NITAS: A "Demand Driven" Workforce Development System for the U.S. Information Technology Industry

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The Workforce Challenge

The size of the American Information Technology (IT) workforce is material to the U.S GNP as it contains an estimated 7-10 million workers operating in a variety of specializations who receive relatively high wages. These workers are active consumers, helping fuel the U.S. and world economy.

Beyond consumption, the average annual investment spending in Information Technology is estimated at $400 Billion based upon U.S. Dept of Commerce figures. This spending is due, in part, to the rapid development of IT technology that produces faster, better and lower cost hardware and software systems.

Commercial businesses and government purchase new computer technology and IT services to gain competitive advantage and efficiency by lowering costs and providing better/expanded customer service. In fact, the operations of businesses in many industries are today entirely dependent upon information technology.

It is no secret that the provisioning of information in a timely and accurate manner provides consumers with unprecedented benefits and commercial organizations with a competitive edge in this new global economy. The tools required to provide this information are primarily computers and software applications that connect users to each other and to their data using the internet and company-internal networks. This infrastructure is complex and is growing as more countries adopt technology to help disseminate information.

The critical enabler to the growth and long term viability of the U.S. IT industry is its workforce. The IT workforce is expected to be the fastest growing labor segment in the U.S. economy with employment projected to increase 86% between 2000 and 2010 based upon BLS estimates. To meet the expected growth of demand by employers the U.S. workforce must maintain sufficient size, skill, productivity and cost competitiveness. These requirements reflect the scope of the coming challenge for IT workforce development during the next decade.

While the U.S. employment outlook for IT is bright, several challenges have emerged that must be adequately addressed to ensure that the projected growth and competitiveness in U.S. IT related employment is realized. Approximately 1 million U.S. IT jobs were lost due to the world recession of the past 3 years.

These reports also indicate that surpluses of IT workers still exist in certain geographic regions of the U.S. How will these workers be re-engaged into the industry?

In addition, offshore outsourcing continues to dominate headlines, even though the evidence pointing to a long term trend is unclear. Research from Robert Half and Associates (December 2003) indicates that less than 7% of companies interviewed will be investing heavily in offshore outsourcing in 2004 and beyond. On the other hand, a report from the Fisher Center at the University of California-Berkeley suggests that up to three million U.S. computer and math professionals are at risk to foreign outsourcing.

These conflicting data notwithstanding, it is clear that the survival and growth of the U.S. IT workforce depends upon workers having the correct skills, providing high productivity and offering high value to employers at all wage points in the IT labor market. How will we ensure that the U.S. IT workers will continue to meet this challenge?

The ETA and CompTIA have jointly addressed these workforce challenges by developing the National IT Apprenticeship System (NITAS). The mission of NITAS is twofold. First, NITAS helps the U.S. IT industry and its workforce maintain *competitive advantage* in the global market. A by-product of maintaining competitive advantage in the industry is stable employment, higher wages and opportunities for the unemployed and disadvantaged. In a related way, therefore, a second objective of NITAS is to support ETA's goal that *no worker be left behind*.

This paper describes the rationale for NITAS, how the system operates in the workforce development context, and how NITAS supports workforce development in the IT industry using the principles of demand driven systems. In a sense this paper is the NITAS program charter. It is a living document that describes the raison d'être of NITAS.

NITAS: The" Demand Driven" IT Workforce Development System

The guiding principles of NITAS as a *demand driven workforce development system* are:

1. Employer Driven: The requirements of employer organizations must drive the requirements of the workforce, and the governmental policies intended to assist the workforce must be aligned to these requirements as well.

2. Economic factors: Once the requirements of employer organizations are identified and communicated in the market, economic forces will cause all suppliers in the workforce market to align their own goods and

services to meet those requirements. This process will occur voluntarily as all stakeholders operate in their own self-interest resulting in overall benefit to the industry and society.

3. Development of a self sustaining system: The systems created to develop and support an industry workforce must be self-sustaining. Government may provide the seed money to help industry initiate the developmental programs, but as quickly as possible government steps away to let the principle of free markets prevail and to let the industry stakeholders participate in the system as they see fit.

Point #1 above is based upon the principles espoused by Deming, Juran and other quality and productivity advocates who suggest that all quality systems begin with a firm understanding of customer requirements. In this case the "customer" is the IT employer, and the "supplier" is the IT worker.

Point #2 is based upon the core economic principle of Adam Smith called the "invisible hand". This principle suggests that as people (and organizations) act in their own self-interest in free markets, the public interest is advanced as a by-product.

Point #3 is based upon the principles of Hayek and other 20th century free market economists who have successfully argued (and whose ideas have been validated by history) that free market systems outperform systems based upon continued centralized planning and involvement by the government.

NITAS utilizes the above principles as the core guiding values. NITAS is demand driven and adaptive to the requirements of IT employers.

Figure 1 depicts both the supply and demand sides of the IT workforce market and highlights the key influencing factors within the market. The demand side of the market is shown on the left, and the supply side is shown on the right as a "to be" process under NITAS. The influencing factors in the market flow from the bottom to top for both the supply and demand sides. As shown, the demand side requirements for knowledge and skills drive the supply side development mechanisms. NITAS aligns the supply side value chain to these requirements.

From both an industry perspective and a public policy perspective the IT workforce market is successful when:

- The market clears at all labor wage points (i.e. supply equals demand)
- The U.S. IT workforce maintains a dominant share of the jobs with high productivity and high average wages (i.e. competitive advantage)
- The IT industry continues to innovate and grow
- Opportunities exist for all workers including the disadvantaged

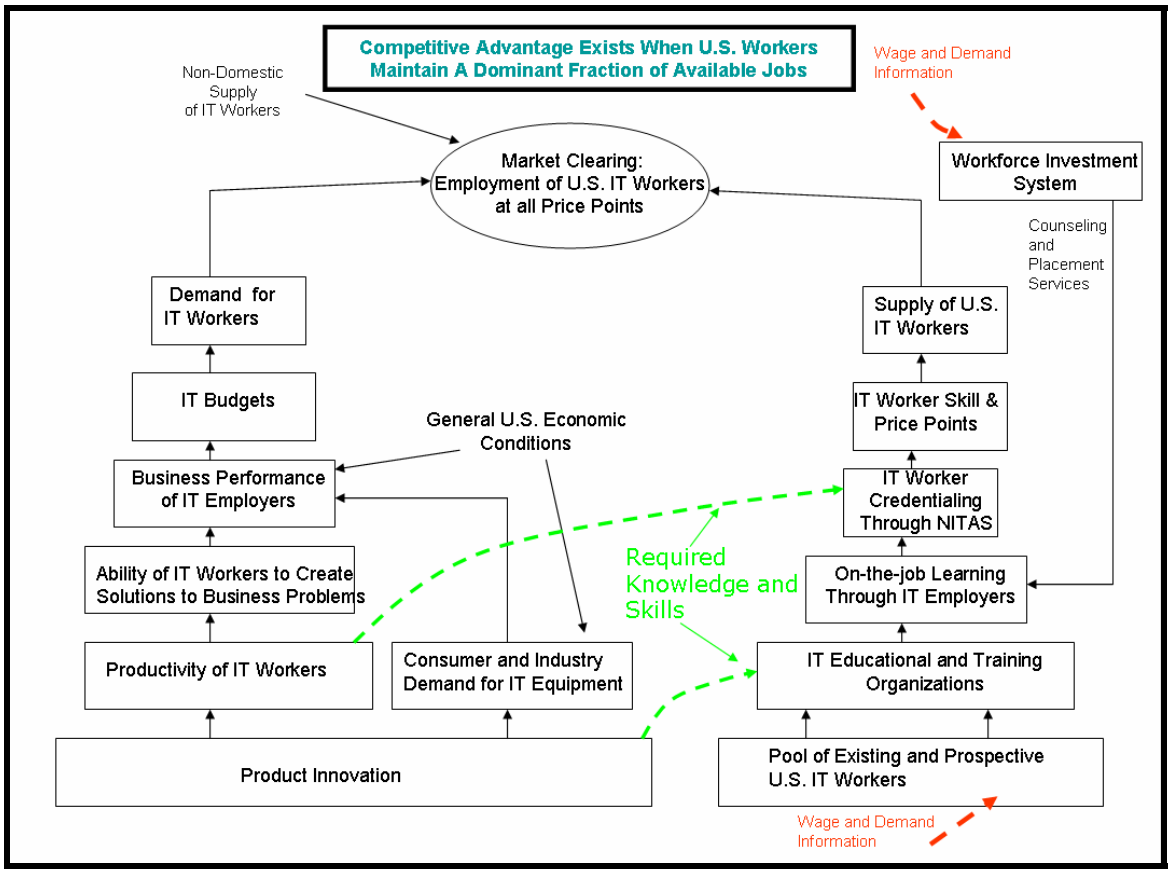

Figure 1---The U.S. IT Workforce Market and Key Influencing Factors

NITAS is a supply side workforce development system that combines the free market principles of demand driven systems with 21st century registered apprenticeship. NITAS contains industry skill standards for the major IT occupational concentrations within three possible levels of proficiency for each concentration. NITAS also contains apprenticeship-based credentialing criteria requiring workers to:

- receive appropriate hours of classroom (ILT) instruction
- receive appropriate hours of work experience
- learn on-the-job under the guidance of a journey worker (coach)
- demonstrate competency on all skill requirements
- demonstrate knowledge on all knowledge requirements

NITAS is supported by a web-enabled database infrastructure that allows workers to maintain transcript records and employers to report/analyze employee progress using the internet.

Employers participate in the system voluntarily because it helps improve their operations in three ways. First, NITAS helps employers maintain competitive advantage by ensuring that their IT workforce possesses the proper skills and

offers high productivity and value. Secondly, NITAS enables employers to better control IT costs by giving employers a vehicle to hire partially trained IT workers at the low end of the wage scale for entry level positions. Then, using the principles of apprenticeship, the employers can bring these workers up to full competency quickly while maintaining the lower wages throughout the apprenticeship training period. Thirdly, NITAS enables employers to obtain a greater return on their training investments. This is made possible because the apprenticeship approach is highly contextualized and is a better way to train workers.

NITAS includes the participation of the U.S. educational institutions, and it leverages the public workforce investment system so that opportunities are made available to all prospective workers across wage-competency levels in the labor market. NITAS helps ensure that an adequate supply of skilled IT workers is available at all wage-proficiency points and supports ETA's policy of *"no worker being left behind".*

Elements of Competitive Advantage for the U.S. IT Workforce

NITAS and its associated programs seek to help the U.S. IT workforce secure global competitive advantage while maintaining the spirit and letter of a free market process. NITAS accomplishes this by clarifying skill standards, by communicating employer requirements and by helping the supply chain align itself to these requirements. The role of CompTIA and ETA in this process is to provide NITAS as the structure to identify the needed competencies, performance standards and value expectations and then to align worker credentialing to those requirements. Market mechanisms take care of the rest.

The workforce model shown in Figure 1 provides an operational framework for the key influencing factors in the IT market. The ETA and CompTIA have focused their attention upon a subset of those areas within that framework that provide the greatest potential opportunity for workforce system improvement and effectiveness. These areas are summarized in Figure 2. Some of these areas are beyond the ordinary purview of workforce development. Yet, to the extent possible, NITAS and its associated programs target these areas to provide support, improvement and care taking.

This paper discusses each of these target areas individually highlighting the relevant issues and considerations impacting the IT workforce. Later, the paper identifies the interdependencies of these areas as part of an overall *demand driven workforce development system.* Finally the paper closes with a summarizing discussion as to how NITAS and its associated programs contribute to overall competitive advantage for the U.S. IT workforce.

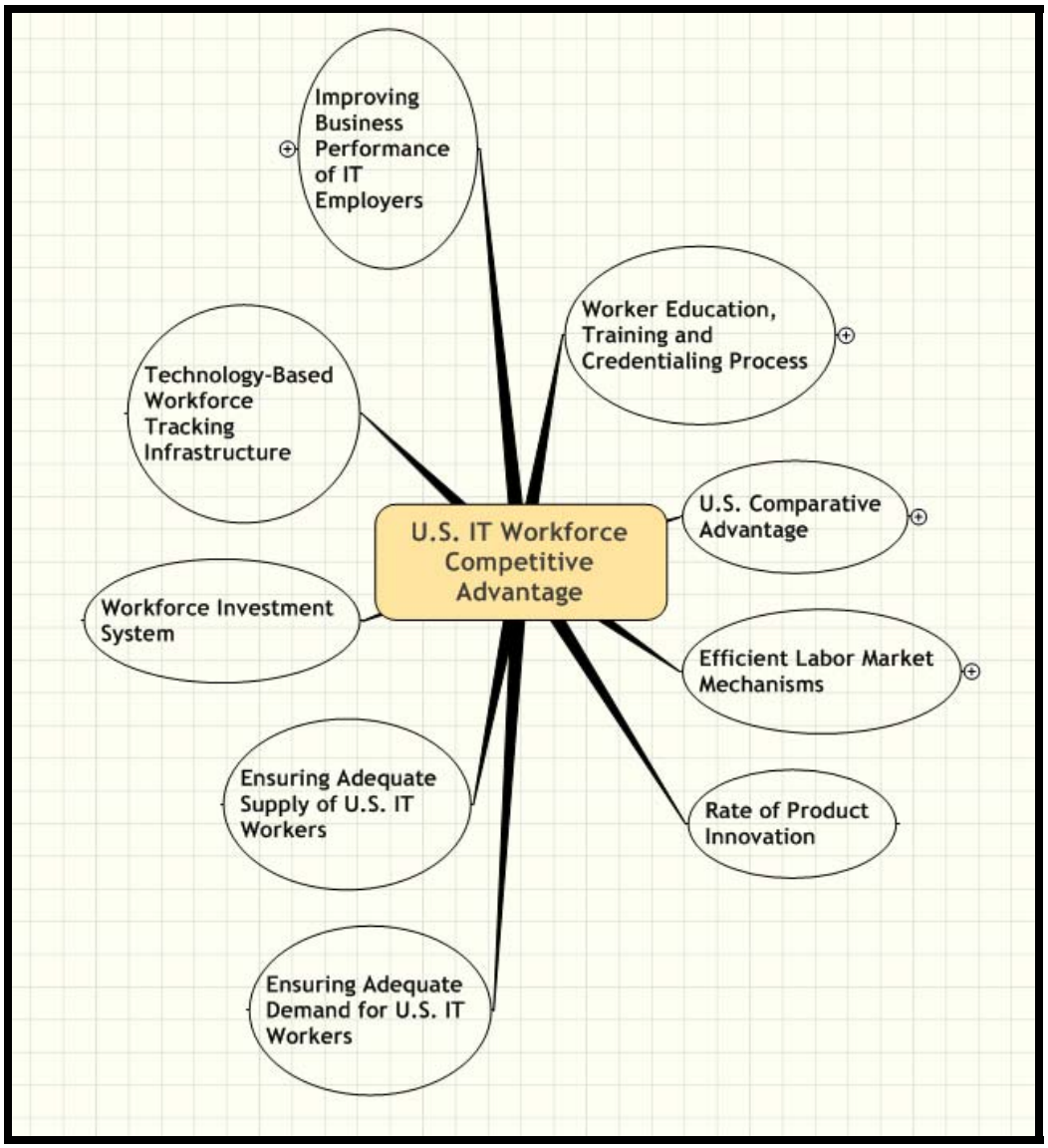

Figure 2 –Target Areas for Impacting Workforce Competitive Advantage

Area #1: The IT Worker Education, Training and Credentialing Process

During the IT boom period of the 1990's IT staffing and training were among the most challenging issues facing companies. One in ten computer service and support positions remained unfilled. More than 75% of companies had to train their IT service and support staff to meet company needs.

While the recent recession has altered demand and wages for IT workers, it did not remove the potential opportunity for improving the way IT workers are trained and credentialed. It became clear that a lack of standards in the IT job market

would remain a challenge to employers vying for the best talent. Prior to NITAS a lack of uniformity in formal education programs existed, and the worker credentialing process was driven by vendors interested in selling their products and services.

IT employers have learned that a worker's experience is just as important as the formal instructor led training (ILT) and degrees that workers received. Most workers learn by doing, yet IT workers traditionally received credentials based solely upon classroom instruction or vendor certifications ---none of which required the worker to demonstrate actual competency. As a result the wages demanded by the IT workers were often unsubstantiated by achievements and performance on the job. From the perspective of the IT employers, they were in a risk-value dilemma often being forced to pay journey level wages for unproven workers.

A second but related concern of employers was the length of time required to bring entry level IT workers up to speed. Based upon survey data obtained during the late 90's **(cite reference)** almost half of IT employers were willing to pay a higher salary to individuals who had completed an industry-supported IT service & support certification program that included hands-on working experience, interaction with customers and working in teams. Employers recognized that the "soft skills" needed could only be developed on the job.

During the past 3 years, employers have become more selective with their hiring practices, due in part to the weak economy. Employers now more than ever are looking for a vehicle that demonstrates and predicts worker competence in addition to the traditional credentials of IT job candidates. Without a system like NITAS this process would remain difficult and inefficient.

By design, NITAS and its supporting programs help ensure:

- Proper credentialing: The credentialing of IT workers is competency based
- Use of Industry defined Skill Standards: Skill standards exist that mark discernable differences in worker competency for various IT concentrations allowing wages to be better aligned with worker competency and productivity
- Educational institutions and training organizations align their programs with these industry competencies
- The supply chain participants (including the members of the public workforce investment system) are aligned to demand side requirements.

NITAS skill standards are based upon industry's identification of relevant specializations (concentrations). With few exceptions each specialization is broken down further into levels 1 through 3. Each level represents increasing proficiency for the worker. (So, for instance, a level 2 is more proficient than a

level 1, etc). Also, each level is anchored in clear exit criteria which the worker must satisfy in order to be awarded the credential for that level.

Because NITAS is an apprenticeship system the credentialing criteria always include:

- appropriate hours of classroom (ILT) instruction
- appropriate hours of work experience
- on-the-job learning under the guidance of a journey worker (coach)
- a demonstration of competency on relevant skills
- a demonstration of knowledge of the task and subject matter. This often includes passing a relevant certification exam.

For each NITAS concentration the three levels of apprenticeship (1-3) correlate to the proficiency levels defined in Bloom's learning taxonomy. Refer to Figure 3 below. The correlation with Bloom's taxonomy suggests that each apprenticeship level in NITAS connotes a specific level of proficiency that can be uniformly applied across the entire IT industry. This correlation to proficiency facilitates the market clearing process and forms the basis of wage differentials between workers at pre-apprenticeship, level 1, level 2 and level 3 in the program.

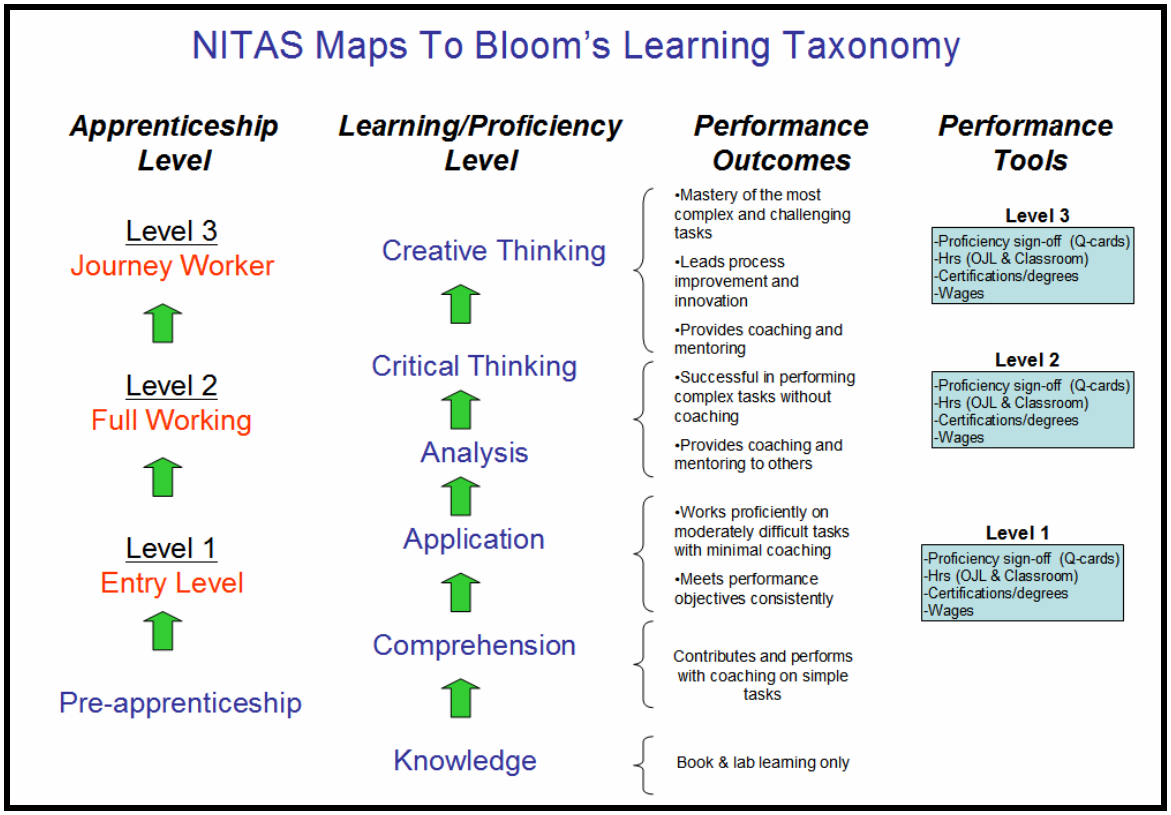

Figure 3: NITAS Correlation with Bloom's Taxonomy of Learning

As the economy recovers, the demand for the correctly skilled IT worker will grow, and the "traditional" IT educational and training credentialing processes will not adequately address the employers' needs. NITAS helps fill this gap.

Area #2: U.S. Comparative Advantage in IT

Comparative Advantage is an economic term used to describe the specific areas of advantage that one country may hold over another in the production and delivery of certain goods and services. The concept, originally coined by David Ricardo, can be described as follows:

> According to the principle of comparative advantage, the gains from trade follow from allowing an economy to specialize. If a country is *relatively* better at making wine than wool, it makes sense to put more resources into wine, and to export some of the wine to pay for imports of wool. This is even true if that country is the world's best wool producer, since the country will have more of both wool and wine than it would have without trade. A country does not have to be best at anything to gain from trade. The gains follow from specializing in those activities which, at world prices, the country is *relatively* better at, even though it may not have an absolute advantage in them. Because it is relative advantage that matters, it is meaningless to say a country has a comparative advantage in nothing. *–P. Samuelson*

During the 1980's and for a large part of the 1990's the US IT workforce provided expertise to a very rapidly growing industry. It was inevitable that demand would outstrip supply. As computer technology gained acceptance and the Internet expanded to the world wide network, U.S. IT worker competencies shifted from administrative to maintenance and now to innovative.

Networks are now far more complex and require expertise to manage and maintain. Employers are aware of the critical nature of these networks, and are demanding more from their IT personnel than ever before. Many of today's IT workers need to be more than technical wizards; they need to be skilled in business practices and in how to use the resources to provide the company with productivity increases. The demand for workers with these kinds of skills will remain strong for the foreseeable future.

A sizable number of existing domestic IT jobs, however, have become standardized and routinized. This kind of occupational maturity, coupled with an expanded world wide supply of IT workers has made low cost foreign labor attractive and feasible for domestic companies that wish to reduce their IT costs. This process is called *offshore outsourcing.*

In making outsourcing decisions employers must consider more than just wage rates. IT employers must also consider risk, service levels, data confidentiality, logistical costs and customer satisfaction. However, strong economic incentives arise when significant wage differentials exist between U.S. and foreign workers and when the productivity differential between foreign and domestic workers is small.

The issue of foreign outsourcing is déjà vu to many who have witnessed the decline of other American industries over the last 50 years. The issue has high relevance to the maintenance of continued U.S. comparative advantage in IT. Over the last several decades we have seen other U.S. and European industries lose comparative advantage and market dominance to lower cost countries in Asia. Examples include the U.S. consumer electronics industry, the German camera industry and certain portions of the U.S. manufacturing industry.

In all of the above cases the erosion of industry dominance for these countries began with the loss of market share at the low price end of their markets. The lower cost foreign competitors (often supported by their governments) would enter the high volume, low price end of the market and then insidiously take larger and larger shares away from the domestic producers. Eventually, all that remained for the domestic producers were the low volume, high priced products. Inevitably this erosion of market share was accompanied by a significant loss of jobs for the domestic producer, loss of innovation and loss of overall market dominance.

Based upon the lessons learned from these other industries, we find that a key pre-emptive strategy for the U.S. IT industry to maintain dominance is to not concede the low end IT jobs to offshore IT vendors. But how will this be accomplished in a free market framework? The answer relates to: 1) having an adequate supply of trained domestic workers across the full range of wage points in the market and 2) to have a vehicle that makes the productivity and *value* of domestic workers visible. Here too NITAS provides a supportive function in the market.

To explain how NITAS plays a role in this process we consider that some employers view their IT workers as homogenous commodities. They seek to minimize costs by hiring and awarding work to the lowest possible bidder without consideration of other factors. However, other employers take a view of their IT workforce as being part of the value chain. Under this assumption these employers make hiring decisions based upon worker *value* which considers productivity as well as wages. NITAS helps these employers discern value from their IT workers. For these employers the outsourcing issue then reduces to a comparison of U.S. IT worker value versus that of an overseas IT worker as well as other factors such as risk, customer service levels, data confidentiality, etc.

The NITAS concentrations and proficiency levels provide a uniform mechanism for employers to better discern employee value at all wage points in the market. Accordingly, NITAS will help employers make more informed decisions as to when a domestic IT worker is more cost effective than a foreign worker. Without a system like NITAS employers view only cost differentials between workers, not value differentials. In this regard NITAS helps employers make more informed decisions regarding hiring and awarding work to outside firms.

NITAS enables employers to implement cost management strategies under a "pay for performance wage process" (which is a signature component of all apprenticeship systems). Under this process employers can hire partially trained but unproven workers at lower wages; provide those workers with on-the-job training relatively inexpensively and quickly, and then enjoy the combination of high productivity and cost savings from the workers throughout the workers' apprenticeship periods. Many employers require a "mix" of workers that range across the wage-proficiency spectrum. The NITAS credentialing process helps employers select the appropriate mix for their workforce.

NITAS is not a protectionist program designed to keep foreign competition out of the U.S. Rather, it is a system that combines skill standards, training criteria, competency criteria and competency tracking that enables employers to better align IT worker hiring decisions and wages with worker value. Also NITAS leverages the public Workforce Investment System to ensure that the U.S. IT labor force is available to employers and competitive at all wage-proficiency points in a global market.

NITAS equips employers to better understand the value they will be getting or not getting from prospective workers based upon productivity as well as wages. Also, NITAS provides clarity to workers as well enabling them to better understand employers' expectations for productivity, competency and quality. Finally, NITAS helps align the supply chain to a common set of demand driven criteria. Collectively, these system elements help support the U.S. IT workforce in maintaining global competitive advantage under a free market system.

Opportunity Area #3: Efficient Labor Market Mechanisms

Throughout its relatively brief existence the IT industry has lacked a uniform set of skill standards and definable occupations. This has been largely due the innovative and dynamic nature of technology which drives the industry. While the rapid pace of technological innovation has been the life blood of the industry, it has hindered the efficiency of the market clearing mechanisms both on the demand and supply sides. Refer to Figure 4 below.

NITAS combines skill standards, training standards, competency criteria and competency tracking packaged into a single system. Because NITAS tracks the credentialing of workers based upon demonstrated competency across the major IT technical and managerial skill areas, it provides greater clarity to worker value and price points. This clarity creates efficiency in the market clearing process.

NITAS provides credentialing in the following areas:

- IT Generalist (apprenticeship program)
- IT Specializations (apprenticeship program, worker selects one or more specializations from 11 possible concentrations at three levels of competency)

- IT Specializations (post apprenticeship, continuing education program)
- IT Business/Enterprise Integration (post apprenticeship)

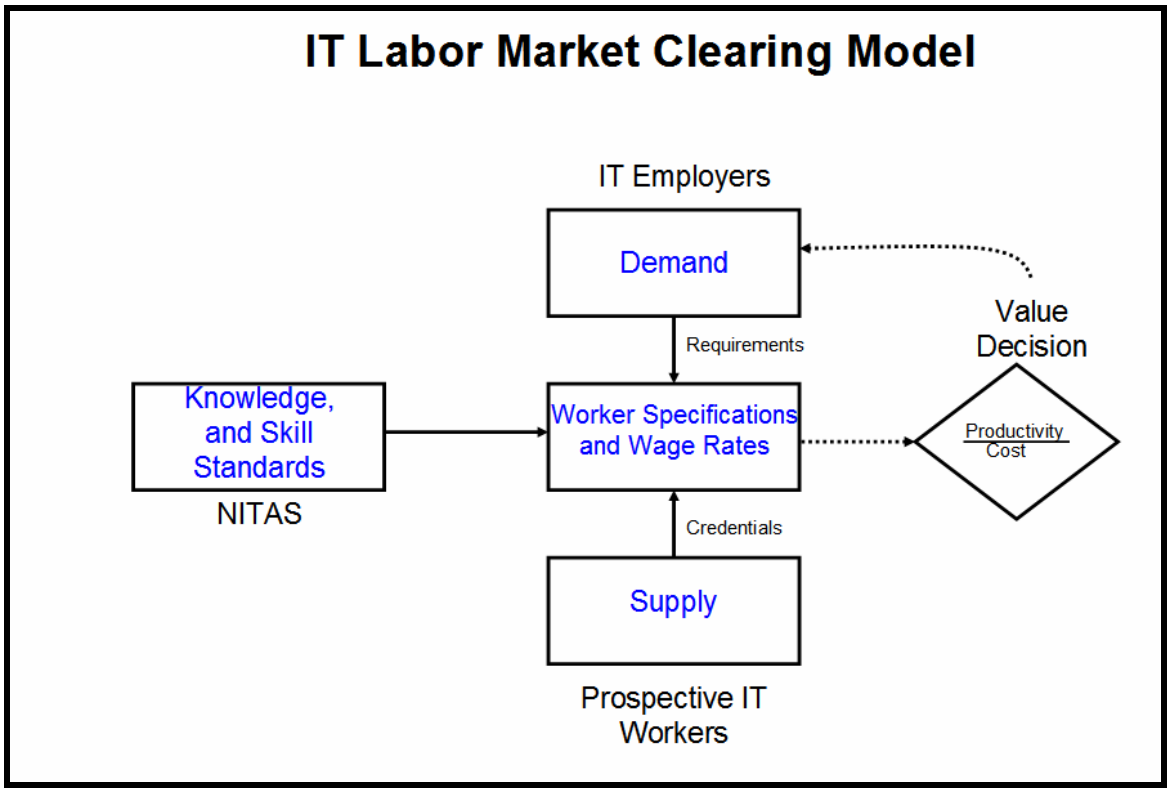

Figure 4 ----How NITAS Creates A More Efficient Market

Participation in NITAS enables IT employers to align IT worker wages with industry benchmarks of worker value at several levels. NITAS equips employers to better understand the value and choose the correct mix of worker skills for their organization.

As Figure 4 implies NITAS makes the concept of worker value visible and uniform to the labor market. Worker value is tied to the ratio of productivity and wages. Based upon standard economic principles, profit maximizing companies operating in competitive markets will consider both productivity and wages into their hiring decisions. We define this principle using standard economic terms for any employer X as follows:

π = Profits= Revenues – Costs

π= P*(Q (L, K)) – w*L-c*K

Where,

-**π** equals profits for company X

-P equals the price of company X's goods or services

-Q (L, K) is the production function for company X based upon inputs of Labor (L) and Capital (K)

-w is the wage rate for labor

-c is the cost of capital

By maximizing profits (π) with respect to Labor (L), and by setting the price (P) equal to 1 (for the sake of discussion), the employer will hire the number of workers to the point that the marginal product of labor $Q`_L$ (i.e. the productivity of labor) equals the wage rate **w** or,

$$Q`_L = w$$

And

$$Q`_L / w \geq 1 \text{ for all workers hired}$$

In other words a profit maximizing firm bases its hiring decisions on the *value* of workers. Moreover, worker's value is tied to the *ratio of the worker's productivity to the worker's wages*. This principle is illustrated in Figure 4 above as the value decision of IT employers.

Prior to the creation of NITAS the value of IT workers was masked to employers because there was no discernable way to objectively identify worker productivity and competency within the various IT concentrations and wage grades. Previously, employers were forced to make hiring decisions based solely upon potentially inaccurate resumes and multiple choice tests (certifications). The NITAS program reduces this gap by making worker value more identifiable. Furthermore, it enables more rational decision making on the part of the employer *because credentialing is linked to demonstrated competency*. This in turn increases clarity, reduces risk and creates a more efficient IT labor market.

In addition, NITAS creates efficiency throughout the stages of the supply chain for the IT labor market. NITAS provides prospective IT workers with clarity as to the career paths available in the IT industry. NITAS contains 11 IT skill concentrations, and the system specifies the knowledge and skill requirements needed for credentialing at three levels of competency within each of these concentrations. This provides IT workers and IT training/educational organizations with clear cut specializations and wage grade levels to pursue. Workers can attain a "mix" of industry recognized credentials on their career transcripts that is based upon their own interests, aspirations and perceptions of career opportunities.

The NITAS program enables workers to become credentialed at a full range of wage points to the IT employer. The program works in conjunction with the ETA's Workforce Investment System to help ensure that a pool of classroom trained, but less experienced workers remain available to compete for the lower wage, entry level positions. Accordingly, U.S. IT employers can hire these workers at competitive wage rates and bring these workers up to full competency quickly while maintaining reduced cost using the apprenticeship training methodology. In many cases the risk reduction and potential cost savings afforded to the employers may make this a more informed option than awarding business overseas.

NITAS contains two post-apprenticeship modules that are designed to help IT journey workers raise and maintain their skills. One NITAS program called the "Enterprise Integration" is a post-apprenticeship module that enables workers to become credentialed as highly skilled technical and managerial specialists or as business integration specialists. The second NITAS post apprenticeship program referred to as the "continuing education" module helps workers document their continued skill development. Throughout the coming years CompTIA will continually update the NITAS concentrations to keep up with the demand side trends and requirements that emerge in IT. All of these mechanisms support a more efficient functioning labor market.

Opportunity Area #4: Rate of Product Innovation

Product Innovation is the life blood of the Information Technology industry. The growth rate of the industry is reliant upon the continual release of new IT products and services that provide greater speed, efficiency and cost effectiveness to both industrial buyers and consumers. Both companies and government purchase new technology to gain competitive advantage and efficiency by lowering costs and providing better/expanded customer service. Consumers purchase this technology to acquire the increased functionality and time savings benefits offered by these equipments.

Maintaining a high rate of product innovation in is essential to the viability of the U.S. IT workforce. History has given us numerous lessons showing how the demise of a domestic industry (and its workforce) can accompany the maturity of an industry if product innovation is allowed to stagnate. The German camera market and the U.S. consumer electronics market (mentioned previously) are two cases in point.

During the 1950s and early 1960's the Germans allowed their dominance to erode in favor of Asian suppliers in the camera market. Similarly during the 1960's and 1970's the U.S. consumer electronics manufacturers allowed their dominance to erode and conceded their manufacturing value add to Asian suppliers.

In both cases the markets matured, the rate of innovation in the core technology declined, and as a result *the workers became interchangeable commodities*. As a consequence the individual productivity improvements of the domestic workers could not outweigh the substantially lower wages of the offshore workers, and the industries were taken over by the lower cost providers. This marketing concept, called *product life cycle maturity*, reflects a normal evolution that is common to all industries and markets.

To date the combination of a leapfrogging technology coupled with a strong educational infrastructure has enabled the U.S. IT workforce maintain competitive advantage. There are now signs, however, that portions of the U.S. IT workforce have reached maturity as some of the jobs have become well defined, repetitive, repeatable type tasks that are easily reproduced by lower cost providers overseas. These are the kind of IT jobs that are now, in fact, being outsourced to lower cost providers.

Continuous product innovation will remain a critical driver to job growth that will offset the negative effects of foreign outsourcing. For the most part innovation is outside the purview of both CompTIA and the ETA. However, both organizations can promote policies and legislation that encourage and stimulate investment in IT research and development.

Opportunity Area #5: Ensuring Adequate Demand for IT Workers

A *demand driven* IT workforce development system must seek to ensure that IT workers at all wage-proficiency points can find jobs. The demand for IT workers is influenced by many factors most of which are beyond the purview of CompTIA and the ETA. However, the NITAS system helps drive productivity improvements in the IT workforce which have positive ramifications upon the business operations of IT employers. These operational performance improvements affect IT budgets in a positive way allowing the continued employment of IT workers.

Figure 5 illustrates that the demand for IT workers is derived from both industrial and consumer purchases of IT goods and services. IT employer companies range from IT departments within companies, to equipment providers (hardware and software), consulting organizations, as well as installation, repair, support and maintenance providers.

Variations in IT worker demand generated by these firms are triggered by a variety of influences. For instance, demand is triggered by product innovations that create obsolescence of existing equipment and new investment opportunities for companies to reduce business costs. Demand for IT workers is also heavily influenced by general business conditions. If, for instance, a company's sales drop, its IT budget will likely be cut causing a reduction in IT spending and employment.

On the consumer side of the market variations in demand are influenced by product innovations that create obsolescence of existing equipment and opportunities for consumers to benefit from new product features. In addition, consumer demand is heavily influenced by anticipated household income which is a function of general business conditions. During a recession for instance, consumer sales of IT equipment drop as households anticipate a possible reduction in income. This reaction results in a domino effect of falling demand for IT workers who are needed to build and maintain the equipment purchased by consumers.

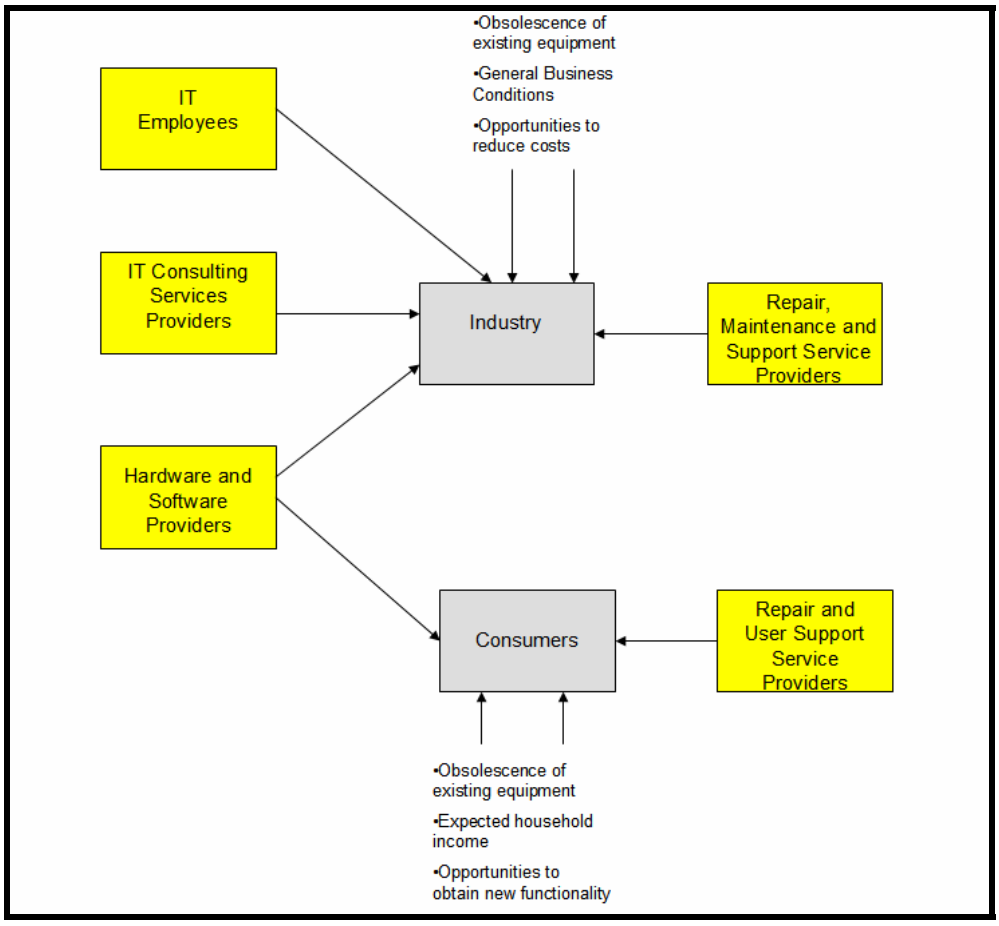

Figure 5—Points of Derived Demand for IT Workers

In summary our ability to maintain a strong demand for U.S. IT workers over the coming decade will be a function of:

- maintaining a high rate of product innovation in IT goods and services
- maintaining strong business conditions and operations for IT employers
- maintaining a healthy U.S. Economy

- continually improving the productivity of the IT workforce

Clearly, the maintenance of a strong U.S. economy is beyond the purview of both CompTIA and the ETA. However, we should not under-estimate the potential impact of using NITAS as a vehicle for continually improving the productivity of the U.S. IT workforce. This concept will be discussed below.

Opportunity Area #6: Improving the Business Performance of IT Employers

IT employers create the direct demand for IT workers. When business is good, IT budgets rise enabling the employers to hire more workers. When business is bad, budgets shrink and frequently workers are let go. Following this line of thought, any factor that contributes to an improvement in an employer's operation will ultimately have a positive impact on IT budgets and subsequently on the demand for IT workers.

Businesses often use IT as an investment vehicle to improve its operations. These investments in IT create additional demand for IT workers, and the expected returns on these investments are driven by the productivity of these workers. At the present time there appears to be plenty of opportunity for improving the productivity of IT workers.

For instance, according to some industry estimates less than half of all IT projects are successful. This astonishingly high failure rate limits the investment in IT by corporations. By improving the productivity of IT workers we can potentially reduce this failure rate to a more acceptable level. This achievement would have a significant positive impact on reducing the risk of IT investments which would lead to improved business operations as well as an increase in demand for IT workers. This is a key objective of the NITAS program.

Pilot studies have demonstrated the efficacy of apprenticeship to rapidly improve the competency and productivity of IT workers. Figure 3 illustrates the correlation between NITAS and the levels of proficiency as defined in Bloom's taxonomy. As shown, the apprenticeship component of NITAS provides the tools for IT workers to go beyond knowledge and comprehension. Under the apprenticeship methodology workers learn by doing and eventually attain mastery in application, critical thinking and creative thinking.

By possessing these kinds of soft skills as well as technical skills the U.S. IT workers can continually show *value* to their employers and improve their business performance. This in turn will help ensure that competitive advantage is maintained for the U.S. IT workforce over the coming decade. For further details on this topic, refer to the White Paper *"Apprenticeship and economic Advantage: A Blueprint for American Industry and Public Policy in the 21st Century"* by Aaron, Rowland, Rude and Wessel.

Opportunity Area #7: Ensuring an Adequate Supply of IT Skilled Workers

Thus far the discussion has focused upon demand side considerations in the IT Labor market. We will now examine the supply chain of the market with special attention given to how the demand side requirements impact the supply side under the umbrella of NITAS and its related programs.

An effective supply chain is a critical component to effective market functioning. The goal of the supply chain is to ensure that an adequate number of skilled workers exist across the range of wage-proficiency points demanded by employers. NITAS aligns the supply side to achieve this objective.

During the 1990s an acute shortage of qualified IT workers created a crisis in the U.S. IT industry prompting inflated wage rates and a temporary inflow of foreign technical workers into the U.S. to help meet the demand. While the recent recession has mitigated this problem for employers, the lack of uniform skill standards and appropriate market clearing mechanisms remained a challenge.

Figure 5 describes the "To Be" process for the supply chain of the IT Labor market using elements of both NITAS and ETA's Workforce Investment System infrastructure. The process begins on the left side of Figure 5 with a pool of U.S. workers who fall into one of four distinct categories. These are:

1. U.S. workers preparing to enter the job market for the first time
2. Already employed workers switching careers to IT
3. Unemployed workers looking for employment in IT
4. Already employed IT workers including those looking to upgrade their skills or looking to switch concentrations within IT

Prospective workers will enter the IT supply chain as long as they perceive the existence of job opportunities. The participation of all workers in the NITAS program will enable them to earn NITAS credentials for various IT concentrations and skill levels that are demanded by employers.

One of the first steps for a prospective worker entering the supply chain is to receive classroom education from a school or training organization. The training and education received would apply to the worker's credentials under the NITAS program. Other workers who already have received education and training may find IT jobs and then begin earning on-the-job learning credits that apply to their NITAS credentials. Still other more seasoned IT workers will already have the training backgrounds and on-the-job experiences to obtain NITAS credentials.

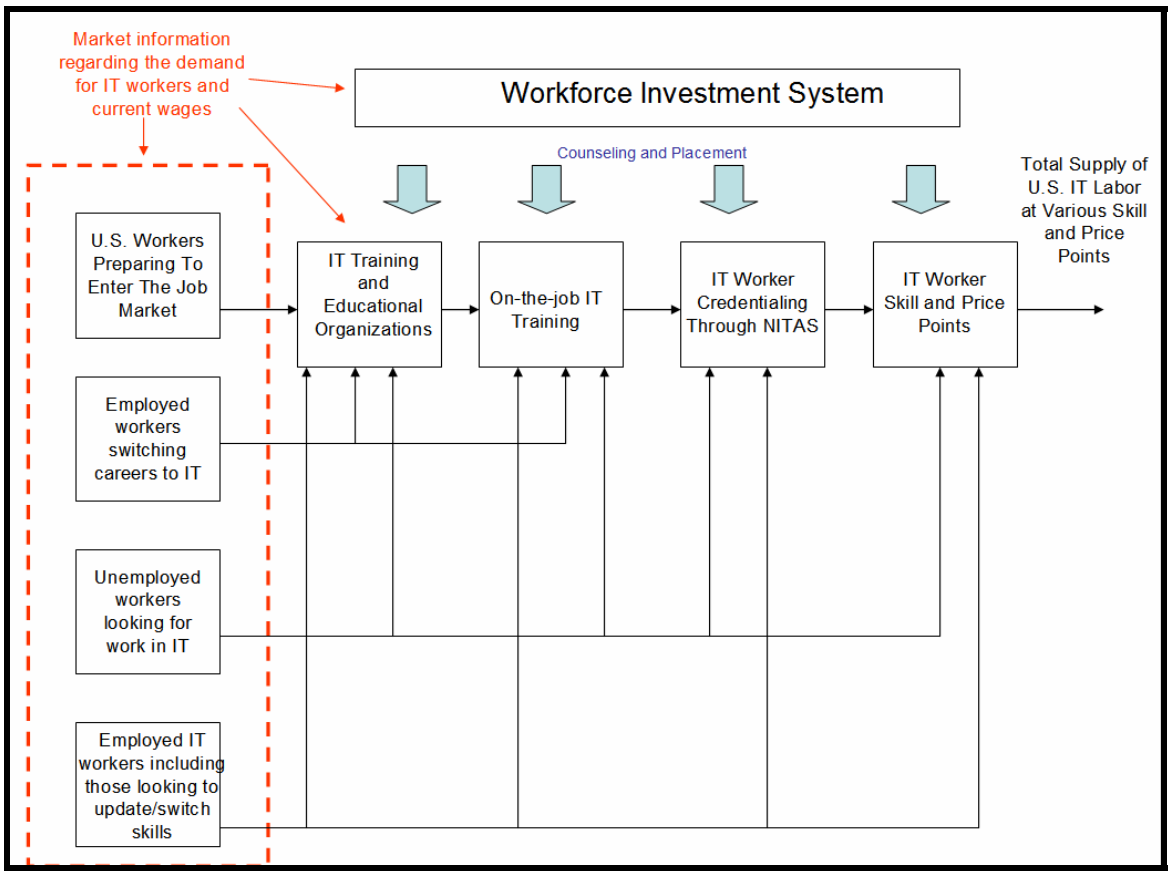

Figure 6—the "To Be" Supply Chain Process for IT Labor under NITAS

The NITAS process pushes the credentialing of workers beyond the traditional academic and training programs offered today. Apprenticeship requires the full suite of learning, including, classroom related instruction, on-the-job learning, certifications and skill demonstration. Therefore, under NITAS, workers do not become fully credentialed in their chosen concentrations until they receive specified amounts of OJL and demonstrate competency.

Having received the NITAS credentials for the chosen concentrations and skill levels the workers become part of the qualified labor force that supplies the IT market. The wage rates for the workers will be based upon the competitive process of supply and demand for workers for the specific concentrations and skill levels at the time they enter the labor market.

A key objective of NITAS is to align the supply side so that the above process works effectively to produce an adequate number of skilled U.S. workers that meets demand across the range of required wage proficiency points in the market. Competitive advantage is attained when U.S. workers hold a dominant share of these jobs.

Opportunity Area #8: Utilizing the Workforce Investment System

Anecdotal evidence exists suggesting the Workforce Investment System is not currently a major factor in the U.S. IT Labor market. However, as shown under the "To Be" process illustrated in Figure 5, the Workforce Investment System will play a key role in providing counseling and placement assistance for *entry level IT workers and unemployed workers* into IT. Because of the importance of supplying skilled workers across all major wage-proficiency points, the participation of the workforce investment system will be a key element to the long term success of the IT supply chain and achieving competitive workforce advantage.

The "One Stop Centers" will be particularly important in helping the U.S. IT workforce compete with foreign labor for entry level positions and positions that involve repetitive and routine IT related work. By assisting the partially trained, inexperienced entry level workers in securing employment as apprentices, the "one stops" will help these workers create value for their employers that is comparable to outsourcing. Two pilot studies (i.e. Exodus IT Services, Inc. and the Naval Undersea Warfare Center-Keyport) have demonstrated that the apprenticeship model is effective for creating *value* for IT employers by enabling these employers to hire inexperienced workers (and even disadvantaged workers) at relatively low wage rates and then enjoy high productivity from these workers during the apprenticeship period.

To be effective the regional "One Stop Centers", which comprise the Workforce Investment System, will need to be equipped with detailed and timely market information (wages and job openings), career path descriptions and data regarding specific regional job openings. This information will allow the "one stops" to appropriately advise prospective workers, to help them plan careers, to obtain appropriate credentials and to secure employment. A challenge for both CompTIA and ETA will be to ensure that these One Stop Centers obtain the critical market and NITAS career path information in a timely manner to help these centers establish solid linkages with their local IT employers.

Opportunity Area #9 -Web Enabled Infrastructure and Support Programs

The ETA and CompTIA have developed infrastructure to support the NITAS program. Figure 7 below shows this infrastructure.

The NITAS infrastructure is made available in real time to employers, apprentices, educational/training providers and consultants through a web-enabled database. The database stores employer registration information as well as apprentices' transcripts, qualification sign-offs, coaching records and other vital information regarding worker development. A report writer is built into the system to provide tabular, analytical and diagnostic reports for apprentices and employers to monitor progress.

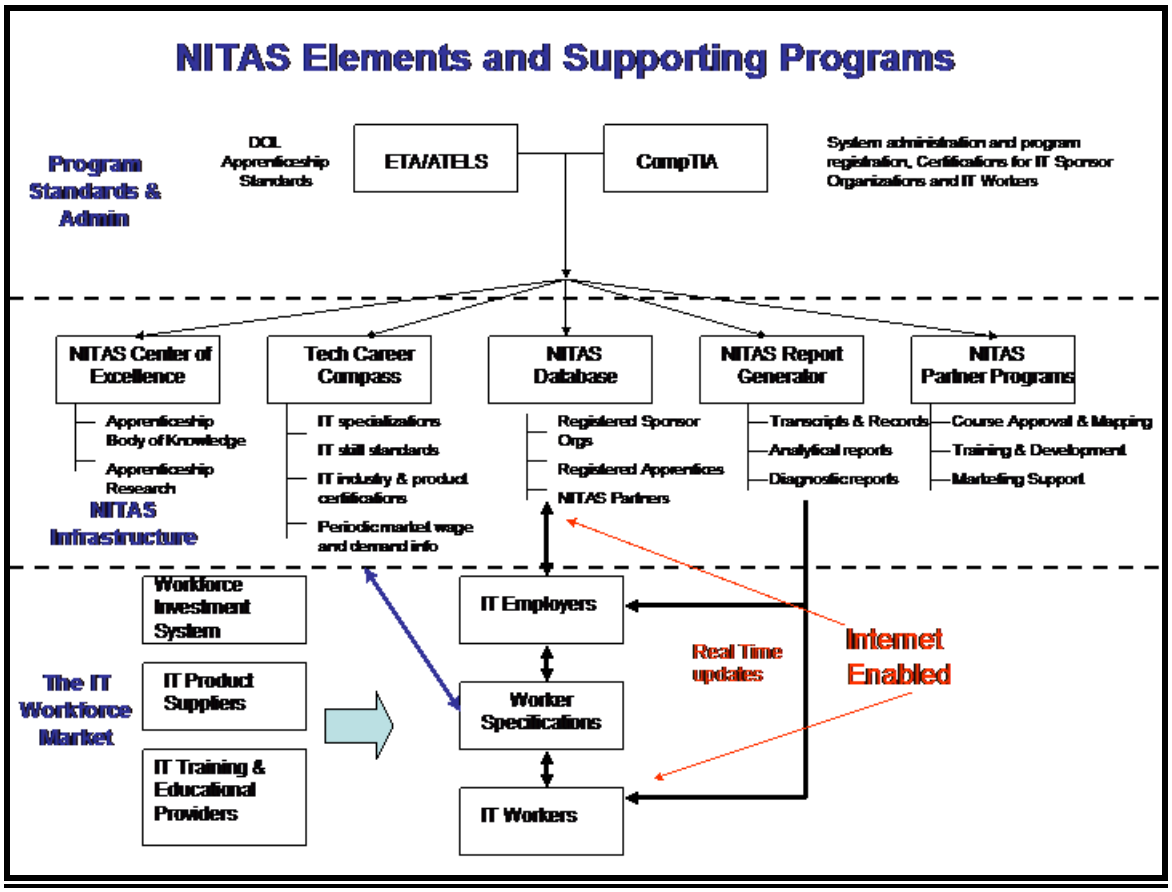

Figure 7: The Integrated NITAS Components

CompTIA's Tech Career Compass™ is a separate database that contains skill standards for each NITAS concentration and other occupational career information including job titles and relevant certifications. The skill standards in the Tech Career Compass are updated routinely.

NITAS provides support programs to partner organizations such as educational institutions, training organizations and consulting organizations. These programs include course mapping to NITAS competencies, course approvals, partner training, and marketing support. Partner programs also exist to interface NITAS with the public workforce investment system.

NITAS also operates a Center of Excellence in Apprenticeship that maintains an apprenticeship body of knowledge (ABOK), performs research, creates partner standards/credentialing requirements and provides periodic industry symposiums.

The IT workforce market shown at the bottom of Figure 7 illustrates the various constituencies of NITAS.

Collectively, these programs and infrastructure ensure the continuing operations of NITAS and alignment of the supply side of the market to the requirements of the demand side.

Putting It All Together

Figure 8 below is a recreation of Figure 1 shown previously. The figure illustrates the vision for the complete *demand driven* workforce system for the U.S. IT Market. The goal of the system is to ensure competitive advantage for U.S. workers and to ensure that no worker is left behind.

The primary scope of CompTIA's and ETA's workforce development efforts in the IT industry includes the elements highlighted in yellow. This paper has discussed those individual components and their inter-relationships. The NITAS strategy is create alignment on the supply side to the requirements of the demand side. CompTIA and the ETA have provided the structure. The free market will do the rest.

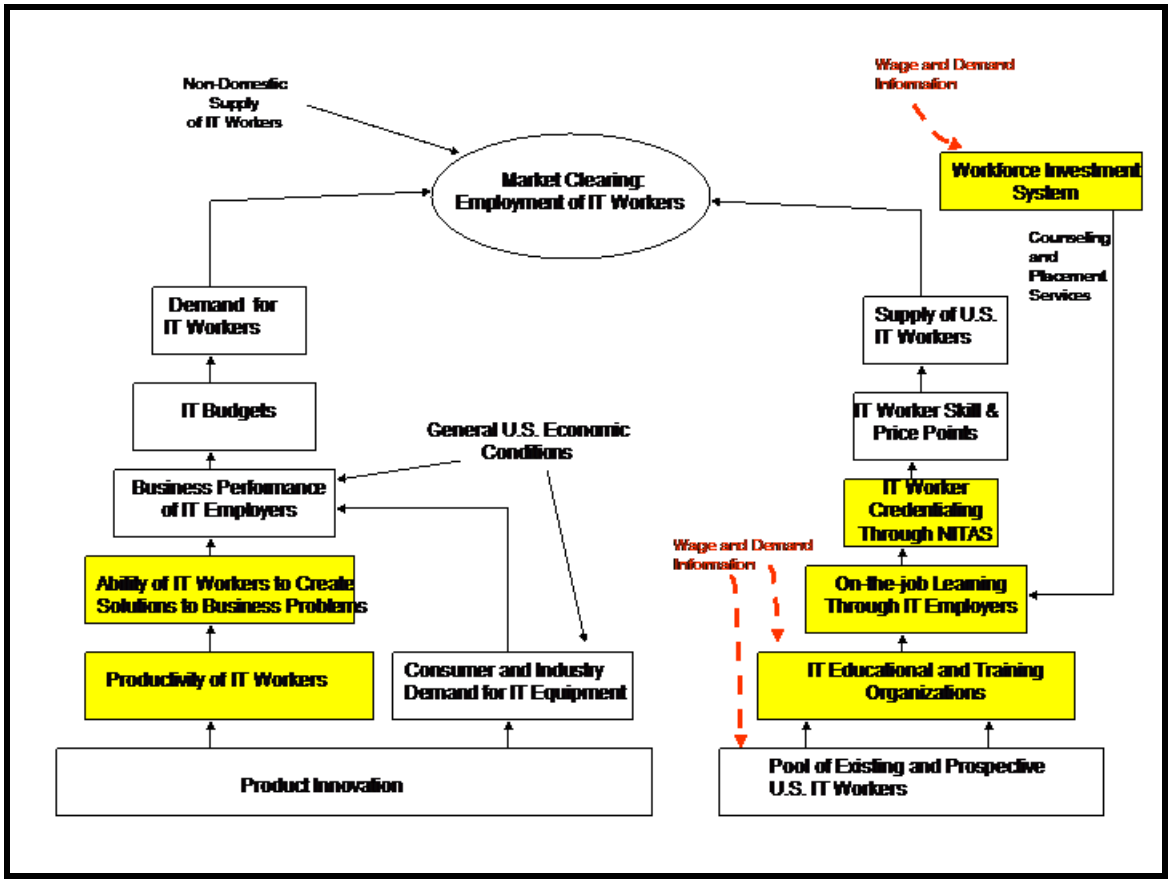

Figure 8: Demand and Supply Sides of the IT Workforce Market Highlighting Areas of NITAS and ETA Areas of Emphasis