noted the idea that people must embrace change as an agent for success. Others talked about never being a victim when working in information technology, believing that keeping up with change would prevent someone from becoming a victim of economic vagaries. Another person referred to managing one's own career and how important this is to success in an IT career. Managing change and managing one's own career were among the more common expressions of the need for continuous learning.

3.2.2.2 Diversity

Diversity was also introduced into the exploration of possible cultural barriers to a sustainable IT workforce. The interviewees

were first asked to define diversity and then discuss its relationship to IT field. Some of them spoke about demographic diversity such as gender, age, race and religion. One person believed that the best teams include both men and women because this individual believes that men and women bring some different skills and attributes to a team that combine to be more powerful than with either group alone. Another person felt that people of all races and religions could and should work in the IT field and noted that:

> *...people of ethnic and religious diversity show no fall off in ability.*

Others spoke about diversity in terms of skills and personality. For example, one person believes the focus needs to be more about having the right people than on diversity per se. This individual thought that skills and personalities were the critical factors to success.

A third perspective on diversity focused not on the IT professional but on the need to reflect the people being served by a particular company. According to this viewpoint, IT professionals support all types of people in all types of jobs. Therefore, having a diverse IT staff is important in order for it to be able to understand and work with those they support.

3.3 IT Industry versus IT Occupational Clustering

Besides the articulation of the IT skills gap, another outcome of the action research project a re-articulation of the project, itself. Among the goals at the outset of this project was that an IT industry cluster supportive of economic development would be nurtured through the establishment of an IT industry consortium. This expectation was the result of ongoing economic development efforts in the state that were based upon Porter's [15] argument about clusters. This is that groups of interconnected firms in an industry that are located in the same region can be leveraged by governments and policy makers in order to achieve competitive advantage. Porter [16] explains that a cluster is a geographically proximate concentration of interconnected companies including suppliers, service providers and associated institutions. These clusters also comprise highly specialized skills and knowledge in a particular nation or region (pp. 15, 16, 32). Porter argues that a cluster of firms with geographic, cultural, and institutional proximity has an economic advantage over geographically dispersed firms in that the former allows for special access, special relationships, better information, powerful incentives, and productivity advantages. Consequently, labor force and economic development efforts in the state have focused on the identification and development of key industry clusters in Pennsylvania [7].

However, while the application of Porter's model makes sense for workforce development efforts in other industries, this approach becomes problematic for IT workforce development planning. The reason is that Porter conceptualization of IT employment only takes into account the primary IT sector. But the workforce reality is that IT professionals work both inside and outside the information technology industry. For states such as Pennsylvania this fact is particularly salient in that roughly 75% of the IT jobs in the state are not in the IT industry. That is, most of the people holding IT jobs in Pennsylvania do not work for companies whose output is computer hardware, software or information services.

Rather, these workers are employed in health care, manufacturing, extraction, education, finance, etc. [28]. Since this situation is not expected to change, viewing the development of IT jobs only within the context of an IT industry cluster, grossly underestimates the size of the actual IT labor force.[3]

Over the course of this project the members of the partnership came to understand the subtle, but extremely salient, distinction between the primary and secondary IT sector. This learning occurred in three ways. First, the first author has written and spoken extensively on the case of Ireland in which the distinction between primary and secondary was clearly articulated. Thus, through her presentations to the partnership members and in planning meetings throughout out Berks County project she was able to explain this distinction. Second, she reinforced this distinction by invoking data from a state-wide project that yielded the data that 75% of IT jobs in Pennsylvania are in the secondary IT sector [28]. Finally, the framing of the interviews conducted by the second author was organized by primary and secondary sector companies. As the project progressed and participants grappled with how to conceptualize the unique situation of the IT labor force, the term 'occupational partnership' emerged. Thus, the language of the objective shifted over time from IT industry cluster to IT occupational cluster.

4. CONCLUSION

As an action research project, this IT occupational partnership was required to provide both practical and theoretical contributions. The practical contributions that were achieved centered on deepening our understanding of the IT skills gap in the region and its relationship to economic development. One outcome in this regard was a more precise understanding of the kinds of technical skills that are needed. Another outcome was greater specificity in the articulation of human skills. Thus, these results reinforce the need for the IT professional to possess both technical and human skills. Finally, the project identified potential cultural barriers to having a sustainable IT labor pool in the region. These include negative attitudes to continuing education and negative attitudes to workforce diversity.

The action research project reported on in this paper was undertaken as a pilot project to serve as a 'proof of concept' of a multiple constituency partnership. That is, a partnership representing three constituencies -- academe, local industry and government – demonstrated a viable way to address the skill and knowledge requirements in the Berks County region of Pennsylvania. Following the completion of this project in June 2006, a second proposal for an expansion of the IT occupational partnership concept was submitted by the Berks County and, nearby, Lancaster County Workforce Investment Boards to the Commonwealth Department of Labor and Industry and was subsequently funded. This project began in January 2007. The first author is currently working on this new project. The practical outcome of this project will be a survey to administer to employers and educational institutions in the Berks/Lancaster region.

There were also two theoretical contributions from this project. First, this project provided empirical support to reinforce existing theorizing about the role of socio-cultural factors in the development of an information economy of a country/region. Trauth's [22] work in Ireland resulted in a theoretical framework

consisting of four factors: economy, culture, infrastructure and policy. This action research project contributed additional empirically-based theoretical insights regarding three of these: human infrastructure development, local economic pressures and cultural barriers. The second theoretical outcome from this action research project related to the concept of a cluster. This research project demonstrated the need to think in terms of occupational clusters rather than industry clusters when developing plans for a sustainable IT workforce.

5. ACKNOWLEDGMENTS

6. ENDNOTES

[1] This characterization of the primary and secondary IT sectors comes from Porat [14] who dissected the American information economy (IT labor force) into the primary and secondary sectors.

[2] Words that appear in brackets are inserted by the authors to clarify meaning of a quotation.

[3] An example can be found in Srivastava and Theodore [20] in which statistics in a labor market study are based solely on primary information sector labor force numbers.

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