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**ADDRESSING THE UNITED STATES IT MANPOWER SHORTAGE:
THE ROLE OF INPATRIATES AND TECHNICAL TRAINING**

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ABSTRACT

The development of new hardware, end user-software and the globalization of the telecommunications industry has generated an acute demand and corresponding shortage for trained IT (information technology) professionals. The IT manpower shortage has become particularly crucial for U.S. domestic and U.S. multinational organizations where staffing shortfalls may generate a significant impact upon U.S. national productivity. This paper discusses the magnitude of the IT manpower shortage in the U.S. and how organizations must now consider the increasing use foreign IT inpatriates to address the current shortfall. Various IT training techniques are discussed and how the growing influx of IT inpatriates will impact U.S. models for the educational training and professional development for IT employees.

INTRODUCTION

With the thirst for information technology (IT) growing over 25% annually, by the year 2005, the IT industry will suffer the most pronounced and critical shortage of qualified IT personnel (World Information Technology and Services Alliance-WITSA, 2000). Clearly, the enormous appetite for information technology and information exchange is transforming the current world economy into a global market for IT skills and information systems manpower. While the U.S. has often led the world with new technological developments in hardware, software, and telecommunications, the demand for trained IT employees has become acute for the IT industry. Since information technology and business have become interdependent components of most United States based organizations, economists fear that the continued shortage

of IT personnel will generate a significant and negative impact upon the United States national productivity (The Information Technology Association of America- ITAA, 1998). The United States holds an understandable appeal to potential IT inpatriates as the promised land of opportunity and a haven for the new information technologies. However, the relevant issues for management are how will foreign IT professionals be identified and trained for organizational environments in the United States? What factors will determine which training techniques would be most effective and appropriate for these new IT candidates?

Currently, there are an estimated 380,000 IT jobs vacancies for IT professionals in the United States, constituting approximately 10% of the U.S. IT labor force (Rubin, 2000). The U.S. Department of Commerce estimates that the software that could be produced if projected IT workforce vacancies were filled would

generate over \$900 billion in corporate revenue and \$18 billion in associated income, raises and signing bonuses beyond what would be normally expected for IT professions (Rubin, 2000). Additionally, 70% of respondents in a national survey of domestic organizations stated that they

The Information Technology Association of America (ITAA, 2000)- which consists of over 400 direct and 26,000 affiliate corporate member companies in 41 countries, identified over 200,000 vacant IT jobs at the beginning of 1998. This figure was revised upward to 346,000 vacancies based upon a later, more extensive survey that included smaller private sector employees nearly doubling what the ITAA predicted less than a year ago. Compensation for U.S. IT workers was two to six times the typical manufacturing employee, with annual salaries increasing an average of 25% as compared to the average 4%-5% in all other fields. A recent survey by the ITAA found that IT- and non-IT organizations both experienced a 37% longer time to fill IT jobs than non-IT jobs.

The International Trade Commission (ITC, 1998)- originally estimated the global market for computer software and related services at \$277 billion. This projection was later upgraded to \$420 billion for 1998 with U.S. demand for software *products* constituted 57% and software *services* constituted 47% of the global software market. Since the U.S. currently possesses the biggest competitive advantage in systems software and outsourcing services, a continued labor shortage of IT professionals would have a pronounced impact upon the competitiveness of U.S. corporations in the software and software services market.

The Bureau of Labor Statistics (BLS, 1998)- predicts that between 1996 and 2006 the U.S. will require more than 1.3 million new IT workers. This demand is particularly acute for three occupations: computer scientists and engineers, systems analysts and computer programmers with an average demand of 137,800 per year (U.S. Dept of Commerce, Office of Technology Policy- U.S. DoC- OTP). Of these three occupations, the largest (absolute) growth is predicted for systems analysts, projected to increase in demand from 506,000 in 1996 to 1,025,000 in 2006; a 103%

have postponed or delayed projects due to a shortage of skilled IT professionals (*Internet Week*, 1999). Several independent agencies and organizations have attempted to quantify the magnitude and impact of the IT employee shortage using various measures:

projected jump. This compares to a 14% increase predicted for all other occupations (U.S. DoC- OTP, 1998). The number of computer engineers and scientists is predicted to grow by 114% while the demand for computer programmers is expected to increase by a much smaller rate of 23%.

Software and Information Industry Association (SIIA, 2000), an organization that lobbies for companies in the software and information industries of the world, predict an urgent national need to transform industrial age employees into information age knowledge workers. SPA predicts that by the year 2005, over 70% of U.S. jobs will require some type of IT proficiency.

World Information Technology and Services Alliance (WITSA, 2000)- states that information and communication technology (ICT) surpassed the \$2 trillion mark in 1999 and is predicted to surpass the \$3 trillion mark by 2004 even as growth continues at a 9% rate (Digital Planet Study, 2000). The total value of Internet purchases in 1999 rose to \$130 billion and is projected to increase to \$2.4 trillion in 2004. Globally, companies invested \$142 billion to create a web presence and an additional \$140 billion in related infrastructure to support electronic commerce.

The National Science Foundation (NSF, 2000)- states that the number of computer science majors graduating from U.S. colleges and universities has declined since 1985. Only 35,160 computer science degrees were awarded in 1993 declining to approximately 25,000 degrees for 1995 with only a recent upsurge to 38,000 for 1998. While over 30% of computer software majors graduating from U.S. educational institutions are foreign citizens, less than one-half of these new graduates remain in the United States (Rubin, 2000). This creates an annual inability to staff new computer software related job openings in the U.S. of over 200,000 jobs.

The objectives of this paper are to: 1) examine the potential pools of IT employees in the United States available to fill the IT manpower shortage; 2) discuss the use of inpatriates as the new, “multicultural” face of IT employees and 3) discuss potential training approaches that may be effective in assisting IT inpatriates to become quickly productive. We believe the current paper addresses an important gap in current IT management literature with regard to the workforce shortage of IT professionals and the appropriate training and educational strategies that can be considered in training inpatriated IT professionals.

POTENTIAL POOLS OF IT CANDIDATES

Manpower analysts predict that the greater the imbalance between the demand for IT personnel and the supply of IT-capable employees, the more creative employers will become in attracting new candidates. Existing organizational employees, college graduates, recent high school graduates, retired personnel and foreign inpatriates are discussed as potential pools of IT candidates (see Table 1).

Table 1: Relative Recruitment, Training and Retention Issues for IT Candidate Pools

<i>Issues</i>	<i>Existing Personnel</i>	<i>College Graduates</i>	<i>Recent High School Graduates</i>	<i>Retired Personnel</i>	<i>Other Companies Employees</i>	<i>Foreign Inpatriates</i>
Difficulty in identifying candidates	L	M	H/M	L/M	M	H
Cost of employment (new)	M	M/H	L	L	H/M	L
Interest/Willingness to be trained	M	H/M	M/H	M	M	H
Length of time to train	L	M	M/H	M	M/L	H
Cost of training	L	M	M/H	L/M	L	H
Opportunity cost of training	M/H	L	L	L	L	L
Impact of training on capabilities	M	H	M	M	M	H
Need to develop "unique" materials/trainers	L	L	L/M	L	L	H
Commitment and/or loyalty to company	M/H	M	M/H	H	M/L	M
Long-run potential of candidate	M	H	M	L	M/H	H

Key: High = H; Moderate = M; Low = L

Existing Personnel- The current employees of an organization have traditionally constituted the most readily available pool of candidates for IT training. Existing personnel are usually segmented into two categories: employees specifically hired to work as knowledge workers and employees currently outside the IT area. Two issues however, surface when training either category of employees: the opportunity cost associated with employee training and the loyalty and commitment

employees invest into an organization. Existing employees have job responsibilities that usually command a large portion of their professional working time. IT training often reduces the available time employees have

to complete their regular organizational duties. With the reduction in organizational "slack" (Stroh & Reilly, 1997) in the past several decades, IT training has often been undertaken by employees at the expense of other work. IT training for existing employees, therefore, may

potentially compound the shortage of day-to-day operational IT expertise required by the organization.

Without the continuous training and upgrading of skills, current IT personnel may quickly become outdated constituting less marginal value for the organization. Additionally, training and developing new IT skills for personnel that are not currently in the IT area must be considered in order to support existing IT personnel. However, if new employees are trained with only the simplest of IT skills, these skills could be outdated within one year. Ironically, while internal IT training may retain employees within organizations, studies have shown that additional IT training may increase the market value of particular employees and accelerate employee turnover among IT personnel (Zingheim & Schuster, 1999). Clearly, the use of existing personnel to address IT manpower shortages will be a function of the magnitude and scope of the particular IT skills required and the ability of an organization to retain its new trained IT employees.

Recent College Graduates: What was formerly an effective mechanism for replenishing employee ranks has developed into trench warfare for organizations seeking to hire recent IT college graduates. The increasing shortage of IT personnel has turned recruiting into aggressive "courting" on many college campuses. Recent IT college candidates now enjoy multiple job offers, relocation allowances, and generous signing bonuses. The major concerns associated with procuring recent college graduates beyond the bidding war phenomenon, remain the long-run loyalty and commitment of college candidates and the impact of IT training on new capabilities. As with any new employee, heavy investments in training are frequently viewed skeptically due to the uncertain future and continuity of IT employees within the organization. Invariably, the question arises as to whether new college recruits will commit to "staying on" with a company so that the organization may regain some of its training investment costs (Fishman, 1998). Recent college IT graduates are keenly aware of downsizing, decreased company commitment, and the flattening of organization structure (i.e., less opportunity for advancement). Subsequently, many new graduates feel less compelled to develop their entire career path within a single organization. Instead, "street wise" IT graduates often negotiate salary increases and career progress by judiciously selecting and managing their careers among several different companies (Minehan, 1998). The use of recent IT college graduates as a viable candidate pool must undoubtedly, factor in considerations for "retention salary adjustments" (i.e. salary increases commensurate with IT market wages) and predicted turnover within an expanding IT industry.

High School Graduates - Recent high school (HS) graduates have become increasingly visible to professional

recruiters as potential pools for IT employees. While many may possess self-taught technological knowledge and may be less expensive to hire, HS graduates may not enjoy numerous alternative career paths (Harvey, 1997). There are also several issues associated with using HS graduates such as required length of training, cost of training, and expected long term commitment to a career in IT. The *level* of professional training possessed by high school candidates may also be limited even though a particular *skill* may be somewhat advanced. Additionally, HS graduates may be more difficult to train since existing computer skills may need to be "unlearned" in order to introduce and relearn new IT computer and operating concepts.

The key issue remains identifying high potential IT employee within this pool of candidates. HS students graduating with high academic success frequently attend college, enter the military (to gain college tuition support), or may consider a trade vocation such as electronics, general electricity, plumbing, and carpentry. The remaining pool of recent HS graduates, often due to poor academic records or other personal problems may be restricted in following IT as a career choice. Unfortunately, these individuals often constitute the majority of the HS candidate pool left to be recruited as future IT trainees. Subsequently, the probability of finding quality candidates among recent HS graduates is dramatically reduced, making it difficult to justify the related time and expense necessary for recruiting and IT training. Additionally, the availability of HS trainees and the depth of technical skill as potential IT candidates may be disappointing.

Retired Personnel - The use of retired personnel as potential IT workers has been increasingly explored by a number of organizations (Rubin, 1997). Retired personnel traditionally have the motivation and time-proven work habits that may be ideally suited for the more routine IT duties within an organization. As retired individuals are reintroduced into the larger work force via the IT sector, other IT employees can be freed up to undertake and address more advanced technical problems. IT training for retired workers can focus on the organization's more routine operational core processes without concern that these particular skills will become outdated. Retired workers often possess good employment work histories and are less likely to leave for higher salaries, making them a reliable and dependable segment of the work force (Johnson, 1991). As potential IT candidates, the risks associated with hiring retired personnel are relatively low. As this particular demographic segment of the U.S. workforce continues to increase, retiring baby-boomers will have increased opportunities to reenter their former organizations thereby continuing to contribute their creative talents and experience to the IT field.

Other Companies' Employees - Raiding other organizations for IT personnel has been a tactic frequently employed by organizations experiencing severe shortages of IT personnel. One reason for the widespread use of raiding is that IT wages are on the average, two to six times higher than wages for manufacturing employees. Additionally, IT wages are expected to increase five to fifteen times the average national wage through 2002 (Rubin, 2000). Acquiring other organization's knowledge workers continues to remain attractive since these employees usually possess skills that can immediately address current IT staffing problems. Unfortunately, the negative aspects associated with this candidate pool are the very factors that attracted them to the organization in the first place: the potential of being lured away by even higher salaries and perks offered by other companies. Newly lured-away IT employees may also generate a disruptive influence upon organizations because their new salaries are often considerably higher than those of existing employees whose compensation has not kept pace with market salaries levels. Given the magnitude of the current IT manpower shortage, higher salaries for new IT workers may contribute to employee dissatisfaction within the organization. Nevertheless, many U. S. organizations continue to employ "raiding" as an effective method of quickly staffing IT job openings.

Inpatriate Employees – Numerous organizations particularly multinational corporations (MNCs), have expanded their recruiting efforts to include IT professionals who have recently immigrated to the United States. Many of these "inpatriates" (Harvey, 1993) possess extensive IT technical training coupled with an extremely high motivation to succeed in their newly adopted country. Many of the "transition" economies (i.e., countries moving from Communism to free enterprise) such as Poland, the Czech Republic, the Ukraine, and Bulgaria possess a significant population of technically competent IT workers who have historically provided staffing relief to the U.S. under-supply of IT professionals. In an effort to alleviate the current shortage of IT workers, the U.S. government has considered increasing the number of special work visas allowed for high technology employees. These special work visas will facilitate the immigration of workers and professionals with critical skills (e.g., IT skills) for a six-year period after which time they can be converted to permanent work visas or "green cards" (Seib, 1998). The use of foreign inpatriates as potential IT employees proves warranted and may provide a partial solution to the growing demand for IT personnel in the marketplace.

THE MULTICULTURAL "FACE" OF IT EMPLOYEES

It is estimated that two percent of the world's population live outside their original country of birth (Passel & Fix, 1997). This figure constitutes approximately 100 million people and includes refugees, political asylees, illegal migrants, and legal migrants. Nearly 25% of the world's immigrants (all categories) are found in North America with 22 million residing within

the United States and 3 million in Canada (Passel & Fix, 1997). The 22 million immigrants living in the U.S. represent approximately 8 percent of the total population, constituting an aggregate number nearly one-half higher than the peak immigrant population of 15 percent that occurred in 1920 (Warren, 1994). However, the percentage of immigrants within many countries eclipses that of the United States: Australia 21%, Israel 43%, Kuwait 60%, Luxembourg 24% and Canada 16% (Castles, 1997). Recent developments in immigration have now set the stage for the projected increases in the world's population flow of among countries.

Since the early 1960s, over 35 million individuals have immigrated from developing countries and have taken up residence in developed economies (U.N. Development Programs, Human Development Report, 1992). It is expected that an additional 1.5 million individuals per year will soon exit from developing countries in the foreseeable future (de Lusignan, 1997). This projection may be grossly underestimated, particularly for those transition countries where highly educated IT workers do not perceive amply employment opportunities commensurate with their training. Consequently, the migratory redeployment of certain skilled populations in central and Eastern Europe is already underway. By the year 2010, it is estimated that the majority of growth in the global work force will originate from the developing countries of East Asia, South Asia and sub-Sahara Africa (de Lusignan, 1997). The World Bank projects the global work force at approximately 600 million by 2010, with only 6 million workers coming from high-income OECD (Organizations of Economic Corporations and Development) countries (Fosler, 1996). These workers will obviously be attracted to developed economies and regions where there is a shortage of skilled IT and knowledge workers.

The post-1965 changes in immigration and refugee legislation have spawned a new era of global immigration for the United States (Conway, 1994). Immigrant flows have been accentuated by the passage of the U.S. Immigration Act of 1990, which is expected to generate an

additional 10 million immigrants (legal and illegal) entering the United States in the 1990s (Passel & Fix, 1997). Because of acute need for skilled IT workers, U.S. House and Senate subcommittees recently recommended that the current limitation for H-1B visas (i.e., three year visas for unique, high demand skills) be increased from 65,000 to 115,000 visas by the year 2002 (Valbrun, 1998). This new legislation would allow a significantly higher number of individuals with IT technology backgrounds to immigrate to the U.S.

Despite a commonly held belief that immigrants may represent a decline in the "quality" of the population, a careful analysis of the 1990 United States census data reveals that recent legal immigrants surpassed U.S. natives in conventional measures of quality. One of the most used criteria for quality of population was education. College educated immigrants to the United States increased by one-third while only one-fifth of current United States citizens possess a college education (Passel & Fix, 1997). The frequently cited "brain drain" of IT workers away from developing and transitional economies is promulgated by the seemingly insatiable demand for knowledge workers in the United States; a trend not expected to subside in the near future.

IT skills required to support the exploding demand for new hardware and software applications continue to increase because of the technological requirements related to specialization. Because of the pronounced shortage in IT workers, governmental agencies, business corporations and software associations all have considered the use of foreign inpatriates as a viable solution to the IT manpower shortage. Over the opposition of organized labor, the U.S. Congress is now considering legislation that would allow 200,000 high-skilled foreign workers into the United States; an increase from the present year 2000 level of 115,00 (Brownstein, 2000). Among the numerous recommendations presented were that United States organizations must:

- consider the strategic use of offshore employee or inpatriates as one of the key approaches used to address the IT manpower shortage in the United States,
- implement immigration reform, in the form of extensive use of offshore IT workers as a mechanism to develop and maintain critical IT systems,
- reconsider and change the entire educational and training model in response to the new

"information age" particularly with regard to inpatriated IT professionals,

- acknowledge foreign and other ethnic minorities as available IT candidate pools in view of declining computer science enrollments by United States citizens.

The use of inpatriate workers clearly constitutes a feasible and expedient approach to addressing the IT worker shortage in the United States. The following section discusses some of the inherent issues and problems that may be associated with training inpatriates for assimilation into the United States IT sector.

INPATRIATE ISSUES AFFECTING U.S. TRAINING MODELS

Distinct differences exist between foreign inpatriates and foreign employees from parent organizations. Parent organizations must examine the planning processes that support both the inpatriates' cross-cultural socialization processes and yet, preserve the value added by their global social knowledge (Harvey, Speier & Novicevic 1999b). Therefore, the learning styles of inpatriate trainees must first be considered to develop a better insight into effectively training IT inpatriates. Individual learning style is influenced by home culture (Hofstede, 1991; Riding & Cheema, 1991) and the inpatriate's dominate learning style that may represent a broad range of learning styles (Green, Snell & Parimanath, 1990; Pelissier, 1991; Rogers, 1986). Since, the training literature espouses matching training material and trainers to a given learning style (Bond, 1992; Ratner, 1991), it would seem logical that the development of inpatriate training programs should "fit" the learning style of each inpatriate for optimal learning results.

Cultural influences affecting learning- Evidence of the mediating effects of cultural on individual perception (Rogoff, 1981; Stumpf & Dunbar, 1991); performance (Ratner, 1991); and ability to recall information (Wagner, 1981) support the importance of matching inpatriate employee learning *style* with appropriate training programs. Individual pre-existing beliefs have also shown to moderate the effectiveness of training pedagogy (Yoshikawa, 1988). In addition to culture and pre-existing beliefs, the inpatriates' exposure to Western-style educational methods may influence their ability to learn new Western methods (Booth & Winzar, 1993; Rogoff, 1981). These results can be extended to examine how culture and individual motivation may affect learning preferences. More specifically, an assessment of the inpatriate's cultural position relative to the individualism-collectivism cultural

dimension is likely to influence learning approaches (Hofstede, 1991; Bond, 1992; Owens, 1985). The closer matching of new in-patriate social skills with the norms of the home country organization will clearly affect their ability to work cooperatively with others and their probability of success or failure (Harvey & Buckley, 1997). An additional goal of in-patriate training is to strengthen weak learning strategies by building upon existing skills and strategies (Wagner, 1981). In-patriates need to "learn how to learn" different social norms within new organizational environments. An appropriate training approach must encourage flexible learning strategies for the transfer of newly acquired problem-solving skills to the workplace (Booth & Winzar, 1993; Rogoff, 1981; Wagner, 1981).

Field dependence and field independence – Differences in learning style have also been characterized as field dependent and field independent (Saracho, 1990; Willis, 1989). The matching of an in-patriate's learning style needs to be accommodated to optimize learning and the transfer of appropriate culturally based social skills to alleviate potential stress (Pelissier, 1991; Ratner, 1991; Saracho, 1990). Disregarding in-patriate field dependency and learning style differences may be wasteful of organizational resources and reduces the likelihood for the foreign in-patriate to cope and succeed in the new environment (Pelissier, 1991; Ratner, 1991). Imposing inappropriate field dependency and learning style assumptions also increases the chances of conflict, stereotyping and may result in co-workers and managers generating incorrect causal attributions regarding the in-patriate (Rogers, 1986; Shaw, 1991; Yoshikawa, 1988).

Differences in causal attributions- In the role of "observers", in-patriate trainees may possess differing perceptions of the world and therefore, may be likely to make misattributions about others. These biases are most obvious when trainees have to "fill in the gaps," or make judgments based on ambiguous information. In such situations, prior beliefs or schemata are often used to make inferences about what is observed. Unfortunately, such biases reinforce beliefs about group clannishness and decrease the empathy of the in-patriate trainer (Ronen, 1991). Attributions may also be influenced by the in-patriate's individualistic-collectivist orientation (Kashima, et al. 1992). In cases where the actor (i.e., manager) and observer (i.e., in-patriate trainee) are from different cultures, the probability of misattribution is greatly increased, preventing the new in-patriate employee from interacting in ways that will assure future social support, thereby making the in-patriate's transfer to North American-based organization more stressful.

Attributional and explanatory style difference and negative outcomes - Attribution is a widely examined issue in management and psychology. An observer's attributional

or explanatory style is a unique way of "making sense" and drawing conclusions from others' behavior. Since observer conclusions are strongly influenced by pre-existing beliefs, attitudes, and schematic constructs (Peterson & Seligman, 1984; Seligman, 1990) they may vary with cultural orientation. Misattribution, however, may be doubly harmful for new in-patriate employees. In addition to overcoming normal manager and employee interaction problems, the in-patriate must also make sense of a behavior (e.g., North American) that may be new to them. When an in-patriate's behavior does not obtain the desired responses, and sense cannot be made of others' behavior, the in-patriate may be prone towards conditions of helplessness, depression, deteriorating physical health, and other generally negative outcomes (Ronen, 1991; Spadone, 1992). These negative consequences are similar to the culture shock and related feelings of isolation experienced during cross-cultural relocation.

Additional issues influencing in-patriate training - New IT in-patriate employees may also possess organizational and perceptual differences which must be considered when designing an appropriate training program in the following ways:

1. **business education** - the in-patriates' business education background may be less developed and may not be as conversant in the business "language" used in the domestic organization,
2. **communication skills** - may not be developed since English may be their second language; they may not be accustomed to generating routine oral or written reports,
3. **differences in social class or organizational status-** may reduce the effectiveness of the new in-patriate trainee due to the relative informal atmosphere of business organizations in the U.S.,
4. **different motivation and reward structure orientation** - aggressiveness, performance-based evaluations and the absence of a rigid seniority dictum may pose a dramatic shock to the in-patriate's previous frame-of-reference,
5. **time perspective** - particularly as it relates in the importance of completing projects on schedule may be a new phenomena to new in-patriate employees.

Given these differences, coupled with expectations of high performance from the in-patriate's new organization,

the careful design of an effective IT in-patriate training program is imperative.

POTENTIAL TRAINING TECHNIQUES FOR IT INPATRIATES

Corporate training in the U.S. is projected to grow from \$63.5 billion in 1999 to \$72.8 billion in 2002 (SIIA, 2000). Most organizational training programs possess a myriad of approaches for transmitting training material and information to new employee trainees (Harvey, 1997). While employee training often refers to specific instruction (to address a current organization need), employee development entails a wider scope and emphasizes longer-term needs rather than current organizational requirements (Anthony, et al., 1993). Training possesses a narrower focus and produces the needed skills designed to benefit the organization immediately (Anthony et al., 1993). However, while many organizations may possess the latest technology, few may know how to effectively use it (Berstein, 1998). Organizations are clearly realizing the importance of acquiring cutting-edge technology and are now spending a considerable portion of their budgets on IT training. Currently, the U.S. corporate training market has soared to over \$60 billion with over \$20 billion used specifically for IT training (Berstein, 1998). The following section focuses on recommendations for employee training techniques that may be used to prepare new IT in-patriates to address immediate organizational needs. Organizational IT training techniques have included the following, though many programs are a combinations of techniques: 1) traditional classroom instruction, 2) computer based training (CBT) learning modules, 3) on-site programmed instruction, 4) hardware and software simulation labs, 5) outside certification agencies, 6) mentoring and apprenticeships, and 7) virtual classrooms and distance learning.

Traditional Classroom Instruction – Structured, classroom instruction has traditionally been used as effective training mechanism to convey the theory and concepts related to the understanding and implementation of IT. It provides the foundation for employees to comprehend why certain procedural tasks are required and how a particular task contributes to the overall goals and mission of an organization. For example, classroom training for IT in-patriates performing systems analysis duties might include readings and classroom discussion of structured methodologies or procedural steps used in "analyzing" and "identifying" customer IT needs. Classroom instruction provides the formal framework and methodologies used in translating "conceptual" user models into working "technical" models that coincide

with organizational strategy. Numerous organizations still use specialized classroom courses for programming languages, systems engineering, network design and other I/S courses offered by educational institutions and colleges (Anthony et al., 1993). These courses can last from one week to an entire semester depending on the course intensity and depth of competency required.

However, within varied multinational trainee groups, traditional classroom instruction may appeal more to some cultures than others. Classroom instruction may be an effective training mechanism for "collectivistic" or group oriented cultures particularly, if the classroom environment includes a team project and collaborative group interaction. Alternatively, if the classroom environment is conducted in a more individualistic-oriented environment (i.e., less group projects and more individually oriented work assignments), in-patriate trainees from collectivistic cultures may find traditional classroom environments impersonal and than less conducive to learning.

Computer-Based (CBT) and Web-Based Training (WBT) - Internet and Intranet based training is expected to grow to \$4 billion by 2002 and to \$11.4 billion in 2003 (SIIA, 2000). CBT is becoming one of the most popular applications of information technology (Filipczak, 1997) and has been used to teach specific computer and software applications. CBT is quickly gaining converts among smaller and more progressive organizations who may not possess formal training departments or facilities. However, approximately 150 hours of development time is required to generate 1 hour of computer based training; a reduction of 50 hours from last year's medium preparation time of 200 hours (Filipczak, 1997). However, the type of skills that most technology companies try to impart through CBT is still undergoing a considerable amount of change. Web-based training (WBT) is a specialized form of CBT. WBT is instruction and education delivered over the Internet or via corporate intranets. Currently, web-based training is one of the hottest trends in the training industry and a preferred mode of training for IT and knowledge employees. Compared to classroom training, WBT reduces time and expenses by as much as 50% enabling human resources personnel to more effectively deploy trainers (Roberts, 1998). Approximately, 39% of corporate organizations surveyed stated that they were currently delivering or planning to deliver instruction via web-based training (Black & Goldstein, 1998). However, while many instructors and potential students are excited about WBT, a large segment of knowledge workers "in training" still prefer traditional face-to-face class instruction (Black & Goldstein, 1998). Culturally, the very nature of CBT and Web-based instruction is

individualistically oriented. New IT in-patriates within these training environments must interact with CBT and WBT on a one-to-one basis and will have little opportunity to experience group or project team type learning or interaction with other IT trainees. However, while there is no replacement for socialization, the Internet may also encourage and facilitate collaborative learning opportunities where it may otherwise not exist (SIIA, 2000).

On-Site Programmed Instruction Modules - Onsite or in-house programmed learning modules are often used an effective mechanism for home organizations to convey specific knowledge and information about selected topics and applications. Programmed modules allow trainees to progress through learning sessions at individual comprehension rates so that more difficult modules are only accessed when pre-requisite concepts are learned. Numerous organizations are currently utilizing programmed learning modules for specific computer languages, such as COBOL, "C", C++, Visual Basic, Java and several other web-based interfaces. The majority of these programmed learning modules are commercially available at affordable rates. Programmed learning modules are also an effective way of relieving home offices of continuously preparing and delivering classes featuring the newest state-of-the-art programming language or other IT interfaces. However, like CBT and WBT techniques, programmed modules are individualistically oriented with little opportunity for foreign in-patriates to learn programming skills and languages within a peer-assisted or group-based environment.

Hardware and Software Simulation Labs - The transfer of technical knowledge may be more effectively enhanced when trainees are able to practice in a "hands on" environment. In-patriate IT trainees can "learn by doing" using simulated hardware and software application laboratories. Research indicates that practicing within simulated environments allow trainees to experience a wide range problem situations involved in following a set of technical instructions without the apprehension related to "making mistakes" (Anthony et al., 1993). Mistakes or errors in simulation labs will not negatively impact actual user applications or files as they would within a real corporate environment. Learning within simulated lab environments is particularly enhanced when IT trainees are provided with immediate feedback. Additionally, simulation labs, like employee orientation programs allow organizations to properly indoctrinate new in-patriate trainees in the particular IT core technologies to be used by the home country organization. Hardware and software simulation labs therefore, become particularly important for in-patriate employees who may not be familiar with the

home organization IT operations. Simulation labs would appear to be excellent settings for in-patriate trainees whose cultural norms may traditionally favor group-based and peer-assisted learning environments. Subsequently, the feedback and interaction provided by fellow trainees within simulation lab environments would be predicted to work well with in-patriate employees from low individualistic or collectivistic cultures.

Outside Certification Agencies - An increasing number of IT professional organizations rely upon outside agencies to "certify" their knowledge workers to become proficient within a needed skill or particular application. The Novell Corporation has long offered training programs to certify participants in the understanding, installation and maintenance of their network software. These certification programs are intensive and their duration is related to the level of certification (i.e., several weeks for a CNA (Certified Novell Administrator®) to several months for a CNE (Certified Novell Engineer®). The Microsoft Corporation also offers offsite certification in the use and maintenance of their network user software: the MCSP (Microsoft Certified Solution Provider®) and the MCSE (Microsoft Customer Service Engineer®). Other software and network providers like Oracle, SyBase, and Cisco offer similar "certifications" of application expertise. Most software certification programs are individualistically oriented. While portions of the certification processes include classroom instruction as well as hands on network labs, trainees are normally tested over self-study modules on an individual basis. Arguably, while many IT in-patriates prepare for certifications tests in "study groups," the ultimate effort in outside certification programs is undertaken on an individual basis and therefore, would appeal more to cultures with high individualistic indices (U.S., U.K., Canada) and less toward collectivistic cultures such as those from Asia and Latin America.

Mentoring/Apprenticeships - Mentoring is a training technique that assigns a guide or knowledgeable person (usually from a higher position within the organization) to assist a new employee in "learning the ropes" of the organization. In addition to providing guidance and advice, the mentor also helps develops a personal social relationship with the trainee so that the new employee feels comfortable confiding in the mentor for advice that would not be asked of the immediate supervisor (Anthony et al., 1993). Apprenticeships have traditionally referred to training programs provided by a master craftsman for individuals who, for a designated amount of time, will work closely with a master craftsman in learning the "tricks of the trade". While apprenticeships conventionally refer to personalized

guidance for skilled trades within certain craft unions (machinists, electrician, masonry, carpentry, etc.) apprenticeships or internships are increasingly being used in the IT field. The most recent use of mentors and internships within the IT field have been for the rapid and controlled development of new or potential employees, particularly in the area of “hot” and critical mission skills

essential for the continued operations of a particular organization. Mentors and apprenticeships may function well for inpatriates from high power-distance cultures (Hofstede, 1991) where the trainee feels comfortable with apparent differences in power and status, often “looking

Table 2: IT Training Techniques and Related Considerations

IT Training Technology	Potential Barriers	Best Uses	Specific Applications
Traditional Classroom Instruction	Availability of qualified instructors, physical facilities, down time away from organization, language barriers	Structured transfer of general to specific organizational info and application knowledge	For general applications and orientations: certification for specific IT HW applications, and SW languages
Computer Based and Web- Based Training	Online access and links, fast downloads, adequate bandwidth, web site maintenance and update	General to detailed training for organizational and area-specific info; may be done at employee’s convenience	Range of general to special industry-wide IT applications: web pages, networks, databases
On-Site Programmed Instruction Modules	Availability of up-to-date, and non-obsolete modules, available facilities and computer interfaces, downtime away from work	Specific to general organizational education; detailed information and reference for mission-critical skills and training and development	Specific programming, object oriented and web-based languages; specific organizational info on Co. Databases, Co. networks, etc.
Hardware and Network Simulation Labs	Availability of supporting network infrastructure, SW licensing costs, flexibility of use for other training	Specialized hands-on experience for designing, installing, trouble-shooting HW components and NW software	Support of company-specific or legacy mainframe systems, company-specific LAN, WAN, and NW Configurations
Software Simulation Labs	Availability of high capacity client-server HW and SW support; maintenance cost; flexibility of use for other training and applications	Specialized, hands-on experience for the engineering, development, execution, testing and debugging of new or company-specific SW applications	Specialized SW engineering applications, CASE tools, database development and applications, Web development and applications (EC)
Outside Certification Agencies	Cost, travel requirements and downtime duration; availability of classes, quality control	Independent and outside certification for specific HW and SW applications and computer programming expertise	Certifications in networking, SW Engineering and Technician Proficiency certifications (e.g., CNE, MCSE, etc.)
Mentoring and Apprenticeships Programs	Availability / time resources of qualified, skilled and technical mentors to train new personnel	Utilized when traditional skills and development methods are too time consuming. Personal guidance by existing and knowledgeable employees	Controlled and supervised development of mission critical skills and “hot skills” by existing, experienced personnel for newly drafted employees
Virtual Classrooms and Distance Learning	Available technical infrastructure facilities to transmit to various sites, adequate transmission bandwidth	On-line, virtual access to numerous classes and information not available from remote organizational sites	Interactive distance learning using latest IT knowledge, qualified instructors and latest applications

up" to a paternalistic mentor. Additionally, mentors and apprenticeships add an element of group collectivism since both parties are considered a "team" as they work together towards a common group goal.

Virtual Classrooms and Distance Learning

- Organizations with offices located through the U.S. or around the world may benefit from online virtual classrooms for their new inpatriate employees. These organizations usually invest heavily into IT education and training allowing employees to take full advantage of the latest technology. At the same time, these organizations may drastically reduce the high cost of travel and the downtime required to send their employees offsite to IT training courses (Berstein, 1998). Professional training organizations like ProSoft® have the ability to connect online with over 100 full-time instructors from over 40 sites throughout the U.S. These interactive learning environments provide long distance learning for "mission-critical" training courses, and drastically reduce training time, travel and expense. Additionally "smart training" modules authored in HTML (hyper-text markup language) allow for instant updating of new web-based course material. Virtual classrooms are effective in combining facilitated online training with self-paced student learning, resulting in well-trained students and satisfied corporate sponsors (Berstein, 1998).

Virtual classrooms have become increasingly popular with collectivistic cultures that prefer their formal learning environments to be a "group" effort. While most traditional classroom instruction has normally been considered more individualistic, virtual and distance learning environments generate the perception of being gathered together as a classroom group interacting with other groups. Additionally, virtual and long-distance classes are usually assigned team projects where groups within a given location may compare their analyses and solutions with sister virtual classrooms. Table 2 summarizes these IT training techniques and related considerations for their potential application.

CONCLUSION AND IMPLICATIONS

The shortage of qualified IT workers is a significant and serious challenge facing the United States. The development of faster computer hardware, sophisticated end user software and the globalization of the telecommunications industry has generated an acute global demand and corresponding shortage for trained IT professionals. Projections from past and current trends also indicate a cumulatively increasing shortfall of IT professionals in the United States beyond the current shortage, even if the number of IT graduates remains at a steady level (London, 1998). Additionally, the magnitude and impact of the United States IT

manpower shortage is predicted to generate a negative impact upon national productivity and potentially the entire U.S. economy. This article discussed the use of foreign or "inpatriated" knowledge workers as a viable candidate pool of employees that may be used to address the current manpower shortage in IT. United States organizations have welcomed "inpatriates" and have increasingly incorporated foreign IT workers into U.S. management levels and project teams on a permanent basis. The growing use of multicultural inpatriate IT workers will clearly impact U.S. learning models for training and professional development.

Effective training programs for new IT inpatriate workers must specifically consider differences in cultural backgrounds, previous academic preparation and organizational needs. Additionally, IT inpatriate training methods must also incorporate the use of new and emerging technologies, and flexible infrastructures so that the latest IT knowledge is disseminated and implemented for an increasing number of end users throughout a given organization (Kendall, 1997). Clearly, the implementation of new and emerging technologies will not be sufficient to provide U.S. businesses with the economic leverage to aggressively compete in an increasingly computerized global market. As the shortage of available IT workers becomes more acute, appropriate and effective IT strategies for training new inpatriates employees coming to the United States must become an integral part of organizational human resource management.

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