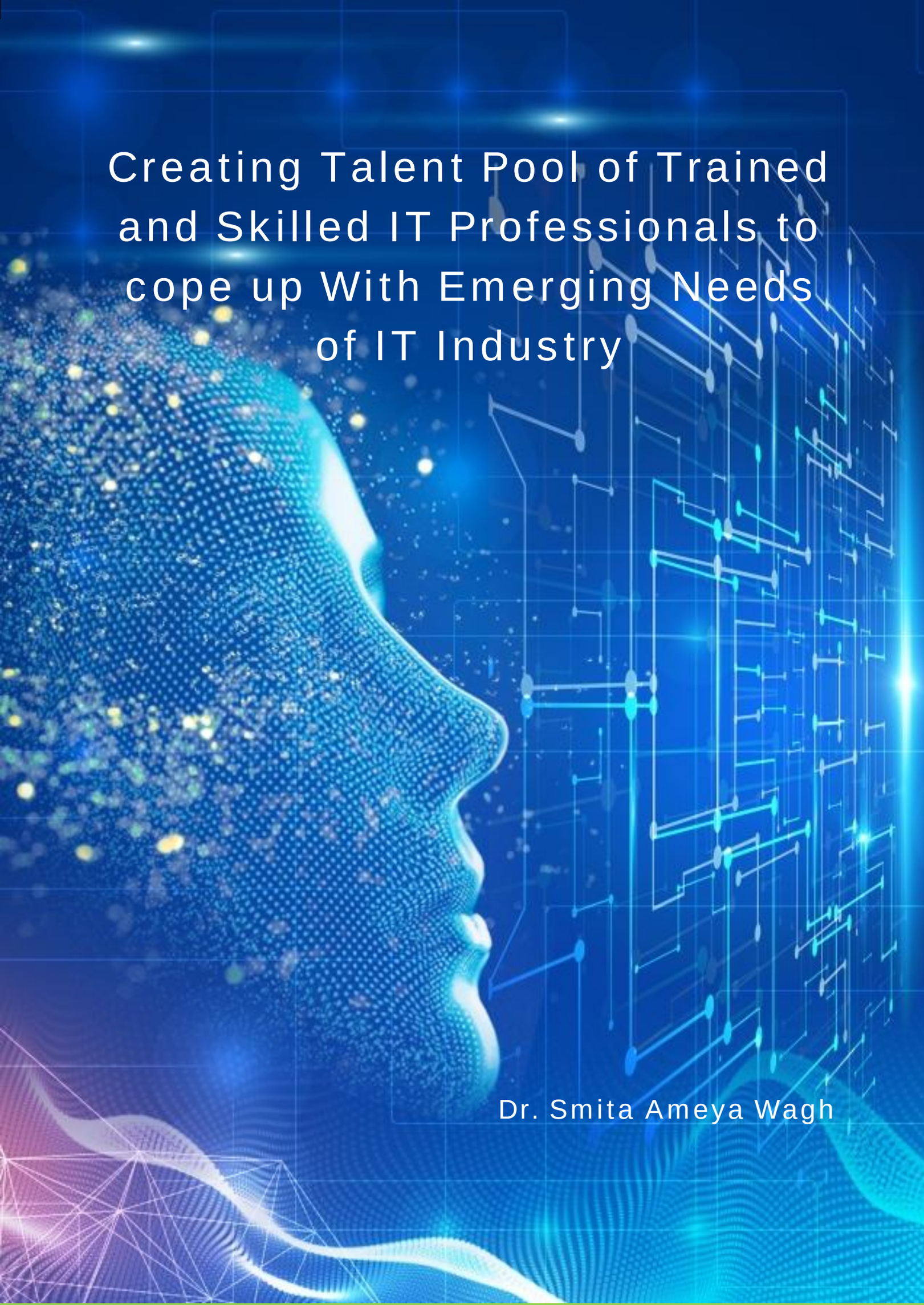
Creating Talent Pool of Trained and Skilled IT Professionals to cope up With Emerging Needs of IT Industry



Dr. Smita Ameya Wagh

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Preface

The book - Creating talent pool of trained and skilled IT professionals to cope up with emerging needs in IT industry explains the importance of various skills and training programs required to recruit in IT industry or to sustain with changing technology. Being an IT faculty for many years, I found there is a huge skill gap between the curriculum and the skills required in IT industry. Industry is never short of openings but it is also observed that the ratio of students getting placed in IT industry is very less. There is necessity to overcome this problem.

This book focuses on employability skills required by the students and employees of industry. It gives appropriate suggestions to bridge the skill gap between students and IT industry. Results of study mentioned in the book should prove benefiting for students, leadership in IT industry, and trainers or tutors in various institutes equally.—

The book contains 7 chapters which elaborates the Introduction, Research Methodology, Literature Review, Overview of IT industries and institutes in Pune region, Data analysis and Interpretation and suggestions.

Dr. Smita Ameya Wagh

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Dr. Smita Ameya Wagh

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CHAPTER - 1

INTRODUCTION

The IT sector has also led to massive employment generation in India. The industry continues to be a net employment generator expected to add 230,000 jobs in fiscal year 2017, thus directly employing about 2.8 million people and indirectly employing 8.9 million, making it a dominant player in the global outsourcing sector. However, it continues to face challenges of competitiveness in the globalised and modern world, particularly from countries like China and Philippines.

India's growing stature in the Information Age enabled it to form close ties with both the United States and the European Union. However, the recent global financial crises have deeply impacted Indian IT companies as well as global companies. As a result, hiring has dropped sharply, and employees are looking at different sectors like financial services, telecommunications, and manufacturing, which have been growing phenomenally over the last few years

1.1 Information Technology Jobs and Skill Standards

Educational and training institutions must restructure themselves to better prepare this new workforce. One effective tool for this restructuring is application of information technology (IT) skill standards.

IT skill standards define the professional job-related knowledge, skills, and abilities required to succeed in the digital-age workplace. They can be used as a foundation tool for developing educational curriculum, profiling jobs, recruiting and evaluating employees, and designing academic and professional certification. They can be used alone or in conjunction with other input, such as that from a subject matter expert, industry advisory committee, professional organization, existing academic or vendor-specific curriculum, or accrediting organization.

IT skill standards create a common-language framework for educators, industry, and other stakeholders to develop the educational and training tools necessary to prepare students and incumbent workers for today’s workplace challenges as well as those that lie ahead.

Skill standards can be used for a number of purposes:

- Improving the education and training of the information technology workforce
- Increasing cooperation between education and business
- Improving academic mobility by facilitating development of an articulated curriculum that continues from high school through community or technical college and on to a four-year institution and graduate work
- Establishing criteria and standards for assessment, certification, compliance, and degrees

1.2 Skill Standards for Information Technology

The millennium edition of this work is the end result of a national review and update of the IT skill standards, with input from expert panels around the country for new and changing skills, work functions, technical knowledge, and related employability skills.

1.3 Why Skill Standards?

Most competitive industrialized nations have evolved a well established professional skill standards system. Applying skill standards to development of curriculum results in courses and programs whose outcomes can be assessed across a range of contextual technical and foundation performance criteria. This results in employees who are prepared to function effectively in the technology- and information-based workplace.

There are numerous benefits to IT skill standards. Companies communicate their performance expectations to their employees, educational institutions reform their curriculum to match workplace needs, and the skills gap between workplace expectation and student preparation can be closed. Among the major stakeholders benefiting from IT skill standards are businesses, IT professionals, students, educators, and government policymakers.

For IT skill standards to be effective, they must reflect the consensus of the industry professionals in the IT career field. To ensure the integrity, quality, and continuity of the skill standards, several principles have guided development:

- Experienced IT workers, who are the experts in their career field, must be used to identify the work performed and the skills, knowledge, and abilities required to be successful.
- Business and education must work together as partners to ensure the link between work expectations and curriculum.
- Skill standards must represent broad career clusters rather than narrowly defined jobs.
- Standards must be flexible and portable and should be updated continually.
- Integrated skill standards must define work duties in the context of the work setting.

1.4 Career Clusters

A career cluster is a grouping of representative job titles, related by close association with a common set of technical skills, knowledge, and abilities. The career cluster approach closely reflects how work is organized today, especially in illustrating mobility and progression among representative job titles.

There is a range of IT careers and career progressions within the profession. The IT career clusters identified by NWCET have been broadly adopted by industry, education, and government policymakers as a standard framework for classifying IT jobs and careers.

1.5 The IT Skills Pyramid

The three-tiered pyramid depicts IT skill standards in three broad IT competency categories:

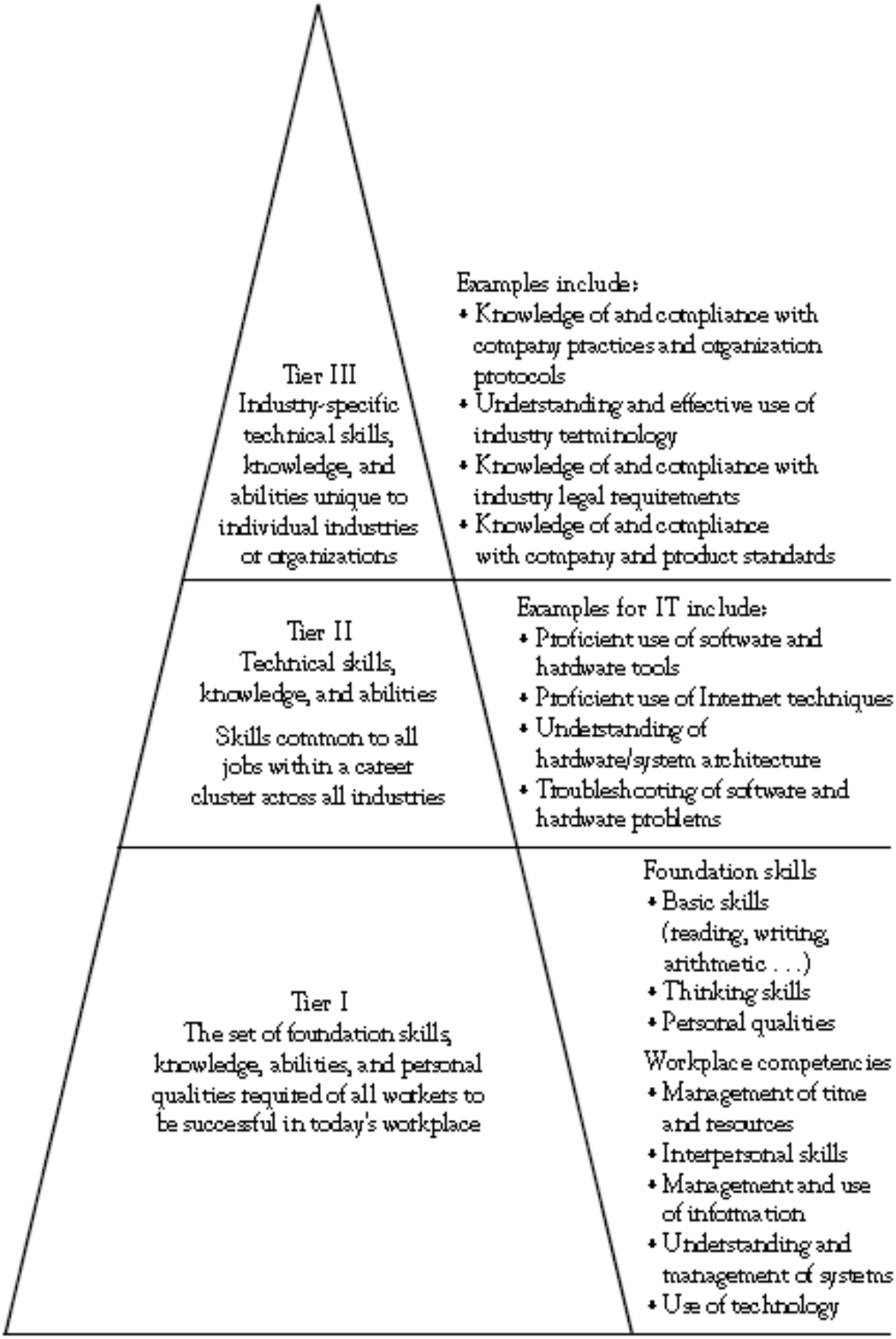
1. Foundation and employability skills,
2. Common technical skills, and industry-specific technical skills and
3. Organizational knowledge.

Tier 1 is the set of foundation and employability skills, knowledge, and abilities that are required of all information worker employees. These are the universal skills problem solving, team skills, and flexibility that are needed to apply technical knowledge and tools effectively.

Tier 2 is the set of technical skills, knowledge, and abilities common to all IT positions within an IT career cluster. For a programmer, for example, knowledge of the principles of programming applies across all industries.

Tier 3 is the set of industry-specific technical skills, knowledge, and abilities that are unique to individual clusters and that are the most susceptible to change. For example, a programmer's required knowledge of data communications and network protocols may differ across companies and industries.

Graph no-1.1: The IT Skills Pyramid



And for quantifying their supply and demand. These are the eight NWCET IT career clusters:

1. Database development and administration
2. Digital media
3. Enterprise systems analysis and integration
4. Network design and administration
5. Programming and software engineering
6. Technical support
7. Technical writing
8. Web development and administration

These career clusters represent a broad range of job titles, from entry level through senior management. They are designed to be usable to educators at every level, and to human resource professionals; training, certification, and assessment developers; students and job seekers; and organizations and individuals conducting research into information technology workforce issues.

1.6 Common Elements across Clusters

Several elements are common across all clusters. This commonality reflects the desire, among virtually all employers, to find employees with a set of common qualities that support specific technical knowledge and skills. These common categories are project management, task management, and problem solving and troubleshooting.

Either explicitly or implicitly, certain other process skills appear repeatedly across all eight clusters (analysis, design, development, testing, implementation, and documentation).

The nature of each of these IT skills differs with the job level and from cluster to cluster. By inference, however, employers want employees who can

- Apply a systematic, methodical approach to solving a problem
- Research to see who else knows about the problem
- Develop a rational set of possible solutions
- Test the solutions cost-effectively and efficiently
- Verify that the problem is truly solved
- Document the solution for others

1.6.1 Technical Skills

In addition to these common elements, specific items of technical knowledge, skills, abilities, attributes, and use of tools are associated with a function or task. These are represented at a high level and avoid reference to a specific vendor, version, or piece of equipment.

This allows maximum flexibility in adapting the skill standards to local specifications while preserving the employer's general requirements for specific skills.

1.6.2 Employability Skills

Finally, there are employability skills general requirements associated with a function or task. Input from industry clearly shows that without solid mastery of employability skills, an employee cannot succeed in the highly competitive environment of today's technology company. Employers often say that "technical skills may get you the job, but foundation skills make you a valued employee and significantly increase career advancement." For our purposes, let us identify seven types of employability skills:

1.6.3 Communication skills

Effective information flow throughout the organization is a critical element in organizational success. Communication with team members, supervisors and subordinates, and customers and clients as well as

between groups must be timely and appropriate. Some jobs rely heavily on written communication, while others depend primarily on verbal communication. Communication in a high-technology organization takes on many forms: informal or formal presentations, technical logs, complex reports, proposals, and so on. No matter the form, communication is vital to individual and team effectiveness.

1.6.4 Organizational skills

As employees are asked to handle more parallel tasks with an increased level of complexity, good organizational and planning skills become important. Depending on the job, the complexity of the organizational task may vary from scheduling and prioritizing multiple tasks or requests to planning and tracking complex and capital-intensive projects involving many people and teams. Regardless of the size of the project, the ability to identify and define tasks, track milestones, recognize when a project timeline is running into problems, and take appropriate action is crucial to ongoing success in a technical job.

1.6.5 Team contribution and leadership

Most organizations are relying increasingly on teams to accomplish projects. This is particularly true in high-tech environments where the success of a project depends on the contribution of many individuals with varied expertise.

The ability to work with team members with diverse backgrounds and communication styles is highly valued and rewarded in most environments. Being able to read the needs of the team as a whole and the needs of individual team members, and to adjust one's role to increase team effectiveness, is essential to the success of the team process.

1.6.6 Professionalism

Dealing with problematic employee issues, attitudes, and behaviors consumes much time in any organization, and it can be quite detrimental to overall morale. Employees with good work ethics, who show up on time, who understand and follow company procedures, and who relate to coworkers and customers with respect are usually the ones selected for a position with an increased level of responsibility and reward.

1.6.7 Critical thinking and decision making

As an organization becomes leaner in management, the employee is expected to assume increased responsibility. An employee's ability to correctly analyze a situation, understand tradeoffs, offer good recommendations, and make the right choice is often rewarded with increased freedom to self-manage, and with the opportunity to engage in more interesting and challenging projects.

1.6.8 Customer relations

Customers can wear many faces. An internal customer is the department down the hall or an offshore division. An external customer is a supplier, client, or end user. The ability to solicit and listen to customer feedback and to effectively address customer issues and concerns is required to qualify for certain positions, such as a technical support job. Customer interaction skills are necessary in every job, whether or not its description formally includes "customer relations."

1.6.9 Self-directed and continuous learning

In the high-technology industry especially in an information technology environment technologies and practices change rapidly and sometimes radically.

To keep up with technology change, employees must constantly engage in self-assessment against the technological landscape of skills and knowledge and then take proactive steps toward enrolling in continual training for their trade. The employer expects employees to be current in their technical skills. Most organizations provide the necessary resources for continual training. However, it is often seen as the employee's responsibility to identify personal gaps in knowledge and take actions to fill these gaps.

Most professional or technical and academic programs include some requirement for practicing foundation skills. However, many lack the emphasis that employers would like to see. Being aware of the importance of such skills can help students and employees enroll in a program that emphasizes using, practicing, and coaching foundation skills in the learning process, class activities, and projects. Educators must be aware of the importance of these skills to the long-term success of graduates; they must create ample opportunity for holistic and contextual practice as well as authentic assessment.

1.7 Future Trends in IT Skill Standards and Emerging Careers

Some of the trends in an IT career that may be of interest to users of skill standards are e-commerce and e-business, outsourcing, specialization, certification, and nontraditional degree pathways.

1.7.1 E-Business and E-Commerce Careers

E-commerce and e-business are often used interchangeably. Arguably, no application of information technology will be more pervasive in the foreseeable future than electronic commerce. Various aspects of electronic commerce affect firms of every type and size, from the home-based proprietor to the global enterprise.

In general terms, electronic commerce is the intensive application of information technology to enable, enhance, and facilitate business transactions. The most obvious examples are consumer oriented businesses selling directly to end users via the Web. Although these activities have garnered a large share of media attention, the total value of their transactions pales in comparison to business-to-business commercial activity.

E-business is the intersection of Internet technology with critical enterprise applications. Thoughtful application of Internet, intranet, and external technologies either to existing or to reengineered systems can create an electronic continuum of business processes, from marketing promotion to a sales transaction through order processing, logistics, manufacturing, billing, shipping, customer support, and cross-selling. The resulting environment extends significantly beyond a simple commerce phase to create a continuous Internet customer life cycle. The term e-commerce, then, is generally limited to using Internet technology in the selling process only.

There are other legitimate interpretations of what distinguishes e-business from e-commerce. One common distinction is that ecommerce describes Internet sales to end users (retail purchases) while e-business defines enterprise-level transactions that may occur between distributors, between business divisions, or between a manufacturer and a vendor, a manufacturer and a distributor, or a supplier and a retailer.

E-commerce will certainly revolutionize how business is done. Entities that may be competitors may find they benefit from “competition” the coined word describing cooperative competition. The considerations surrounding conduct of business, data integrity, security, rights, access, restrictions, and interoperability are substantial.

1.7.2 IT Outsourcing, Contracting, and Consulting

The trend toward focusing on core business and core competencies that started with large firms is being adopted by smaller firms and educational institutions as well. For information technology, this trend has resulted in an increasing number of long-term contract positions at the technician level and large growth in consulting services at the professional level.

Firms for whom information technology is not a core competency may contract for computing infrastructure, hardware, maintenance, Web site hosting, transaction processing, data warehousing, and employee training in use of technology. This trend has created opportunities for full-time employment with the contractor supplying the service, rather than with the end user of the service. Contract workers often do not have permanent status. Although many assignments extend for the duration of the contract (and are therefore considered long-term), they are temporary because there is no assurance the contract will be renewed or extended. Because of the explosive growth of the information technology industry and the shortage of skilled workers, relatively few proficient individuals have experienced a period of unemployment, and this is expected to be the case for the foreseeable future.

Many firms also employ consultants in short- and long-term positions to help with implementation and integration guidance and to research and offer strategic input (especially in technology forecasting and deployment). Large and small firms also seek consultants with specific skills in current or emergent technologies as they apply to their business needs. A consultant may work independently but is often part of a skilled group whose services are arranged through a large firm specializing in consulting services.

People working for these firms often acquire a valuable worldwide enterprise perspective as they work through their assignments, bringing their technical expertise and aggregated experience to each new assignment.

Some educational institutions are also following the IT outsourcing trend, focusing on their core competency (instruction delivery) and their core service (student services delivery). These institutions are usually outsourcing in the areas of internal computing and network infrastructure or Internet access and Web site hosting with Internet service providers (ISPs). Some institutions have even outsourced their entire IT department to a vendor that hires the incumbent IT staff, which allows retention of the staff's knowledge of current operations and business processes. Another emerging outsourcing trend among higher education institutions is contracting out their business or student services application to an applications service provider (ASP).

1.8 IT Specialists Versus Generalists

An interesting divergent trend seems to be emerging in the structure of the information technology workforce in large companies as opposed to small ones. Larger firms seem to gravitate toward specialization at both the technical and management levels. Some technical workers support relatively small groups dedicated to one project that is narrow in scope. As a result, there is a tendency to develop extreme experts in a tightly focused area.

Interestingly, educational institutions and some larger companies for which IT is not a core business express strong interest in finding individuals with a range of skills, knowledge, and abilities.

This implies that the employee is able to determine when the firm needs to seek external resources and to make the case for justifying their use when necessary. It also means the employee is more effective when able to communicate not just laterally but to all organizational levels. Since students and recareering adults often start with small concerns, this trend implies that educational and training efforts should include activity and assessment that build the student's ability to integrate a range of skills and abilities.

1.9 Nontraditional IT Degree Paths and Certifications

The nature of information technology work and the explosive growth of the field have created opportunities for rapid career progression and salary advancement. The iterative and project-based nature of the work means an experienced person has increasing responsibility in project management, planning, and coordination.

There is a trend toward upside-down degrees, where someone at the technician level acquires additional business education by which he or she becomes qualified for increasing management responsibility.

A four-year college, especially one catering to working adults, is often willing to evaluate technical education and professional development in partial fulfillment of academic degree requirements, and increasingly willing to offer individualized study and flexible cohort based learning groups to facilitate degree completion.

Information technology workers at all levels value their education, strive to stay current, and are often among the employees most eager to take advantage of professional development and career advancement opportunities. This trend implies that employers must continue to offer professional development and career advancement opportunities; it also suggests that there will be continued growth in nontraditional undergraduate and graduate education for information technology workers.

IT skill standards constitute a common-language framework for educators, employers, and corporate trainers to develop the educational and training tools necessary to prepare students and incumbent workers for today's workplace challenges. Both IT educators and HR professionals are realizing that these standards can be used effectively as a foundation tool for developing educational curriculum, profiling jobs, recruiting and evaluating employees, and designing academic and professional certification. All major stakeholders in IT workforce development business, IT professionals, students, educators, government policymakers benefit from IT skill standards.

1.10 Employment Trends and training in Information technology

In recent years, students, workers, and jobseekers have received mixed signals about the job market for information technology. Periods of strong job growth have been punctuated by brief periods of employment declines. Optimism about information technology, commonly referred to as IT, as a career field has been tempered by concerns about job security and competition abroad. Jobseekers and students, unsure of what the future holds, are understandably confused about the direction in which IT careers are headed. The IT field continues to offer opportunities for jobseekers that have the right skills and training.

1.11 Meaning of IT workers

There is no universal definition of the IT workforce. For purposes of this article, IT workers are grouped into 10 selected occupations commonly identified for their computer-related focus. These occupations are in nearly all areas of the country and in nearly all types of organizations. Workers in most of the occupations are in demand and, as a group, earned wages that were almost twice the national average of $40,690 in May 2007, according to BLS.

Computer and information research scientists explore new ideas in information technology. They create and refine the theories that are the starting point for many computer products and systems.

Computer and information systems managers are in charge of the computer systems in an organization. They determine which IT products the organization needs such as computers, networks, and software and supervise the workers who operate these products.

Computer hardware engineers design computer hardware, such as computer chips, circuits, and drives. These engineers' products are in personal computers, cellular phones, and cars, among other equipment.

Computer software engineers design computer software. They analyze the needs of computer software users and then design, develop, and test software to meet those needs.

Computer programmers translate the designs of software engineers into computer code a language that the computer understands. This code tells the computer what to do, such as to navigate to a Web page when the user clicks on a link to that page.

Database administrators determine the best way to organize and store data. They deploy and maintain database software systems and take steps to ensure that the data remain secure.

Network systems and data communications analysts plan, design, and test computer systems. They also design new ways for computer systems to share information.

Computer systems analysts help businesses and other organizations select the best products for their computing needs. They determine which types of systems and software will help an organization reach its goals and recommend ways to keep the systems safe. Network and computer systems administrators oversee the computer networks and systems in an organization. They make sure that computer systems run efficiently, and they maintain system security. Computer support specialists fix technical problems for computer users. Some of these workers run diagnostic programs and perform network maintenance. Others answer users' technical questions or install computer equipment in customers' homes or businesses.

1.12 IT employment facts and fallacies

Job prospects in information technology, like those in many career fields, vary by occupation. Some computer jobs were eliminated when their tasks moved overseas a business practice known as off shoring. Although off shoring affected only a few IT occupations, many people were concerned that information technology as a whole was in distress. Technology jobs timeline. In the 1990s, technology became a larger part of everyday life. As personal and business use of computers and the Internet grew, so did demand for IT services. Employers hired IT workers at a rapid pace throughout the decade to meet this demand.

Then, in 2001, employment in IT services began to decline. Studies suggest that many students believed that this decline would be permanent. Students feared that demand for IT services would fall, resulting in poor job prospects for IT workers. And when reports of IT off shoring became widespread, students began to believe that a significant number of technology jobs were being moved abroad.

Enrollment in computer-related majors fell. However, Current Population Survey data show that these concerns were largely unfounded. Overall, employment in IT occupations grew by about 8 percent between 2001 and 2007. In 2001, IT employment reached about 3.54 million workers.

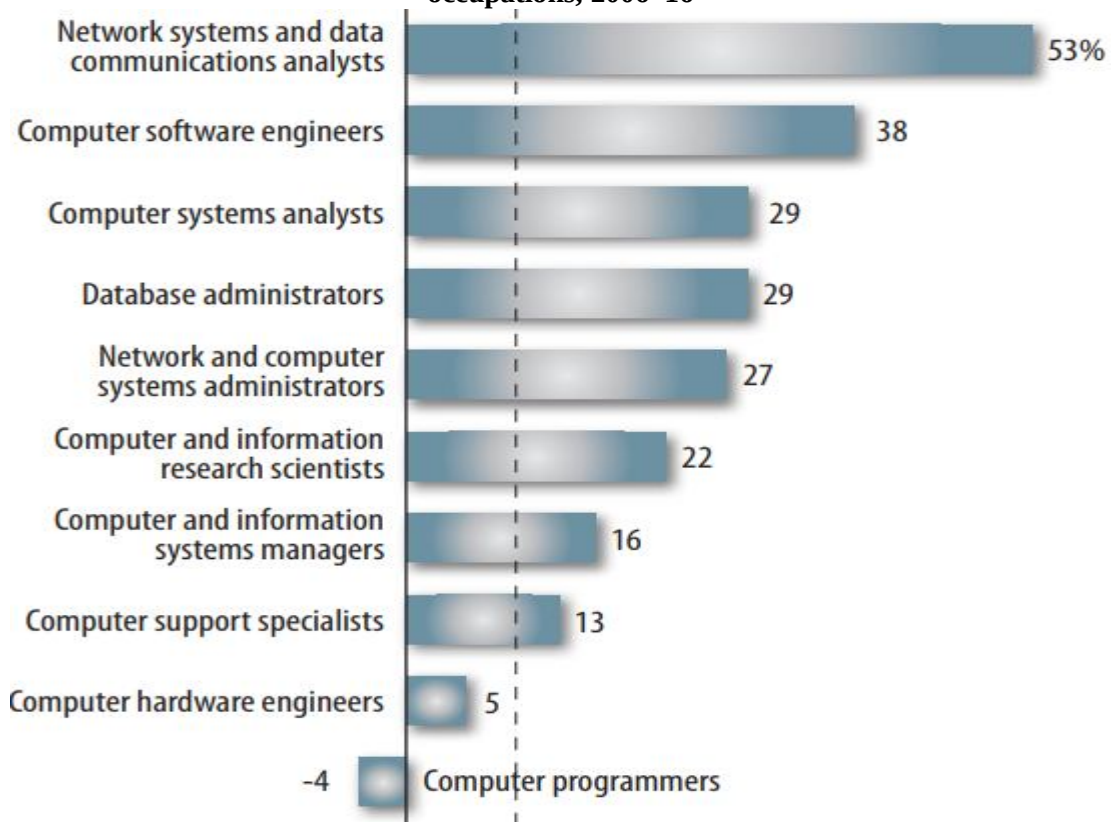
In 2002, that number dipped to about 3.37 million. This decline was at least partly the result of the downturn in Internet-related ventures. But in 2003, employment began to increase again, and by 2006 there were more IT workers in the United States than the previous high in 2001. Employment continued to go up, reaching 3.84 million workers in 2007. As these data show, the demand for IT workers continued to increase over time, despite off shoring. An analysis of the factors affecting employment helps explain why.

1.13 Factors affecting employment

Recent IT employment patterns have varied by occupation. This variation is a result of several factors, including demand for certain IT services, increasing efficiency in particular fields, and different susceptibilities to off shoring. For example, employment of database administrators, computer and information systems managers, and computer software engineers all grew by 22 percent or more between 2001 and 2007. Computer scientists and systems analysts, network and computer systems administrators, and network and data communications analysts also saw employment growth, with increases between 8 and 16 percent over the same period.

Employment in some occupations did fall, however. Computer programmers and computer support specialists, for example, both saw job losses of more than 6 percent. These two occupations are more susceptible to off shoring than other IT occupations, according to BLS, because their tasks are routine, can be done by telephone or over the Internet, require little interaction with other types of workers, and require little familiarity with the cultural practices of customers.

Graph no-1.2: Percent change in employment of information technology (IT) workers, by selected occupations, 2006–16



Although off shoring may have contributed to job losses in those occupations, it is likely that other factors also played a part in their employment declines. For example, some programming and support functions that were previously performed by IT workers have been automated. This automation has lowered demand for workers in these occupations, resulting in job losses.

Apart from those two occupations, off shoring's impact on technology jobs has probably been limited. A report by the Association for Computing Machinery states that in previous years, IT jobs in which workers need comparatively lower levels of skill such as programmers and support specialists were the primary focus of off shoring efforts; meanwhile, other occupations that require higher level skills were largely unaffected.

1.14 Preparation for IT careers

There are many paths. Having both general and specific skills is helpful. But for many jobs, formal training is essential. During the technology boom of the 1990s, workers with no more than a high school diploma reportedly could land a high-paying job in a wide array of computer occupations. Now, however, most employers prefer applicants who have at least a bachelor's degree. Certification, which may be required in some jobs, is also available.

- **Skills**

A general foundation, such as ease with computers and a curiosity about how they work, is important for working in IT. And several specific skills may be helpful for a variety of IT occupations, especially for those that are expected to remain in demand. Among these skills is business aptitude and proficiency in wireless networking; knowledge of information security also is recommended. In addition, problem-solving skills and attention to detail are essential in all areas of IT. Students can begin gaining some of these skills as early as high school.

Business aptitude is useful as profitability, project management, and cost-benefit analyses increasingly become the responsibility of a number of IT workers, such as computer and information systems managers. High school classes in mathematics are helpful for establishing a strong foundation for IT training and for business-related subjects ranging from accounting to finance.

As technology improves, and cell phones and other wireless devices gain networking capabilities, people increasingly seek access to the Internet. As demand for mobile access continues to grow, workers who are proficient in wireless networking will be in high demand. Workers in this area need to be detail oriented to effectively design, install, and maintain wireless networks and systems. Protecting information systems and data from the threat of cyberspace criminals is important to businesses and other organizations. Specialized training prepares IT workers to gain expertise in security issues.

- **Degrees**

A bachelor's degree is the usual minimum qualification for many IT jobs. Many entry-level software engineers and computer systems analysts, for example, are required to have a bachelor's degree. Those who do the most complex tasks may need a master's degree. In 2007, according to BLS, almost 70 percent of IT workers had a bachelor's or higher degree.

The most applicable degrees for IT jobs are those in computer science, computer engineering, software engineering, or information systems. But many other types of degrees can lead to a career in information technology. According to the National Science Foundation's 2006 science and engineering workforce surveys, almost 66 percent of IT workers indicated that their highest degree was in a field other than computer and information sciences. These fields included management, electrical and computer engineering, mathematics, and arts and humanities. Not all IT workers need a bachelor's degree, however. One example is computer support specialists. Jobs in this occupation may be open to applicants who have a high school diploma, some college, or an associate degree.

- **Certification**

Certification demonstrates a level of proficiency in a product or subject. Certification programs usually require candidates to take a test or a series of tests; a passing score represents to employers an IT applicant's or worker's knowledge and skills. Some programs allow candidates to study on their own for these tests, and others offer test preparation courses. Certification is offered by IT product vendors and professional organizations. IT product vendors generally offer certification in the computer software or hardware they produce. Some vendors require certification for people who work with their products. Professional organizations offer voluntary certification programs in a broad range of subjects. Popular topics include wireless networking and information security. Before entering such programs or paying any fees, workers should research the program to determine its reputation within the IT community.

- **Future prospects**

Every 2 years, the BLS Occupational Statistics and Employment Projections program produces long-term employment projections for occupations, industries, the labor force, and the overall economy. Data from the most recent set of projections indicates that the outlook for technology jobs is relatively bright. Employment in combined IT occupations is expected to increase by more than 800,000 jobs over the 2006–16 projections decade. This increase represents expected job growth of 24 percent compared with 10 percent growth for all occupations.

So, opportunities should be plentiful for workers who hope to enter the IT field. IT workers are needed in nearly all types of organizations, from retail establishments to manufacturing plants. As IT operations expand across the economy, demand for IT workers should expand along with them. Although off shoring is likely to continue, BLS research suggests that job opportunities in information technology will continue to be excellent. And a study by the Association for Computing Machinery finds that even though off shoring may increase, prospects for IT workers in the United States will be strong.

Employment in several IT occupations is expected to grow especially fast over the 2006–16 decade. With a projected employment increase of 53 percent more than 5 times the rate for all occupations network systems and data communications analyst is projected to be the fastest growing IT occupation. It's also projected to be the fastest growing of all occupations in the United States. As businesses and other organizations continue to adopt newer, more efficient computer networks, these workers will be in high demand. But one occupation is expected to see employment declines. Employment of computer programmers is to decrease by 4 percent from 2006–16. Continued off shoring in this occupation, as well as increased efficiency, will reduce demand for programming services during the projections decade.

1.15 IT labor growth

It's a strategy described as digital transformation. Organizations that are successfully executing this strategy use automation and information technology to improve existing business processes and create new business opportunities.

The year 2016 will reveal the state of digital transformation. business leaders launching their organizations on the path they'll take through the next few decades, or they instead scrambling to keep up appearances and remain moderately competitive.

The strategy of digital transformation will test whether the platforms in place today become part of the future, or relics of the past. As information technology represents a growing share of the global economy, this report tracks both the causes and the implications of this trend, for IT markets in the U.S. and the world as a whole.

1.16 IT labor growth is robust

Posted job notices in the U.S. IT field grew in 2015 by an annual rate of nearly 40%, although the posting rate for Q4 2015 had declined over the previous quarter. For December 2015, according to the Bureau of Labor Statistics, U.S. unemployment in the IT sector remained at a steady low of 2.6%, well below the general rate.

- **IT industry confidence remains solid**

IT Industry Business Confidence Index for the second quarter of 2016 to climb to historically high levels. As it stood in Q1 2016, the BCI was just a fraction of a point off its all-time high, at 64.0 points. From there, however, the Index began a slight downward tick, to 63.1 points in Q2, and then another 1.7 points to 61.7 in Q3.

- **Cloud computing is still the driving force**

In just a few years' time, hybrid cloud has become the principal infrastructure model of the world's data centers. With cloud resources such as computing power and bandwidth having already become commoditized, a new IT economy is taking shape around them, just as the industrial revolution was made feasible by ubiquitous energy. Nearly all the other trends in the IT sector are actually triggered by the cloud: for instance, the rise in demand for real-time analytics, the reconsideration of security models, and the industry refocusing on software and hardware above hardware as the principal growth driver.

1.17 IT Industry and IT Workforce Overview

According to the research consultancy IDC, the global information technology (IT) industry market, encompassing hardware, software, services, and telecommunications, is expected to reach $3.8 trillion in 2016, up from $3.7 trillion the previous year. The U.S. market accounts for approximately 28% of the total, or slightly more than $1 trillion. Over the past decade, the biggest shift in global industry allocations stems from growth of the Asian region, fueled primarily by the rise of China.

The IT channel plays an integral role to facilitating the flow of information technology goods and services from producer to customer. The channel ecosystem, consisting of solution providers, MSPs, VARs, vendors, distributors, cloud service providers, and more, work in concert to supply and support customers' technology needs. Estimates suggest upwards of two-thirds of IT products and services sold to U.S. businesses flow through or are influenced by indirect channels in some way.

There are two distinct elements of the IT workforce:

1) Employment in the IT sector, and

2) IT occupations spanning all industry sectors. In the aggregate, the U.S. IT sector employs an estimated 5.9 million workers in technical (e.g. software developers, network administrators, etc.) and non-technical (e.g. HR, finance, marketing) positions.

The second element of the IT workforce, IT occupations, consists of an estimated 5.04 million workers as of yearend 2015 found in IT departments across businesses in every industry sector of the economy. Based on how 2015 data is tracking, the year could record the highest IT job growth rate in over a decade.

1.18 The Information Technology (IT) Industry

The term technology commonly refers to society's application of scientific knowledge to solve practical problems in industry or commerce. Technological innovation, or the application of technology, takes many forms and often involves the interplay of expertise across multiple disciplines and industry verticals. One framework for categorizing technology entails the use of five distinct groupings.

Each segment of this technology framework has contributed to economic growth and the well-being of society. The magnitude of advances in medicine, transportation, safety, manufacturing, agriculture, media and communication are almost difficult to comprehend.

Since the turn of the millennium though, the one segment that arguably has had the greatest impact on businesses, consumers and other industry sectors is information technology (IT).

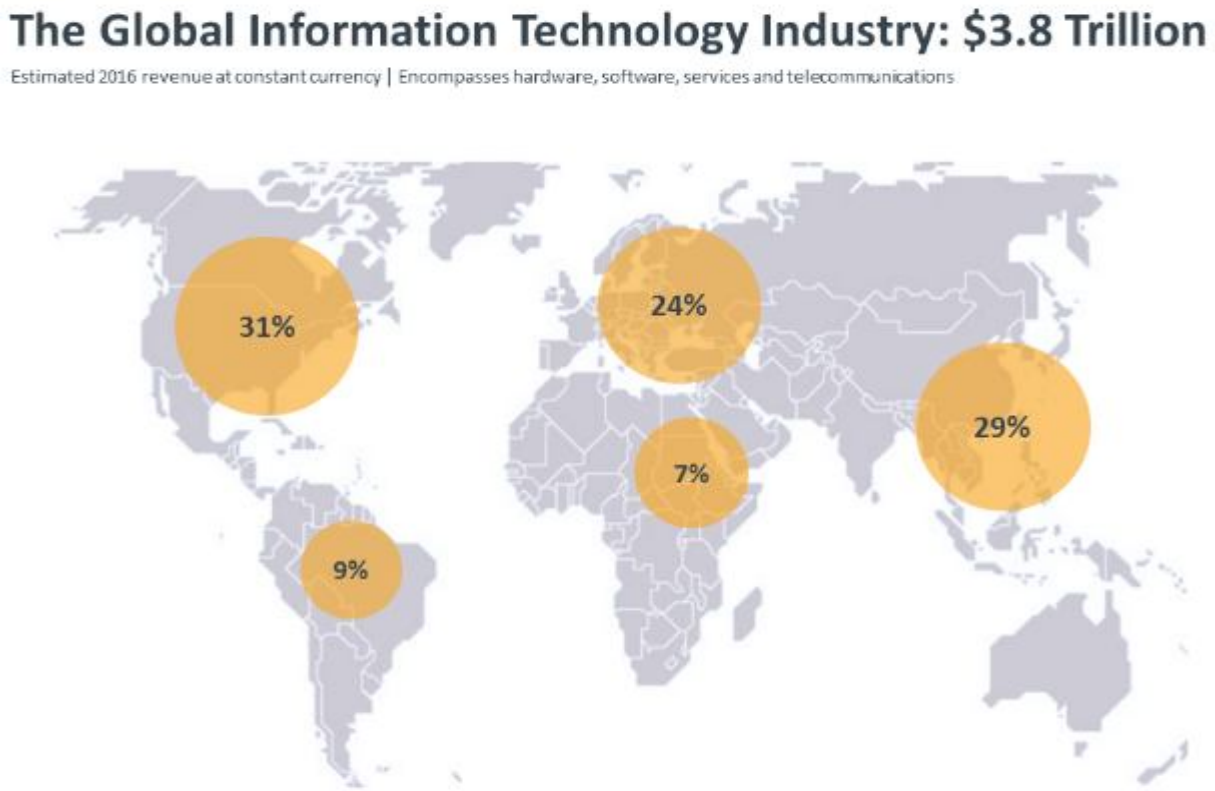
Information Technology (IT) can be defined as the utilization of computing via hardware, software, services and infrastructure to create, store, exchange and leverage information in its various forms to accomplish any number of objectives. Additionally, the term encompasses the workers that develop, implement, maintain and utilize information technology directly or indirectly.

- **Sizing the Information Technology (IT) Market**

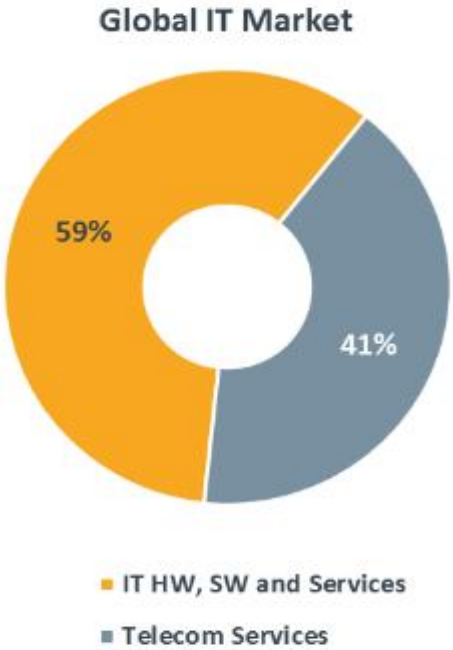
According to the research consultancy IDC, the global information technology (IT) market surpassed $3.7 trillion in 2015 and is on track to reach $3.8 trillion in 2016 (constant currency). This covers revenue generated from hardware, software, IT services, and telecommunications.

The vast majority of spending stems from information technology industry purchases made by business or enterprises, with a small portion coming from consumer spending. With the increasing blurring of work and personal life, especially in the SMB space, along with the BYOD phenomenon, it is difficult to classify certain types of technology purchases as being solely business or solely consumer.

The U.S. market represents about 28% of the worldwide total, or slightly over $1 trillion. Over the years, market proportions have gradually shifted due to the emergence of rapidly growing markets in Asia, Latin America, and Africa.



Breaking the IT market down into its core components provides a mechanism to better understand industry dynamics. On a global basis, the hardware, software and services categories – core IT, account for 59% of the industry, with telecom services accounting for the remaining 41%.



Graph no-1.3: Global IT Market

The allocation of spending tends to vary from country to country. Some markets may be relatively immature in the traditional categories of computers and software, and yet relatively advanced in the areas of mobility and wireless communication. As result, their spending allocation may skew towards telecom and data services, while they play “catch□up” n the other categories.

Conversely, the U.S. information technology market features a large installed base of hardware, software and services. Not that telecom services are unimportant in the United States, but rather, the spending on the aforementioned categories is much higher relative to the global benchmark. In the U.S. market, IT services and software capture larger shares compared to the global market: 25% vs. 18% and 21% vs. 12%, respectively.

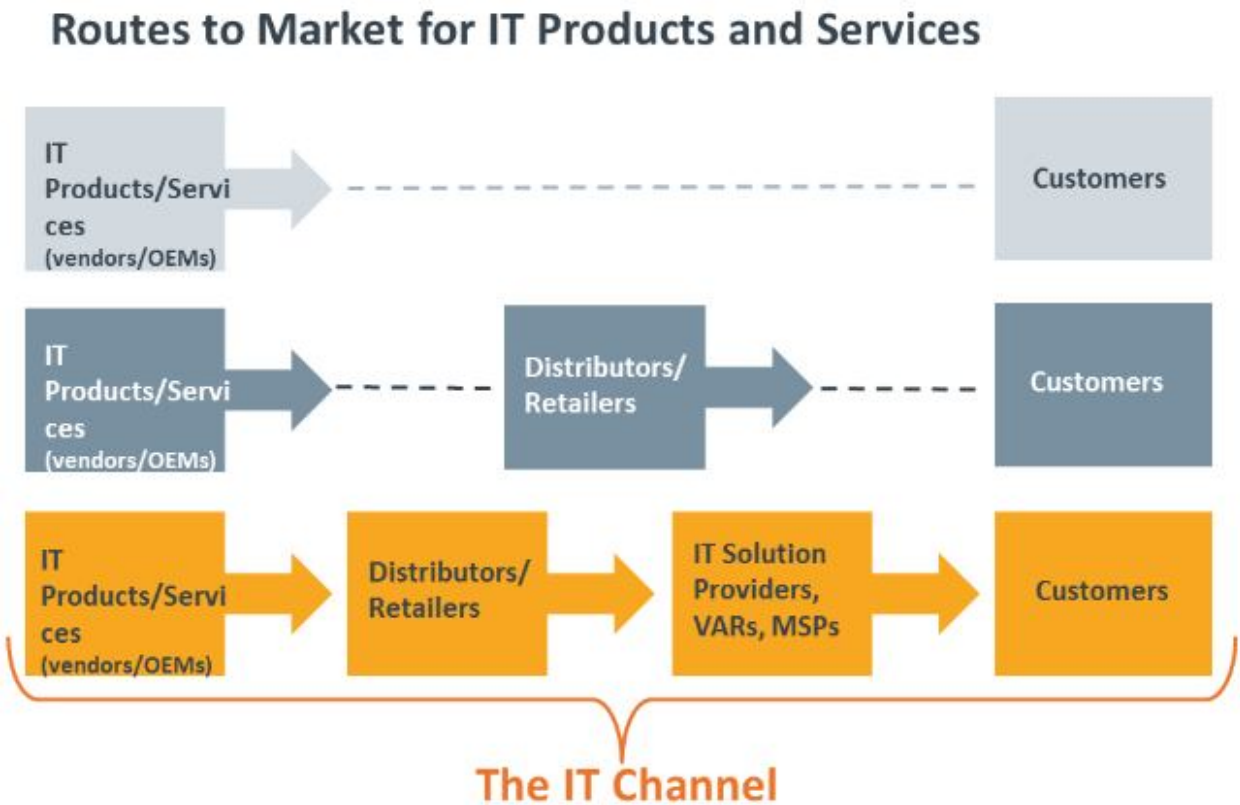
Within each category several dynamics may be at play that affects the ratios. In hardware, for example, as the number of units increases and manufacturers reach economies of scale, prices tend to fall. As prices fall the product may attract more buyers, which helps offset the lower average per-unit price. At some point, however, the total revenue generated for the product plateaus and eventually enters a period of decline. Because the ratios in the chart above are revenue-based, categories prone to pricing pressure can lose share, even when turning over high volumes.

When considering the IT market, it is worth taking note that other sectors are steadily incorporating more information technology elements (e.g. IoT farm equipment), blurring the lines between the IT sector and other industries.

- **Defining the IT Channel**

Every industry sector across the economy has a distribution mechanism to connect customers to products and services. While some producers or manufacturers of goods sell direct to customers, most rely on intermediaries, or indirect channels, that can more efficiently or effectively deliver products and services to customers.

Graph no-1.4: Routes to market for IT Products and services



In the information technology sector, this mechanism is referred to as the IT channel. As depicted in the chart to the right, technology vendors or OEMs develop a product, which may then flow through a distributor and/or a value added reseller (VAR) before reaching the customer.

Among those outside the IT industry, it is not uncommon to wonder why vendors do not simply sell directly to customers. In some cases, vendors do sell directly to customers. A small software vendor may sell direct to customers via the software-as-a-service model. Or, a hardware vendor may sell a large order of servers

for a datacenter directly to an enterprise level customer. In many cases, though, vendors see value in working through their channel partners. Estimates suggest upwards of two-thirds of core IT products flow through or are influenced by indirect sales channel.

- **Defining the IT Workforce**

There are two distinct elements of the IT workforce:

1) Employment within information technology companies, and

2) IT occupations.

- **IT Occupation Employment**

Includes technical occupations, such as software developers, network engineers, computer support specialists, etc. working in a range of industry verticals, such as healthcare, education, manufacturing, professional services and others.

Beyond core IT occupations, there are a range of technology-intense positions on the periphery, typically referred to as knowledge workers.

- **IT Industry Employment**

Includes technical occupations, such as software developers, network engineers, computer support specialists, etc. Includes non-technical professions, such as sales, marketing, HR, finance, operations and general management that support and facilitate the operation of IT companies.

Typically, technical positions account for 25% to 75% of an IT company's workforce. There are a number of factors that affect this rate. For example, a start-up may initially be comprised of nearly all software architects, programmers and other technical workers. When firms scale, they may add sales and marketing staff, thereby reducing the percentage of technical workers.

- **IT Occupation Employment**

The information technology industry workforce employed an estimated 5.04 million workers as of year-end 2015. This translates to job growth of 3.1%, or nearly 152,000 additional IT jobs. If this rate holds upon the final tally of 2015 data, it will be the highest annual growth rate for IT jobs in over a decade.

IT occupation employment spans every industry vertical. For example, the IT department within a hospital will employ a range of senior, mid and staff level IT workers to ensure physicians, nurses and administrators have reliable access to computers, networks, applications and so on.

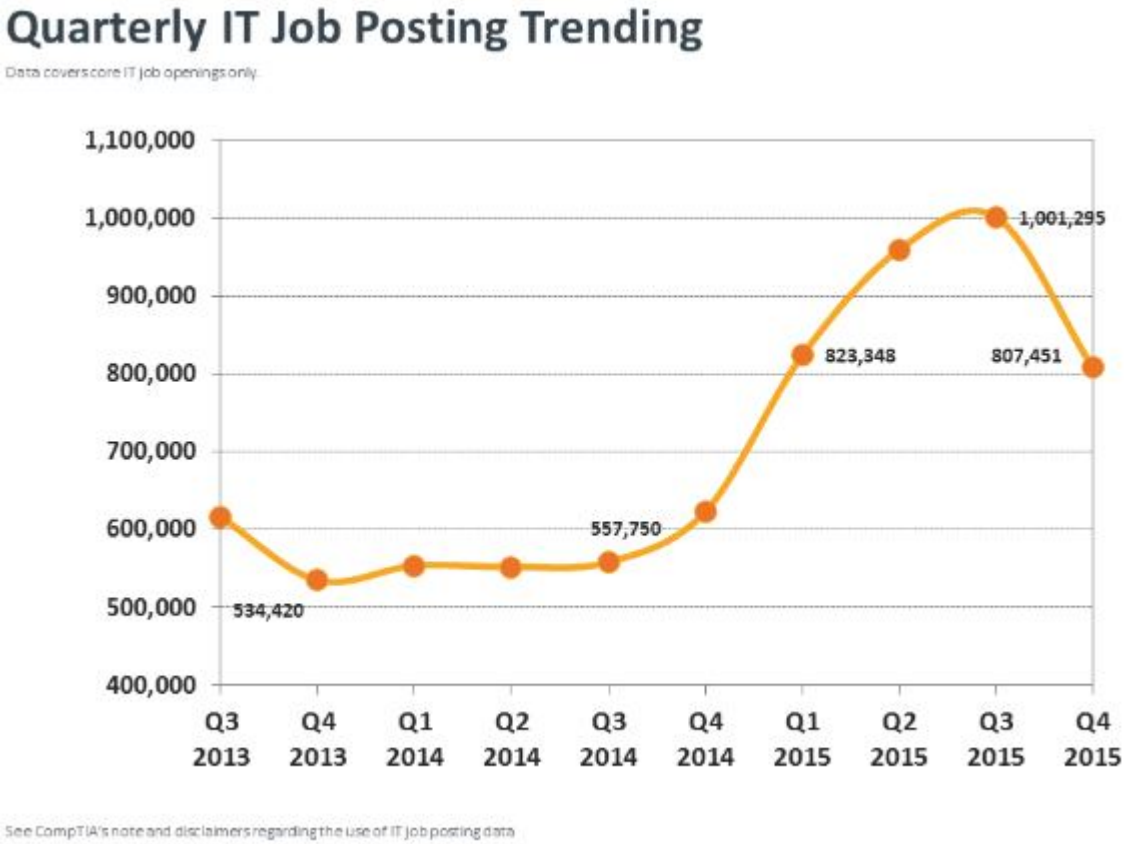
- **Top IT Growth Occupations**

1. Cyber security Analysts
2. Web Developers
3. Software Developers, Applications
4. Software Developers, Systems Software
5. Systems Analysts
6. IT Support Specialists
7. IT Managers / Directors / CIOs

In addition to core IT positions, there are many technology-intense occupations on the periphery. For example, occupations such as IT project management, health information technicians, audio/video technicians, technical sales, technical writers, automated manufacturing computer operators and IT training positions, all require significant expertise and experience with various aspects of technology. While these positions are not typically found in an 'IT Department' they are an important component of the IT workforce. Depending on the criteria used, peripheral or knowledge worker-type positions may number between 1 million and several million additional workers.

Because the need for technology is so pervasive among businesses of all types, it follows that information technology industry jobs are spread across every region of the country. While tech clusters do exist think Silicon Valley or Silicon Alley, with high concentrations of IT workers, many unassuming regions have large numbers of IT workers as well. For example, more than 325,000 IT workers can be found in the Mountain states region.

Graph no-1.5: Quarterly IT job posting trending



The unemployment rate for the BLS computer and mathematical occupation category, a reasonable approximation of IT occupations, continues to remain far lower than the national rate. For December 2015, the category recorded an employment rate of 2.6%, about half the national rate. This recent percentage is in line with the 2014 average rate of 2.6%.

The low unemployment rate for information technology industry workers combined with strong demand for certain skill sets can make for a challenging hiring environment. A majority of IT company executives confirm a challenging or very challenging hiring environment for technical positions.

According to Burning Glass Technologies Labor Insights, U.S. businesses posted job notices for approximately 807,450 core IT jobs during Q4 of 2015, an increase of 39% over Q4 2014.

As indicated previously, the total core IT occupation workforce increased by an estimated 151,200 jobs in 2015. This explains a portion of the job posting data. Companies may be expanding or moving into new areas and need to employ more workers.

The other factor at play is workforce churn, also referred to as labor turnover. This may include separations due to workers that retire, leave to pursue other employment opportunities, leave to pursue additional education, leave for family reasons, or are fired or laid-off. This helps explain why the number of job postings exceeds the number of new IT jobs created.

Job posting data is a useful, but an imperfect proxy for job demand. Not every posting translates to a new job; hiring firms may change their plans, post multiple times for the same job, hire internally, and try different approaches to find the right candidate and so forth. Also, one ad may be posted for multiple

openings. Burning Glass Technologies Labor Insights addresses many of these issues, but not all. Additionally, within a time period, there may be situations where a worker is hired, the person isn't the right fit and is let go, and a firm starts the process over again. In the aggregate there is single position, but using job posting data, it may appear there are two positions.

1.19 Thesis Outline

Chapter **one** contains Introduction, Information Technology Jobs and Skill Standards, Skill Standards for Information Technology, Why Skill Standards?, Career Clusters, The IT Skills Pyramid, Common Elements across Clusters, Technical Skills, Employability Skills, Communication skills, Organizational skills, Team contribution and leadership, Professionalism, Critical thinking and decision making, Critical thinking and decision making, Self-directed and continuous learning, Future Trends in IT Skill Standards and Emerging Careers, E-Business and E-Commerce Careers, IT Outsourcing, Contracting, and Consulting, IT Specialists Versus Generalists, Nontraditional IT Degree Paths and Certifications, Employment Trends and training in Information technology, Meaning of IT workers, IT employment facts and fallacies, Factors affecting employment, Preparation for IT careers, IT labor growth, IT labor growth is robust, IT Industry and IT Workforce Overview, The Information Technology (IT) Industry etc. Next chapter is research Methodology.

Chapter **two** contains Research Methodology, Research Hypothesis, Research Objectives, The Purpose Of Research, Research Process, Research Plan and Limitations Of Study. Next chapter is General Trends in the IT Industry.

Chapter **three** contains General Trends In The IT Industry, Rapid technological developments, Industries Hiring IT Workers, IT Skills And Certifications, A strategic framework for skills development, Sustaining robust training policies and systems, Sharing knowledge and experience, A broad definition of training and skills, Benefits from adequate investment in good-quality education and skills, Widely agreed guiding principles linking skills and work, Sustaining relevance to the world of work and A Review of Technology Trends in India. Next chapter is IT Industry in India.

Chapter **four** contains the IT Industry In India, Market Size, Investments/ Developments and The growth of India's IT sector. Next chapter is Opportunities and Challenges for Training Institutes for Skills Development.

Chapter **five** contains Opportunities and Challenges for Training Institutes for Skills Development, Global trends, Demographic change, Educational attainment, Equity and inclusive growth, Globalization of markets, Technology and innovation, Climate change and transition to the green economy, Diverse realities, common and different challenges, Workers' qualifications in India Meeting today's and tomorrow's skills needs, A life-cycle perspective, Training and skills development strategies, Anticipating future skills needs, Labor market information and employment services, Training quality and relevance, Gender equality and Broad access to training. Next chapter is The Overall IT Job Market Context In India.

Chapter **six** contains The Overall IT Job Market Context In India, Overseas IT market, Trends in the Information Technology Labor Market in India compare to overseas, Meeting Potential Future Shortages, Newly Emerging Training Opportunities, Public and Private Responses to Tight Labor Markets for Skilled Workers, Using School-Career Initiatives Effectively, Developing Career Pathways, Integrate Work and School-Based Learning, Encourage Business-Government Partnerships, Encourage Employer-Sponsored Training and Improve Academic Achievement. Next chapter is Data Analysis & Interpretation.

Chapter **seven** contains Data Analysis & Interpretation, Background of Pune region (Study area), Data Analysis, Validity and Reliability, Hypothesis Testing and Summary Of Hypothesis testing.

Chapter **eight** consists of Finding, conclusion, suggestions and recommendations based of data collection and analysis.

CHAPTER - 2

RESEARCH METHODOLOGY

2.1 Research Hypothesis

H1: There is significant relationship between the skill set of students and employability.

H2: There is significant relationship between the conventional education system and lack of skill set responsible to cope up with the emerging need in IT industry

H3: There is a significant difference between the perception of industry and academic about the employability skills of IT students.

H4: There is a significant relationship between 'industry- academic collaboration' and creating employable talent pool of trained and skilled IT professional

H5: There is a significant relationship between 'Simulating Work Experience' and enhancing skill set to face the real business world.

H6: There is a significant relationship between skilled, industry-ready candidates and growth of IT industry.

H7: There is a significant relationship between enhancing the skills of trainer and creating employable talent pool of trained and skilled IT professional

2.2 Research Objectives

1. To evaluate the progress made by the IT industry in India since its inception especially in the global market.
2. To identify the risks and constraints faced by Institutes and it's preparedness to overcome problems and challenges before them with special reference to the skilled staff.
3. To identify the requirements of Indian IT industry as regards to the skilled and trained technical staff.
4. To find out scope for the development of Talent Pool in Indian IT industry.

2.3 Research Methodology

It is necessary to follow a systematic methodology for any scientific research work. This chapter contains an outline of the methodology and research design. There are many potential choices to make when developing a research design. It is about the best way to collect and organize data for individual research in order to achieve research objectives and aims. These of course vary depending on theoretical orientation and the timeframe allowed carrying out the research.

What is Research?

The word research is derived from the Latin word meaning to know. It is a systematic and a replicable process, which identifies and defines problems, within specified boundaries. It employs well-designed method to collect the data and analyses the results. It disseminates the finding to contribute to generalize able knowledge.

The five characteristics of research are:

- **Systematic** problem solving which identifies variables and tests relationships between them
- **Logical**, so procedures can be duplicated or understood by others
- **Empirical**, so decisions are based on data collected
- **Reductive**, so it investigates a small sample which can be generalized to a larger population
- **Replicable**, so others may rest the findings by repeating it.

The Scientific Method

According to Smith & Glass (1987) there are seven steps involved in the Scientific Method.

Step 1 : A theory about the phenomenon exists.

Step 2 : The researcher detects a research problem within the theory and develops a research question for investigation.

Step 3: A research hypothesis is deduced from the propositions in the theory. The research hypothesis is a statement about the relationship between constructs.

Step 4: The researcher determines the operations (specific procedures or methods) by which the constructs will b defined and states a hypothesis that can be tested statistically. This hypothesis is called the null hypothesis. A research design is developed as a plan for implement ting the operations and testing the null hypothesis. These operations, the null hypothesis, and the design make up the guidelines for the study.

Step 5: The researcher conducts the study according to the guidelines.

Step 6: The null hypothesis is tested based on the data from the study.

Step 7: The original theory is revised or supported based on the results of the hypothesis testing.

2.4 The Purpose of Research

Each of the following objectives has an important role in research and science.

- Exploration is especially important in the early stages of research to generate concepts and theories that can be further tested later. It gets research started; it gives researchers the direction.
- Description is carried out, to some degree, in every research study; it provides needed information and helps understand exactly what one is looking at.
- Explanation is important because it studies causes and effects and it involves testing and improving theories (i.e., our explanations).
- Prediction is common in the mature sciences, and helps us to improve our world by predicting what will happen. Predictions can be followed with interventions to help prevent the negative outcomes. For positive predictions, one wants to do whatever leads to the positive predictions.
- Influence is the ultimate goal of research as we strive for social betterment and improvement of our world; in education, influence comes about through the implementation of demonstration programs to show what works and then later through changes in educational policies to have a broader social impact.

TYPES OF RESEARCH

The basic types of research including surveys and fact - finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present. In social science and business research we quite often use the term Ex post facto research for description research studies. The main characteristic of this method is that the researcher has no control over the variables; he can only report what has happened or what is happening. Most ex post facto research projects are used for descriptive studies in which the researcher seeks to measure such items as, for example, frequency of shopping, preference of people, or similar data. Ex post facto studies also include attempts by researcher to discover causes even when they cannot control the variables. The methods of research utilized in descriptive research are survey method. In analytical research, on the other hand, the researcher has to use facts or information already available and analyze these to make a critical evaluation of the material.

With reference to these subjects chosen both Ex post facto studies and Analytical research have been carried out.

Applied vs. Fundamental Research

Research can either be applied (or action) research or fundamental (or basic or pure) research. Applied Research aims at finding a solution for an immediate problem facing a society or an industrial / Business organization, whereas fundamental research is mainly concerned with generalizations and with the formulation of a theory. “Gathering knowledge for knowledge's sake is termed as 'pure' or "research'. Research concerning some natural phenomenon or relating to pure mathematics are examples of fundamental research, similarly, research studies, concerning human behavior carried on with a view to make generalization about human behavior, are also examples of fundamental research aimed at certain conclusions (say, a solution) facing a concrete social, economic or political trends that may affect a particular institution or the copy research (research to find out whether certain communications will be read and understood) or the marketing research or evolution research are examples of applied research. Thus, the

central aim of applied research is to discover a solution for some pressing practical problem, whereas basic research is directed towards finding information that has a broad base of application and thus, adds to the already existing organized body of scientific knowledge.

3. Quantitative vs. Qualitative

Quantitative research is based on the measurements of quantity or amount. It is applied to phenomena that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e. phenomenon relating to or involving quality or kind. For instance, when we are interested in investigating the reasons for human behavior (i.e. why people think or do certain things.) We quite often talk of Motivation Research', an important type of qualitative research. This type of research aims at discovering the underlying motives and desires, using in depth interview for the purpose. Other techniques of such research are word association tests, sentence competition test, story competition tests and similar other projective techniques. Attitude or opinion research i.e., research designed to find out how people feel or what they think about a particular subject or institution is also qualitative research. Qualitative research is especially important in the behavioral sciences where the aim is to discover the underlying motives of human behavior. Though such research we can analyze the various factors which motivate people to behave in a particular manner or which make people like or dislike a particular thing. It may be stated, however, that to apply qualitative research in practice is relatively a difficult job and therefore, while doing such research, one should seek guidance from experimental psychologists.

Applicable and related qualitative and quantities study has been carried out during this research.

4. Conceptual vs. Empirical

Conceptual research is that related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones. One the other hand, empirical research or observation alone, often without due regard for system and theory. It is data based research, coming up with conclusions which are capable of being verified by observation or experiment. We can also call it as experiment type of research. In such a research it is necessary to get at facts firsthand, at their source and actively to go about doing certain things to stimulate the production of desired information. In such a research, the researcher must first provide himself with a working hypothesis or guess as to the probable results. He then works to get enough facts (data) to prove or disprove his hypothesis. He then sets up experiment designs which he thinks will manipulate the person or the materials concerned so as to bring forth the desired information. Such research is thus characterized by the experimenter's control over the variables under study and his deliberate manipulation of one of them to study its effects. Empirical research is appropriate when proof is sought that certain variables affect other variables in some way. Evidence gathered through experiments or empirical studies is today considered to be the most powerful support possible for a given hypothesis.

5. Some other type of Research

All other types of research are variations of one or more of the above stated approaches, based on either the purpose of research or the time required to accomplish research or the environment in which research is done, or on the basis of some other similar factor. From the point of view of time, we can think of research either as one time research or longitudinal research. In the former case the research is confined to a single time period, whereas in the latter case the research is carried on over several time periods. Research can be field setting research or laboratory research or simulation research, depending upon the environment in which it is to carry out. Research can as well be understood as clinical or diagnostic research. Such research follows case study method or in-depth approaches to reach the basic causal relations. Such studies usually go deep into the causes of things or events that interest us, using very small and very deep probing data gathering devices. The research may be exploratory your it may be formalized. The objective of exploratory research is the development of hypotheses rather than their testing, whereas formalized research studies are those with substantial structure and with specific hypothesis to be tested. Historical research is that which utilizes historical sources like documents, remains etc. to study events or ideas of the past, including the philosophy of persons and groups at any remote point of time. Research can also be classified as conclusion - oriented and decision-oriented. While doing conclusion oriented research a researcher is free to pick up a problem, redesign the enquiry as he proceeds and is prepared to conceptualize as researcher wishes. Decision

- oriented researcher is this case is not free to embark upon research according executive departments with a quantitative basis for decisions regarding operations under their control.

2.5 Research Process

Before embarking on the details of research methodology and techniques, it seems appropriate to present a brief overview of the research process. Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps. The chart will illustrate a research process.

The chart indicates that research process consists of a number of closely related activities as shown through I to VII But such activities overlap continuously rather following a strictly prescribed sequence. At times, the first step determines the nature of the last step to be undertaken. If subsequent procedures have not been taken into account in the early stages, serious difficulties may arise which may even prevent the completion of the study. One should remember that the various steps involved in a research Process are not mutually exclusive. Or they are separate and distinct. They do not necessarily follow each other in any specific order and the researcher has to be constantly anticipating at each step in the research process the requirements of the subsequent steps. However the following order concerning various steps provides a useful procedural guideline regarding the research process;

1. Formulating the research problem,
2. Extensive literature survey,
3. Developing literature survey,
4. Preparing the research design,
5. Determining sample design,
6. Collecting data,
7. Execution of the produce,
8. Analysis of data,
9. Hypothesis testing
10. Generalizations and interpretation, and
11. Preparation of the report or presentation of the results, i.e. formal write - up of conclusions reached.

Criteria of Good Research

Whatever may be the type of research works and studies, one thing that is important is that they all meet on the common ground of scientific method employed by them one expects scientific research to satisfy the following criteria.

1) The purpose of the research should be clearly defined and common concepts be used.
2) The research procedure used should be described in sufficient detail to permit another researcher to repeat the research for further advantage, keeping the continuity of what has already been attained.
3) The procedural design of the research should be carefully planned to yield results that are as objective as possible
4) The researcher should report with complete frankness, flaws in procedural design and estimate their effects upon the findings.
5) The analysis of data should be sufficiently adequate to reveal its significance and the methods of the data should be checked carefully.
6) Conclusions should be confined to those justified by the data of the research and limited to those for which the data provide an adequate basis.
7) Greater confidence in research is warranted if the researcher is experienced, has a good reputation in research and is a person of integrity.

In other words, we can state the qualities of a good research as under.

1. **Good research is systematic:** It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules. Systematic characteristic of the research does not rule out creative thinking but it certainly does reject the use of guessing and intuition in arriving at conclusion.
2. **Good research is logical:** This implies that research is guided by the rules of logical reasoning and the logical process of induction and deduction are of great value in carrying out research. Induction is the process of reasoning from some premise to a conclusion which follows from that very premise. In fact, logical reasoning makes research more meaningful in the context of decision making.
3. **Good research is empirical:** It implies that research is related basically to one or more aspects of real situation and with concrete data that provides a basis for external validity to research results.

4. **Good research is replicable***:* This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

2.6 Research Plan

Data Collection

It is necessary to design a suitable methodology for understanding systematic and scientific study. The study is exploratory, descriptive as well as casual. The methodology designed for this research work is as following:

Data Collection: Data is collected through Primary Data Sources and Secondary Data Sources. Primary Data Sources are collected specifically for the purpose of research study, which is to be done, and secondary data source are already collected data, with some other objective.

Questionnaire: A formal list of Questions is formulated and asking the questions from the people who are having the related information. Here the Questionnaire is Structured and Non Disguised Type. Close end Questionnaire with Dichotomous and Multiple Choice Questions. Research design depends on type of research studies that we are going to make. Both Descriptive and exploratory research was used in compiling this study.

Secondary Data Source

Sources: On-Line Information from web sites, local Reports, official reports, records, books and journals, Annual report published etc.

ii) **Sampling Design**

Universe of the study

The universe selected for the study is Pune region.

Population: The target population for this study was the IT companies - Head or senior managers. Students are selected from various Technical Institute, who are providing degree diploma on IT related subjects and Teachers are selected who are working in various computer institutes on different grades like Trainer and tutor etc were selected.

Sample Size

Two questionnaires are prepared for studying the training institutes for creating talent pool of trained and skilled it professional to cope up with the emerging need in IT industry – challenges and potentials.

Total sample size: 465

Sampling Unit	Respondent
IT companies	118
Student	183
Teachers	164
Total	465

Sampling is done with the help of stratified random sampling.

iii) Tools of Research

Pre-designed questionnaire and pre-structured interview schedules shall be canvassed for collecting primary data for studying the training institutes for creating talent pool of trained and skilled it professional to cope up with the emerging need in IT industry – challenges and potentials. The questionnaire will be subjected to validation.

2.7 Limitations of Study

The key limitation of the study had been frequent change of opinions of the primary respondents. A few factors that limit the study are due to their response itself.

- Answer to questions might not be consistent.
- It is difficult to find respondent who take their decisions by their own and stick to it, they always influenced with the other factors, like friends, relatives
- The universe of study is limited to Pune region. Though the region has a very cosmopolitan population mix, it may not be the exact representation of the global.
- Sample size restricted which might limit the study to one particular region.
- Respondents are seems to be bias to the particular answer.
- Minds of the respondents are changing by the changes in environment.

CHAPTER – 3

GENERAL TRENDS IN THE IT INDUSTRY

3.1 Rapid technological developments

Rapid technological developments have led to a diffusion of information technology, and that has translated into an increased demand for IT workers across all industries and all sectors. In 2011, approximately 4.8 million people nationally were employed in IT jobs, with an estimated average 177,550 jobs open annually. Between 2011 and 2016, IT occupations are projected to grow by 8 percent. In 2010, 63 percent of IT workers were aged between 25 and 44 years old, and men held 77 percent of IT jobs. IT workers could be found across industries, with a substantial number employed at administrative and support services companies, financial institutions, insurance companies, government agencies, educational institutions, software publishers, telecommunications organizations, and health care organizations.

Table No-3.1: Continued General Trends In The IT Industry, 2011-2016

DESCRIPTION	2011 JOBS	2016 JOBS	% CHANGE	ANNUAL OPENINGS	2011 MEDIAN HOURLY WAGE	2011 JOB POSTINGS	EDUCATION LEVEL
Computer specialists, all other	225,543	237,778	5%	7,389	$34.49	829	Associate's degree
Computer hardware engineers	68,630	68,579	0%	2,450	$46.25	7,217	Bachelor's degree
Multimedia artists and animators	181,824	201,261	11%	7,972	$11.77	9,604	Bachelor's degree
Graphic designers	385,511	418,159	8%	18,479	$17.11	31,934	Bachelor's degree
Technical writers	51,404	55,281	8%	1,636	$28.31	23,517	Bachelor's degree
Audio and video equipment technicians	65,499	69,691	6%	2,840	$16.37	7,108	Postsecondary vocational award
Desktop publishers	30,220	28,650	(5%)	601	$15.24	1,225	Postsecondary vocational award
Total	**4,838,610**	**5,237,018**	**8%**	**177,550**	**$31.54**	**1,473,854**	

SOURCES: 2011-2016 Projections, Openings and Wage: EMSI Complete Employment-2011.4; 2011 Job Postings: Burning Glass, Labor Insight, Education Level: Integrated Postsecondary Education Data System (IPEDS)

Job postings data can also demonstrate labor market demand in real time that is, demand that can be pulled from employer job advertisements and analyzed daily. IT occupational demand nationally between 2007 through 2011 as measured by job ads data. In 2011, the data show an increase in the number of IT job postings. These data provide historical job posting trends by occupation.

Table No-3.2: Demand For IT Workers, 2007-2011

IT OCCUPATION TITLE	2007	2010	2011
Computer and information systems managers	14,479	10,999	14,328
Network systems and data communications analysts	56,838	51,736	69,083
Computer and information research scientists	1,940	1,651	1,775
Computer systems analysts	189,048	152,167	194,189
Computer programmers	335,584	340,658	374,282
Software developers, applications	231,701	216,438	285,931
Software developers, systems software	94,911	90,045	109,625
Database administrators	101,881	87,898	102,878
Network and computer systems administrators	115,167	95,675	120,271
Computer user support specialists	119,675	91,769	120,058
Computer hardware engineers	7,823	5,560	7,217
Multimedia artists and animators	9,045	8,588	9,604
Graphic designers	35,025	28,162	31,934
Technical writers	24,794	20,335	23,517
Audio and video equipment technicians	8,045	5,632	7,108
Desktop publishers	2,806	1,027	1,225
Computer occupations, all other	922	721	829

Table No-3.3: IT Employment Trends, 2007 Vs. 2009, By Occupation

DESCRIPTION	2007 JOBS	2009 JOBS	% CHANGE	ANNUAL OPENINGS	2007 JOB POSTINGS	2011 MEDIAN HOURLY WAGE
Computer and information systems managers	321,412	315,141	(2%)	8,611	14,479	$50.59
Computer and information scientists, research	29,150	29,790	2%	1,339	1,940	$44.57
Computer programmers	462,346	438,187	(5%)	11,751	335,584	$30.93
Computer software engineers, applications	534,386	536,003	0%	15,332	231,701	$39.72
Computer software engineers, systems software	419,110	416,747	(1%)	11,210	94,911	$42.28
Computer support specialists	583,168	565,114	(3%)	20,644	119,675	$20.90
Computer systems analysts	604,835	598,157	(1%)	21,244	189,048	$33.77
Database administrators	114,071	112,420	(1%)	3,264	101,881	$33.17
Network and computer systems administrators	357,440	353,902	(1%)	10,515	115,167	$31.48
Network systems and data communications analysts	377,848	386,293	2%	15,753	56,838	$27.26
Computer specialists, all other	217,314	219,779	1%	8,294	922	$34.49
Computer hardware engineers	70,467	66,910	(5%)	2,882	7,823	$46.25
Multimedia artists and animators	176,739	178,467	1%	7,041	9,045	$11.77
Graphic designers	407,808	386,999	(5%)	15,089	35,025	$17.11
Technical writers	51,690	50,361	(3%)	1,578	24,794	$28.31
Audio and video equipment technicians	67,337	65,303	(3%)	2,823	8,045	$16.37
Desktop publishers	35,765	31,818	(11%)	677	2,806	$15.24
Total	**4,830,885**	**4,751,392**	**(2%)**	**158,047**	**1,349,684**	**$31.54**

SOURCE: EMSI Complete Employment-2011.4

3.2 Industries Hiring IT Workers

In a report about IT workers, EMSI noted that IT jobs are spread across nearly every sector, complicating labor market analysis at the industry level. The data confirm that many IT occupations are in non-tech industries, as traditional LMI data show between 2011 and 2016. IT employment in the industries expected to fill the greatest amount of IT occupations over the next five years. In 2011, 55 percent of all IT job postings were in three industry sectors: professional, scientific, and technical services (30 percent); manufacturing (14 percent); and administrative and support and waste management and remediation services (11 percent).

Table No-3.4: Industries With The Highest Number Of IT Job Openings, Actual For 2011 And Projected For 2016

INDUSTRY	2011 JOBS (ACTUAL)	2016 JOBS (PROJECTED)	CHANGE	PERCENT CHANGE
Computer systems design services	567,189	665,450	98,261	17%
Custom computer programming services	556,081	634,416	78,335	14%
Corporate, subsidiary, and regional managing offices	220,427	230,709	10,282	5%
State government	186,110	195,267	9,157	5%
Local government	176,307	184,958	8,651	5%
Software publishers	175,025	197,995	22,970	13%
Data processing, hosting, and related services	116,430	134,699	18,269	16%

SOURCE: EMSI Complete Employment-2011.4

Table No-3.5: IT Job Postings By Industry Sector, 2011

INDUSTRY SECTOR	2011 JOB POSTINGS	PERCENTAGE OF TOTAL JOBS
Professional, scientific, and technical services	302,518	30%
Manufacturing	146,319	14%
Administrative and support and waste management and remediation services	109,393	11%
Information	88,231	9%
Finance and insurance	76,494	8%
Educational services	59,100	6%
Health care and social assistance	58,606	6%
Retail trade	51,446	5%
Public administration	34,694	3%
Transportation and warehousing	25,413	3%

SOURCE: EMSI Complete Employment-2011.4

3.3 IT SKILLS AND CERTIFICATIONS

Table No 3.6 In-Demand IT Certifications

1. Microsoft Certified Systems Engineer
2. Cisco Certified Network Professional
3. Help Desk Certification (e.g., Comptia)
4. Microsoft Certified Professional
5. Project Management Certification (e.g. PMP)
6. Certified Information Systems Security Professional
7. Cisco Certified Internetwork Expert
8. Microsoft Certified It Professional
9. Microsoft Certified Systems Administrator
10. Network+ Certification
11. Microsoft Certified Technology Specialist
12. Oracle Certification (e.g., Oracle Certified Associate)
13. Certified Information Systems Auditor
14. Java Certification (e.g., Sun Certified Java Associate)
15. Six Sigma
16. Microsoft Certified Solution Developer
17. Cisco Certified Network Associate
18. Database Administrator
19. Certified Public Accountant
20. Sap Certification
21. Vmware Certified
22. Cisco Certified Design Professional
23. Cisco Certified Voice Professional
24. Capability Model Maturity Integration Certification

SOURCE: Burning Glass Labor Insight

In a different approach to identifying in-demand skills, Computerworld polled 353 IT executives about their hiring plans for 2012. The results show that U.S. companies plan to invest in their IT workforces through summer 2012. Nearly 29 percent of respondents plan to hire new staff. The survey also identified new and emerging skills that employers are seeking. According to responses from IT employers, increases in the skills are due in large part to those needed in the development of mobile applications for the health care industry.

This is an example of a non-tech management skill required by the IT sector. Job postings data can tell jobseekers which nontraditional skills and credentials employers require. IT employers also require skill in networking and business intelligence; this is influenced by the fact that IT is found across organizations, industries, and workplaces.

Similarly, data center and Web 2.0 skills also emerged in both the survey and the job postings data. These types of skills are needed to support the visualization and cloud strategies of organizations. Cloud computing is a general term for anything that involves delivering hosted services over the Internet. Using job postings data, industry survey data, and traditional LMI together provides a robust look at the IT sector.

Using job postings data, the specialized IT skills most in demand and the 10 nontechnical skills requirements. As IT professionals struggle to keep their skills current in a rapidly evolving industry, educators face a similar challenge: ensuring that students receive the skills sought after in today's labor market. Having a clear understanding of the skills currently required by hiring employers helps educators provide students with those skills, increasing the employability of their students. Acting on this data will inform and lead to an alignment of curricula to market needs.

3.4 A strategic framework for skills development

Equipping the workforce with the skills required for the jobs of today and those of tomorrow is a strategic concern in the national growth and development outlooks of all G20 countries. Together, G20 leaders have pledged to support robust training strategies to meet the challenges of fostering strong, sustainable and balanced growth in each country and globally.

The globalization of markets is accelerating the diffusion of technology and the pace of innovation. New occupations are emerging and replacing others. Within each occupation, required skills and competencies are evolving, as the knowledge content of production processes and services is rising.

A major challenge in all G20 countries is simultaneously to enhance the responsiveness of education and training systems to these changes in skill requirements and to improve access to training and skills development.

Many G20 countries have used training and retraining in their responses to the employment challenges arising from the global financial crisis of 2008. Lessons learned since that time are being applied more widely.

Ultimately, each country's prosperity depends on how many of its people are in work and how productive they are, which in turn rests on the skills they have and how effectively those skills are used. Skills are a foundation of decent work.

The cornerstones of a policy framework for developing a suitably skilled workforce are broad availability of good-quality education as a foundation for future training; a close matching of skills supply to the needs of enterprises and labor markets; enabling workers and enterprises to adjust to changes in technology and markets; and anticipating and preparing for the skills needs of the future.

When applied successfully, this approach nurtures a virtuous circle in which more and better education and training fuels innovation, investment, economic diversification and competitiveness, as well as social and occupational mobility – and thus the creation of more but also more productive and more rewarding jobs.

Good-quality primary and secondary education, complemented by relevant vocational training and skills development opportunities, prepare future generations for their productive lives, endowing them with the core skills that enable them to continue learning.

Young women and men looking for their first jobs are better prepared for a smooth transition from school to work when they are given adequate vocational education and training opportunities, including in-work apprenticeships and on-the-job experience.

Working women and men periodically need opportunities to update their skills and learn new ones. Lifelong learning for lifelong employability captures the guiding policy principle here.

3.5 Sustaining robust training policies and systems

Robust training policies and systems are grounded in the characteristics and institutions of each country. Nevertheless, a number of common building blocks can be identified. A good skills development system will be able to: anticipate skill needs; engage employers and workers in decisions about training provision, including in specific sectors; maintain the quality and relevance of training; make training accessible to all sectors of society; ensure viable and equitable financing mechanisms; and continuously evaluate the economic and social outcomes of training.

To keep training relevant, institutional and financial arrangements must build solid bridges between the world of learning and the world of work. Bringing together business and labor, government and training providers, at the local, industry and national levels, is an effective means of securing the relevance of training to the changing needs of enterprises and labor markets.

Institutions to sustain the involvement of employers and workers and their representative organizations are critical to keeping training relevant and ensuring that training costs and the gains of productivity improvement are shared equitably.

Maintaining a close connection between training policies and employment policies creates an effective bridge between the worlds of learning and of work. Policies to improve skills combined with policies to sustain growth and investment facilitate job search, and support entry and re-entry into the labor market can lead to more and better jobs.

Many benefits derive from making training and skills opportunities broadly accessible to all women and men. Special measures can help overcome the difficulties some groups face in accessing skills – for example, people with disabilities, members of minority groups, those in need of a second chance.

3.6 Sharing knowledge and experience

There is plenty of scope for continuing and deepening exchanges of knowledge and experience among countries on training and skills development policies and systems. It is particularly valuable for countries to share their experiences in dealing with the more difficult challenges of maintaining the relevance of education and training to the world of work, and in moving from policy principles to application.

There is also scope for taking a close look at the inter-linkages between skills policies, training systems and development, reviewing how knowledge and experience of training strategies and policies can help low-income countries address their growth and development challenges.

3.7 A broad definition of training and skills

Training and skills development is understood in broad terms, covering the full sequence of life stages. Basic education gives each individual a basis for the development of their potential, laying the foundation for employability.

Initial training provides the core work skills, general knowledge, and industry based and professional competencies that facilitate the transition from education into the world of work. Lifelong learning maintains individuals' skills and competencies as work, technology and skill requirements change.

Different countries focus on different elements as they see relative strengths and weaknesses in their own skills development systems, and as they learn more about innovations and experience in other countries.

3.8 Benefits from adequate investment in good-quality education and skills

Skills development enhances both people's capacities to work and their opportunities at work, offering more scope for creativity and satisfaction at work.

The future prosperity of any country depends ultimately on the number of persons in employment and how productive they are at work. A rich literature exists on the links between education, skills, productivity and economic growth.

Estimates for European countries show that a 1 per cent increase in training days leads to a 3 per cent increase in productivity, and that the share of overall productivity growth attributable to training is around 16 per cent (CEDEFOP, 2007).

Available evidence firmly establishes that a combination of good education with training that is of good quality and is relevant to the labor market

- empowers people to develop their full capacities and to seize employment and social opportunities;
- raises productivity, both of workers and of enterprises;
- contributes to boosting future innovation and development;
- encourages both domestic and foreign investment, and thus job growth, lowering unemployment and underemployment;
- leads to higher wages;
- when broadly accessible, expands labor market opportunities and reduces social inequalities.

3.9 Widely agreed guiding principles linking skills and work

Good-quality basic education for all is an agreed goal and an essential prerequisite for further skills development. Establishing solid bridges between vocational education, training and skills development, and the world of work makes it more likely that workers will learn the "right" skills, namely those required by the evolving demands of labor markets, enterprises and workplaces in different economic sectors and industries.

Effective partnerships between governments, employers' and workers' organizations, and training institutions and providers are critical to anchor the world of learning in the world of work.

Broad and continued access to training and skills development opens up the opportunities for and benefits of both initial and lifelong learning to all, enabling women and men of all ages, in both urban and rural areas, to fulfill their aspirations.

Dedicated policies and measures are required to facilitate access to training and skills development by individuals and groups hindered by various barriers, including poverty and low income, ethnic origin, disability and migrant status.

Education and skills policies are more effective when well coordinated with employment, social protection, industrial, investment and trade policies. By using up-do-date information, those working in education and training can assess the match between the skills they are teaching and those in demand in the workplace.

When that information is put at the disposal of young people and workers by employment and vocational guidance services, it can help them to make better-informed choices about education and training.

3.10 Sustaining relevance to the world of work

Countries share many of the difficulties in ensuring that learning is effective, sustained and relevant to the world of work. General education budgets account for a large proportion of total government expenditure. Yet educational achievements vary widely both across and within countries.

When general education fails in its basic objective of raising the cognitive skills of the population, the economic and social costs can be high. In some countries, possible cuts in spending on education and training in the framework of fiscal consolidation policies could substantially hinder future development. It is all the more important to manage public training resources effectively, given their importance as a key driver of long-term growth.

During the financial crisis begun in 2008, training and education featured as key components in the stimulus packages adopted by many G20 countries. Now, as some of these countries are embarking on fiscal consolidation, it is important to ring-fence education and training budgets. Cutting back on these social expenditures can jeopardize long-term growth perspectives and aggravate rather than alleviate fiscal problems. The gulf between the world of learning and the world of work can be wide. The former is often classroom-based and academic, while the latter is dominated by the practical demands of production processes, deadlines and workplace organization.

Change happens fast in the world of work, driven by innovation and by developments in technology and markets. Keeping up with this pace of change is a continuing challenge for learning institutions. The active participation of employers' and workers' representatives in vocational education and training institutions is essential to bridging this gulf. Crossing the gulf can be particularly challenging for women, people with disabilities, and communities in remote rural areas and others without access to good-quality education.

While most countries have seen an unprecedented expansion of their education and skill base over the past decades, there is a persistent gap between the kind of knowledge and skills that are most in demand in the workplace and those that education and training systems continue to provide. The ease with which young women and men enter the labor market is a good indication of how relevant their skills training has been.

Assessing the continued relevance and quality of training institutions and programmes, relative to their cost, is a challenge. Tools and methods, including international comparisons, require further development.

Most importantly, skills by themselves do not automatically lead to more and better jobs. Skills policies must be part of a broad set of policies that are conducive to high rates of growth and investment, including investment in basic education, health care and physical infrastructure, strong growth in good-quality employment, and respect for workers' rights.

3.11 A Review of Technology Trends in India

India has long history in the support of science and technology as a means to improve the national economy and the lives of its citizens. The political commitment is reflected in the Scientific Policy Resolution of 1958, the Technology Policy Statement 1983 and the 2003 Science and Technology Policy of the Government of India. These initiatives have led to the creation of a substantial S&T infrastructure covering government institutions, universities, nongovernmental organizations and industry. It should be emphasized that India has had recent successful demonstrations of indigenous capabilities such nuclear power, satellite launches and multi-use launch vehicles. India's system for innovation is dominated by the central and state government agencies. Government is responsible for about 74% of national R&D expenditures. The industrial sector (public and private) accounts for about 30% of total expenditures. The government encourages greater participation from the industrial sector over the recent years.

Within India, there are about 400 national laboratories, 400 R&D institutions in the government sector, and about 1,300 R&D organizations in the industrial sector. More than 300 multinational companies have opened their R&D centers and laboratories in different sectors of the economy. Some corporations have formed alliances with Indian institutions for joint research projects. India's planning commission issues five-year plans since independence in 1947. Each plan contains a section on S&T. The plans discuss accomplishments and relevant issues during the previous five years and propose initiatives for the next five years. India has a stated goal of becoming a developed nation by 2020, and it aims to be one of the top 5 countries in the world in terms of GDP. The five-year plans highlight S&T as a contributor to this long-term vision. Other stated goals include the increase of R&D expenditures from 0.9% to 2% of GDP and to increase education spending from 4% to 6% of GDP. In an effort to increase educational resources, the Indian government recently presented to the Parliament the Foreign Educational Institutions Bill. The Bill allows foreign universities to establish campuses in India. It is expected that the bill will spur an increase in the number of top-quality institutes in India and will offer students an alternative to travelling overseas for education. The current plan (2007-2012) sets out a broad strategy for improving the national S&T environment by enlarging the pool of scientific manpower, encouraging risk taking on the part of scientists, supporting creativity in the education system, supporting both basic research and applied research and technology development, encouraging industry to interact with academia, and providing incentives for young people to pursue scientific careers. The plan also recommends that scientific developments in the rest of the world be monitored and surveyed in order to assist in the selection of critical technologies for prioritized investment. The current five-year plan identifies detailed research foci and envisioned outcomes for 16 sectors with the greatest proposed national laboratory funding in the following areas, in descending order:

- Aerospace;
- Pharmaceuticals;
- Materials;

- Information technology;
- Biology;
- Earth systems and exploration (including on- and off-shore geophysical studies); and
- Energy

Within central government are emphasized funding for atomic energy and space and ocean exploration. In addition to promoting S&T advancement, these three areas present dual-use opportunities. A specific national goal is to develop indigenous technologies to protect itself from denial of technology (by other countries). The Department of Science & Technology has set up the Technology Information, Forecasting and Assessment Council (TIFAC) to look ahead in technologies, assess the technology trajectories and support technology innovation by network actions in select technology areas of national importance. In 1996, TIFAC formulated a Technology Vision for the country in various emerging technology areas. The outcome of the Technology Vision 2020 exercise led to the set of 17 documents, including sixteen technology areas and one on services. The "Technology Vision 2020," lays out a recommended set of actions that India should undertake to become a developed nation by the year 2020. It identifies five broad areas for development that can leverage India's core competencies and address its critical needs:

- Agriculture and food processing;
- Infrastructure with reliable electric power;
- Education and healthcare;
- Information and communication technology; and
- "Critical technologies" (defined as nuclear, space, and defense).

TIFAC is focusing on the identification of technologies for detailed sectors e.g. "Technology Road Map for Indian Aluminium Industry" (2009-10); quality seed production, crop diversification, deep water rice cultivation for agriculture; "Technology Roadmap for Electric and Hybrid Electric Vehicle introduction" etc. TIFAC is also facilitates commercialization through the establishment of relevant centers.

The following are the key programmes specified in the 11th Five-Year Plan 2007-2011. Space, Biotechnology, Ocean, Atomic Energy, CSIR open-source drug discovery programme; Department of Science and Technology drinking water and Technology for Rural Enterprises and Employment programmes. It is important at this point to mention the success of the Software Technology Parks (STP) of India, which has contributed substantially in the development of the ICT industry. A primary objective of the STP has been the provision of international data communication facilities. However a set of comprehensive incentives contributed to developing a successful ICT sector. The incentives offered include:

STP units are exempted from payment of corporate income tax up to 2010;

- Capital invested by foreign entrepreneurs, know-how fees, royalty, dividend etc., can be freely
- Repatriated after payment of Income Taxes due on them, if any;
- Repatriation of foreign currency for payments can be freely done;
- Rebates on cost of land;
- Reimbursements of stump duties;
- Concessionary power tariffs;
- Exemptions from labor regulations;
- Duty free imports;
- 100% Foreign Equity is permitted;
- Approvals are given under single window clearance scheme; and
- A company can set up STP unit anywhere in India.

CHAPTER – 4

IT INDUSTRY IN INDIA

India is the world's largest sourcing destination for the information technology (IT) industry, accounting for approximately 67 per cent of the US$ 124-130 billion market. The industry employs about 10 million workforces. More importantly, the industry has led the economic transformation of the country and altered the perception of India in the global economy. India's cost competitiveness in providing IT services, which is approximately 3-4 times cheaper than the US, continues to be the mainstay of its Unique Selling Proposition (USP) in the global sourcing market. However, India is also gaining prominence in terms of intellectual capital with several global IT firms setting up their innovation centers in India.

The IT industry has also created significant demand in the Indian education sector, especially for engineering and computer science. The Indian IT and ITeS industry is divided into four major segments – IT services, Business Process Management (BPM), software products and engineering services, and hardware.

4.1 Market Size

The Indian IT sector is expected to grow at a rate of 12-14 per cent for FY2016-17 in constant currency terms. The sector is also expected triple its current annual revenue to reach US$ 350 billion by FY 2025.

Employees from 12 Indian start-ups, such as Flipkart, Snapdeal, Makemytrip, Naukri, Ola, and others, have gone on to form 700 start-ups on their own, thus expanding the Indian start-up ecosystem. India ranks third among global start-up ecosystems with more than 4,200 start-ups.

Total spending on IT by banking and security firms in India is expected to grow 8.6 per cent year-on-year to US$ 7.8 billion by 2017.

India’s internet economy is expected to touch Rs 10 trillion (US$ 146.72 billion) by 2018, accounting for 5 per cent of the country’s GDP.

The public cloud services market in India is slated to grow 35.9 per cent to reach US$ 1.3 billion according to IT consultancy, Gartner. Increased penetration of internet (including in rural areas) and rapid emergence of e-commerce are the main drivers for continued growth of data centre co-location and hosting market in India. The Indian Healthcare Information Technology (IT) market is valued at US$ 1 billion currently and is expected to grow 1.5 times by 2020. India's business to business (B2B) e-commerce market is expected to reach US$ 700 billion by 2020 whereas the business to consumer (B2C) e-commerce market is expected to reach US$ 102 billion by 2020.

Cross-border online shopping by Indians is expected to increase 85 per cent in 2017, and total online spending is projected to rise 31 per cent to Rs 8.75 lakh crore (US$ 128 billion) by 2018.

Post the government’s announcement of demonetization of specific currency denominations, digital payment platforms such as Paytm, MobiKwik, Oxigen witnessed a sharp spike in user transactions, app downloads and merchant enquiries, thereby indicating a greater demand towards digital payments by consumers.

India ranks among the top five countries in terms of digitalization maturity as per Accenture’s Platform Readiness Index, and is expected to be among the top countries with the opportunity to grow and scale up digital platforms by 2020.

4.2 Investments/ Developments

Indian IT's core competencies and strengths have attracted significant investments from major countries. The computer software and hardware sector in India attracted cumulative Foreign Direct Investment (FDI) inflows worth US$ 22.83 billion between April 2000 and December 2016, according to data released by the Department of Industrial Policy and Promotion (DIPP).

Leading Indian IT firms like Infosys, Wipro, TCS and Tech Mahindra, are diversifying their offerings and showcasing leading ideas in block chain, artificial intelligence to clients using innovation hubs, research and development centers, in order to create differentiated offerings.

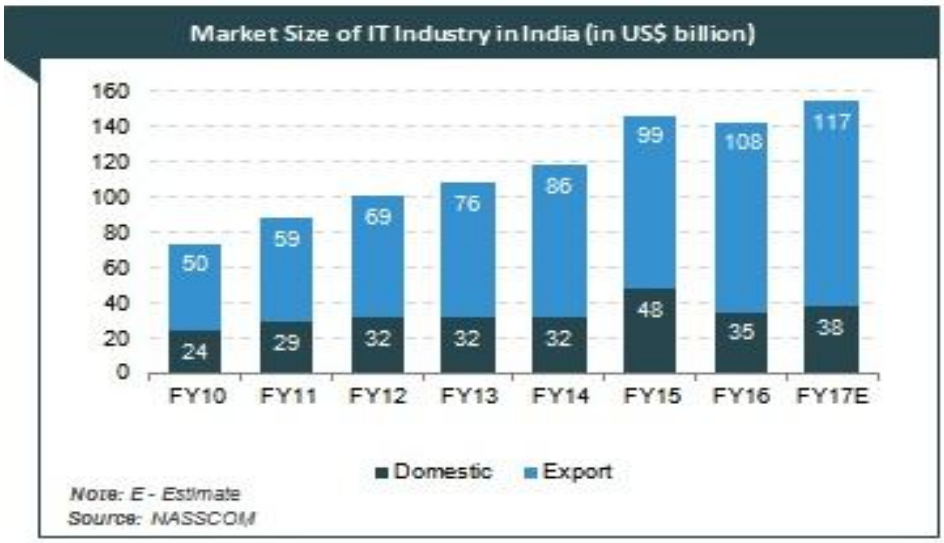
Some of the major developments in the Indian IT and ITeS sector are as follows:

- Bengaluru-based fintech company ZestMoney, owned by Camden Town Technologies Pvt. Ltd, has raised US$ 6.5 million in a series A round of funding led by Naspers-owned PayU; and will invest the funds in technology and product development.

- Google plans to set up its first data centre in India in the city of Mumbai by 2017, to improve its services to local customers wanting to host their applications on the internet, and to compete effectively with the likes of Amazon and Microsoft,
- Sagoon Inc, a social network and e-commerce start-up, has filed mini-initial public offering (IPO) papers with the US Securities and Exchange Commission (SEC), to raise around US$ 20 million, which will be used to set up a campus in India, expand its team in India, the US and Nepal, and support marketing and branding and other general purposes.
- SAP SE, in partnership with the Associated Chambers of Commerce of India (ASSOCHAM), has rolled out a knowledge sharing resource centre which will serve as a one-stop portal for businesses looking to adopt or migrate to technology that will make them future ready for the biggest taxation reform of goods and services tax (GST).
- Freshdesk, one of first companies from India to offer Software-as-a-Service (SaaS) to global companies, has raised US$ 55 million in the latest round of funding led by Sequoia Capital India and existing investor Accel Partners, estimating to value the company at US$ 700 million.
- Warburg Pincus LLC, the US-based private equity firm, plans to invest around US$ 75 million in series C round of funding to buy a significant stake in Capital Float, an online credit platform.
- Helpshift Inc, which makes customer support software for mobile apps, announced raising US$ 2 million from Cisco Investments, in addition to working with Cisco to integrate its in-app customer support with Cisco's contact centre solutions.
- Knowlarity Communications Pvt Ltd, a cloud telephony provider, has announced raising US$ 20 million from multiple investors such as Dubai-based private equity investor Delta Partners, existing investors Sequoia Capital Funds and Mayfield Fund, apart from venture-debt from Blacksoil and Trifecta Capital.
- Flipkart, India's largest e-commerce marketplace, has re-entered the private label business by launching Smart Buy, the first of two new private labels, with a view to boost earnings and fill gaps in its product selection.
- Fitpass, a Delhi-based revolutionary app which offers access to gyms and health clubs membership, has raised US$ 1 million in seed funding from investors in Mumbai, Delhi, and Bengaluru.
- Apple's supplier and assembler, Taiwan-based Winstron, will set up an iPhone assembly facility in Peenya, Bengaluru's industrial hub, thus making India the third country across the world to have an assembly unit for Apple's iPhone.
- Kratikal Tech Pvt Ltd, a cyber-security start-up, has raised around US$ 500,000 in seed round of funding led by Mr Amajit Gupta, former director of Microsoft India, which will be used for product development and building training modules.
- International Finance Corporation (IFC) plans to invest US$ 10 million as equity in Bengaluru-based Zinka Logistics Pvt Ltd, which provides a technology platform called Blackbuck for long-haul trucking market in India, estimated at US$ 70 billion.
- Paytm's online marketplace unit raised US$ 200 million in a funding round led by a US$ 177 million investment to be made by Alibaba Group Holding Ltd, and balance by SAIF Partners.
- Intel Corporation plans to invest in Digital India related solutions such as India stack, Unique Identification (UID), e-government 2.0 and other government initiatives, and scale up operations of its data centre group (DCG), as per Mr Prakash Mallya, Director DCG, Asia for Intel Corporation.
- Reliance Industries Ltd (RIL) plans to set up entrepreneurship hubs in key cities and towns, and a Rs 5,000 crore (US$ 748 million) fund, under the name of Jio Digital India Startup Fund, to invest in technology based startups.

- Gurgaon-based digital wallet start-up MobiKwik, which is owned and operated by One MobiKwik Systems Private Limited, has raised US$ 40 million from Nasdaq-listed firm Net1, a South African payments technology company.
- Orange Business Services, the business services arm of Orange Group, has launched a state data centre for Himachal Pradesh government, which will be the first data centre in India to be designed using 'green' data centre concepts that minimize power requirements and increase power utilization efficiency.
- PurpleTalk Inc, a US based mobile solutions company, has invested US$ 1 million in Nukkad Shops, a Hyderabad based uber-local commerce platform that helps neighbourhood retail stores take their businesses online through a mobile app.
- KartRocket, a Delhi based e-commerce enabler has completed its US$ 8 million funding round by raising US$ 2 million from a Japanese investor, which will be used to enhance Kraftly, a mobile-first online-to-offline marketplace targeting small sellers, individuals and home-based entrepreneurs in India in product categories such as apparel and accessories.
- Xpressbees, an e-commerce logistics firm operated by Busybees Logistics Solutions Private Limited, has raised US$ 12.5 million in a Series A funding, led by its existing investors SAIF Partners, IDG Ventures, Vertex Ventures and Valiant Capital, which will be used to strengthen technology initiatives and processes of the firm.
- Housejoy, an online home services provider, has raised Rs 150 crore (US$ 22 million) in a Series B round of funding led by Amazon, and which also includes new investors such as Vertex Ventures, Qualcomm and Ru-Net Technology Partners.
- Nasscom Foundation, a non-profit organization which is a part of Nasscom, has partnered with SAP India to establish 25 National Digital Literacy Mission (NDLM) centers in 12 cities across India, as a part of Government of India's Digital India initiative.

Graph no-4.1: Market size of IT industry in India



India is the topmost off shoring destination for IT companies across the world. Having proven its capabilities in delivering both on-shore and off-shore services to global clients, emerging technologies now offer an entire new gamut of opportunities for top IT firms in India. Social, Mobility, Analytics and Cloud (SMAC) are collectively expected to offer a US$ 1 trillion opportunity. Cloud represents the largest opportunity under SMAC, increasing at a CAGR of approximately 30 per cent to around US$ 650-700 billion by 2020. The social media is the second most lucrative segment for IT firms, offering a US$ 250 billion market opportunity by 2020. The Indian e-commerce segment is US$ 12 billion in size and is witnessing strong growth and thereby offers another attractive avenue for IT companies to develop products and services to cater to the high growth consumer segment.

India's much-vaunted Information Technology (IT) sector is composed of two parts: the software sector, and the IT-enabled sector (ITES). In both cases, work that was earlier done in the developed world, particularly the US, has been 'outsourced', or contracted out, to locations in India. In the case of the ITES, the activities outsourced include call centres, medical transcription, data entry, ticket-reconciliation, claims processing, credit card administration, and such other routine office work as can be performed at remote locations. While this work requires knowledge of English, it does not require superior education or skills. In IT, India has built up valuable brand equity over the years. In IT enabled services (ITES), India is emerging as one of the most preferred destinations for business process outsourcing (BPO). The importance of IT industry in the Indian economy can be gauged from the fact that its contribution to the national gross domestic product (GDP) has increased by seven fold in a span of just one decade from 0.6% in 1994-95 to 4.3% in 2004-05. Although industry figures are not directly comparable with GDP as they are based on revenues rather than value added, they provide an indicator of growing importance of the IT sector in the country.

Assuming that the Indian economy and IT sector will replicate the past six years performance during the next six years and value added in IT sector is two third of its sales revenue, the contribution of IT sector to national GDP will be around 8.5% during the year 2010-11, quite similar to that in the United States (US) today. The IT sector revenue is expected to increase from Rs. 1276 billion in 2004-05 to Rs. 6435 billion in 2010-11. The Indian IT industry is broadly categorized into IT services and software, ITES-BPO, and Hardware segments. Although IT services and software continues to remain the key contributor to the IT sector's revenues, ITES- BPO is emerging as the fastest growing segment of the sector. Between the year 2000-01 and 2004-05, contribution of ITES-BPO to the IT sector's total revenue increased from 7.4% to 20.2% whereas the corresponding figure for IT services and software fell from 64.5% to 58.5%. Presently, ITES-BPO segment of the industry is almost as big as the hardware segment. Size of the industry Indian Information Technology industry contributes 5.9% of the country's GDP while providing employment to a significant number of its tertiary sector workforce. In March 2009, annual revenues from outsourcing operations in India was up to US$ 60 billion and this is expected to increase to US$225 billion by the year 2020. The most prominent IT hub is IT capital Bangalore and the other emerging destinations are Chennai, Hyderabad, Mumbai, Pune, NCR, Jaipur and Kolkata. India's growing stature in the information Technology enabled the country to form close ties with both the United States of America and the European Union. Domestic and Export Share According to Department of Information Technology, the Indian software and services exports was expected to reach US$ 49.7 billion in 2009-10 as compared to US$ 47.1 billion in 2008-09, with an increase of 5.5% in dollar terms.

Further, the Indian IT Industry's services exports is estimated to grow from US$ 25.8 billion in 2008-09 to US$ 27.3 billion in 2009-10, with a growth of 5.8 %.In the year 2008-09, the domestic IT attained revenues worth US$ 24.3 billion as compared to US$ 23.1 billion in FY 2007-08, with a growth of 5.4%. The tremendous demand for IT services and goods by India Inc. has majorly strengthened with the expansion of the domestic market as agreements worth extraordinarily to US$ 100 million. Till 2012, the domestic sector is estimated to expand to US$ 1.7 billion against the existing US$ 1 billion. IT exports software and services of India are to nearly 95 countries around the world. India’s domestic IT market over the years has become one of the major driving forces of the industry. The domestic IT infrastructure is developing in contexts of technology and intensity of penetration. In FY 2008-09, the domestic IT sector attained revenues worth$24.3 billion compared to $23.1 billion in FY 2007-08, registering a growth of 5.4 per cent.

Moreover, the increasing demand for IT ser- vices and goods by India Inc has strengthened the expansion of the domestic market with agreements’ worth rising up extraordinarily to $100 million. By FY 2012, the domestic sector is estimated to expand to $1.7 billion from the existing $1 billion. Impact of Information Technology on Indian Economy A particular industry that has been instrumental in the growth of the Indian economy is the IT sector.

The design, development, implementation or management of information systems is referred to as information technology. It describes the production, storage, manipulation and dissemination of information. IT industries account for 6% of the GDP of India and provide employment directly or indirectly for over 2.3 million people. It also contributes very significantly to India’s exports: accounting for around 18% in 2001. India produces roughly 150,000 technically and socially adept engineers every year. Most of them migrate to

developed countries and form an integral part of the workforce there, thus becoming India's most beloved export.

In the 21st century, India has risen to the position of one of the largest IT capitals of the world. As of 2006, technologically inclined services sector in India accounted for 40% of the country's GDP and 30% of export earnings. The IT industry has helped the growth of modern India in many ways. Indian engineers and technicians are sought world over for their competency and diligence and strong fundamentals in their field of work and study. India's technology boom has also helped her shed her "Hollywood" image of being the land of mystics, snake charmers and beggars and has put her on the world map for being a global information hub.. Each of the above mentioned industries have grown at massive rates, providing jobs and products to Indians. For example HCL Enterprise is electronics, computing an IT company based in India, has become a leading provider of IT service and technological solutions worldwide. In fact, the IT boom of the 90's and the 2000's in India was also accompanied with the growth of BPOs in the nation.

India has come under fire from certain groups of people worldwide for "stealing their jobs", but the fact stands that foreign corporations love India for its abundant availability of skilled labour that can master foreign languages and are satisfied at comparatively low salaries. But with most recent graduates these days being absorbed into IT companies and BPOs and then getting their ticket to America and Europe, India is losing a large chunk of its brains which will perhaps be detrimental to the growth of innovative, indigenous technology and inventions in India. The IT industry in India has seen massive change, growth and development over the years. The future of this industry seems bright with more growth being predicted. Financial analysts are optimistically predicting strides in software technology development in India.

Additionally, the growth of the IT sector is expected to bring about a corresponding growth in other sectors like employment, exports and Foreign Direct Investments. IT sector is also intimately linked to other relevant sectors like biomedical technology, defense and infrastructure. Thus the future of the IT sector will directly impact the growth of the nation. Growth of India's IT Industry India's IT industry has recorded phenomenal growth over the last decade. During the period from 1992-2001, the compounded annual growth rate of the Indian IT services industry has been over 50%. The software sector in India has grown at almost double the rate of the US software Sector. The statistics of the India's IT industry substantiates the huge momentum acquired by the IT sector in the recent past.

During the financial year 2000-2001, the software industry in India accounted for $8.26 billion. The corresponding figure was $100 million 10 years back. As per the report of a study undertaken by NASSCOM-McKinsey, the software export from Indian IT industry is likely to reach 50 billion US dollars in the year 2008. This growth rate of the software sector for the year 2008 has been projected on the basis of the 35% per year growth rate achieved in the last couple of years. Export of software and services from India is expected to add almost 41 billion US dollars to the annual revenue of the Indian government in the current year. The share of technology industry in India's GDP is expected to reach 5.5% in 2008; while the corresponding figure in 1998 was as small as 1.2%.The study of NASSCOM has revealed that the growth of India's IT industry has prompted the growth of Indian exports by almost 36%. Another favourable effect of India's IT boom is the expansion of opportunities of employment. By the end of fiscal year 2008, the IT sector of India is expected to employ around 2 million skilled Indian youths.

4.3 The growth of India's IT sector

The growth of India's IT sector has brought about many other positive changes in the Indian economy. The purchasing power of a large section of Indian population has increased dramatically. This has resulted in an increase in the average standard of living of the majority of population of the country. The increase in purchasing power of the common people has propelled the growth rate of the other sectors of the economy as well. There has been considerable increase in the amount of fund available for venture capitalism and equity financing. The ITES sector has also come up to complement the growth of Indian IT sector. Domestic IT market has shown a 24 per cent growth in the last fiscal as against 17 per cent in software exports, according to Dataquest Top 20 survey. However in terms of size of the market, domestic sector at Rs 33,374 crore in 2003-04 is way behind the export revenue of Rs 40,870 crore.

The overall Indian IT industry is estimated at Rs 92,924 crore. If BPO and hardware exports are added to overall IT exports from India then the figure for growth in exports comes to 24 per cent. The growth of domestic IT market in 2003-04 compares favourably with the previous year growth of nine per cent while the pace of increase in software exports slowed down to 17 per cent in last fiscal from 26 per cent in 2002-03. In the domestic market, services grew by 26 per cent and hardware by 23 per cent. For the 2012 financial year (which ended March 2012), annual business crossed US$ 100 billion in sales revenue, with IT contributing to 7.5 per cent of India's GDP.

Furthermore, India had 58 percent of the "global IT services" outsourcing revenue, Indian IT services account for 25 percent of its exports. Most Fortune 500 companies outsource some of their work to Indian IT companies, and many operate either directly or indirectly in India. The IT company Tata Consultancy Services reached $ 10 billion in annual revenue by March 2012, with a healthy bottom line (22 per cent). Another company, Infosys (with $ 7 billion in annual revenue), created the "ACM Infosys Foundation Award for Computing Science" in 2007 to celebrate 25 years of service. Fortune magazine recently named Infosys founder NR Narayana Murthy, who is known for his unique way of combining capitalism and socialism, as one of the 12 greatest entrepreneurs of our time. India's IT industry is growing steadily. Indian IT companies have reached the global stage and are undertaking interesting IT projects.

The IT sector has created jobs for 2.8 million IT professionals and has indirectly employed an additional 8.9 million. The rapid growth or engineering education, with more than 500,000 undergraduate IT engineers graduating per year, feeds into this steadily growing IT industry.

Latest Developments As per a Confederation of Indian Industry (CII) report, the Indian IT industry is growing at an annual rate of 35%.

National e-Governance Plan (NeGP): The Government of India plans to give high priority to improve the quality to the citizens by providing basic services at their doorstep for which it has formulated a NeGP covering 27 mission mode projects.

State Wide Area Networks (SWANs): The Government has started a scheme for establishing SWANs across the country in 29 states with a total estimation of US$ 682.27 million over a period of five years.

State Data Centers (SDCs): SDCs have been identified important for the core infrastructure of supporting e-Governance initiatives under NeGP.

Common Service Centers (CSCs): The main objective of CSCs is to develop a platform that can enable Government, private and social sector organizations to carter their social and commercial goals for the benefit of the rural population in the country with a combination of IT-based as well as non-IT-based services.

Community Information Centres (CIC): Government has initiated the CIC's in the hilly and far-flung rural areas of the country with main objective to bring the benefits of ICT to the people for the purpose of socio-economic development.

Nanotechnology: Department of Information Technology started nanotechnology development programme during the 10th plan with the aim of creating infrastructure for research in nanoelectronics and nanometrology at the national level.

Information technology (IT) is amongst the fastest growing sectors in the country. Its contribution to GDP rose from 1.2 per cent in 1999-2000 to 5.2 per cent in 2006-07 and to an estimated 5.5 per cent in 2007-08. Growth of Indian IT industry has been driven by the IT software and services (IT services) and IT enabled services (ITES). The software and services (IT services) industry of India has been moving up the value chain, giving India formidable brand equity in the global markets. The Indian software and services exports including ITES-BPO are estimated at US$ 40.3 billion (Rs. 163,000 crore) in 2007-08 as compared to US$ 31.4 billion (Rs. 141,000 crore) in 2006-07, showing an increase of 28.3 per cent in dollar terms and 15.6 per cent in rupee terms. Department of Electronics and Information Technology (DIT) is the nodal organization in the country, responsible for formulation, implementation and review of national policies in the field of information technology.

All policy matters relating to silicon facility; internet; computer based information technology and processing including hardware and software; standardization of procedures and matters relating to international bodies; promotion of knowledge based enterprises; e-commerce; information technology education; etc are addressed by it. The department has been making continuous efforts towards making India a front-runner in the age of information revolution.

Some of the major initiatives undertaken by it include

A 'National Taskforce on Information Technology and Software Development' was formed with the objective of framing a long term 'National IT policy' for the country and also for removing the impediments to growth of the InfoTech industry. The taskforce suggested various measures towards building India's IT industry and proliferating the use of IT in the country. It submitted its recommendations in the form of three key reports to the Government. Enactment of the Information Technology Act, which provides a legal framework to facilitate electronic commerce and electronic transactions; prevent computer crimes; promote electronic filing or documentation and digital signature. It aims to create an enabling environment for e-Governance and to boost e-Commerce in the country.

Community Information Centers (CICs) have been set up in the seven North East States and Sikkim for socio economic development of the region. These CICs provide internet connectivity, e-mail facilities, interface between citizens and government, distance learning programs, information on national programmes, disaster management system, public health awareness, etc to the public. E-Governance is one of the areas in which Information and Communication Technology (ICT) is having a profound impact on the way governments function and the manner in which government services are made available to the citizens. The e-governance projects are expected to increase efficiency, enhance effectiveness and improve quality of the government services. Hence, National e- Governance Plan (NeGP) has been announced with the vision of making all government services accessible to the common man in his or her locality, through common service delivery outlets and ensures efficiency, transparency and reliability of such services at affordable costs. Besides, various IT activities such as development of software applications packages, creation of e-governance infrastructure, National ID, citizen databases, smart card, etc are being taken up on pilot scale basis.

State Wide Area Network (SWAN) is a scheme for establishing state wide area networks across the country in 29 States and 6 Union Territories over a period of five years. The scheme envisages providing central assistance to States and Union Territories (UTs) for establishing SWANs from State and UTs headquarters upto the block level with a minimum bandwidth capacity of 2 Mbps. State Data Centers have been identified as one of the important elements of the core infrastructure for supporting e-Governance initiatives under NeGP. It is proposed to create data repositories or data centers in various States so that common secured data storage could be maintained to serve host of e-Governance applications. Common Service Centers (CSCs) are one of the three infrastructure pillars of NeGP and are deemed to serve as the physical front end for delivering government and private services at the doorstep of a citizen. The government has approved a scheme for facilitating establishment of 100,000 broadband internet enabled CSCs in rural areas of the country, to be implemented in public private partnership.

Unique ID for BPL families is a project launched with the objective of creating a core database of all residents of the country and assigns unique ID number to all such residents over 18 years, in order to facilitate better targeting of government social welfare schemes and poverty alleviation initiatives. e-District projects have been launched with the objective of computerising the backend workflows at the district level with appropriate business process reengineering (BPR); reduce the work load at the district level; ensure fast processing of cases or grievances; and enable better monitoring of various government schemes. It aims at bringing a number of services online, in a web-based mode, including applications under the Right to Information Act; applications for house sites, ration cards, transfers of teachers, inclusion in the electoral roll, filing of police complaint, issue of birth/death certificates and copies of land records. Most of these services are provided at the district level and they serve as the primary interface between the government and the citizens.

National Informatics Centre (NIC) has been instrumental in steering Information and Communication Technology (ICT) applications in Government departments at Central, State and District levels. It is facilitating improvement in government services; wider transparency in its functions; and improvement in

decentralized planning and management. Some of the major projects undertaken by it include budget computerization; central excise computerization; commercial tax computerization; courts computerization project for supreme court, high courts and district courts; agricultural census and marketing; parliamentary elections data transmission and analysis; land records computerization; and utility mapping project; etc. With the convergence of computing, communications, and electronics, the scope of IT is changing, as are key industries such as

- Transportation (road, rail, air, sea, and urban transport).
- Financial services (banking, insurance and stock trading).
- Hospitality (hotels, restaurants, and tourism).
- Automotive and aerospace.
- Core industries (oil, gas, steel, and mining)
- Services (education and healthcare) and
- Retail.

Areas such as industrial automation and medical electronics are embracing open standards and starting to use commodity hardware. Leading companies in those domains-such as ABB and Siemens-could soon become "IT companies" Indian IT is thus likely to enjoy steady and sustained growth for at least another decade.

CHAPTER - 5

OPPORTUNITIES AND CHALLENGES FOR TRAINING INSTITUTES FOR SKILLS DEVELOPMENT

5.1 Global trends

Global trends, affecting all regions, set the context for education and training today and in the future. A selected number of global drivers of change are considered here: namely, the supply-side challenges of demographic change, educational attainment and commitments to inclusive growth, and the demand-oriented challenges of globalization of markets, technological innovation and climate change.

5.2 Demographic change

Worldwide, the rate of population growth is declining, though it remains high in some countries and regions. Some countries face ageing societies. Others have burgeoning youth populations.

Taken as a whole, the world population is marked by declining fertility and rising life expectancy. The primary consequence of both trends is population ageing. The proportion of the population aged 60 years and over will rise in the more developed regions from 22 per cent in 2010 to 33 per cent in 2050, and in the less developed regions from 9 per cent to 20 per cent.

The population of working age (25–59 years) will decline in the more developed regions between 2010 and 2050 in both absolute and proportional terms, falling from 49 to 41 per cent of the total population. In contrast, the working-age population in the less developed regions will grow slowly as a proportion of the whole, from 43 per cent in 2010 to 46 per cent in 2050.

These trends have three major implications for education, skills and training.

First, economic growth will depend even more heavily than today on the productivity of the workforce, complemented by rising labor force participation rates, especially among women and older workers. The challenge of lifelong learning, particularly among ageing but economically active persons, will increase in salience correspondingly. For example, China will experience rapid population ageing in the next few decades and so will have to maintain and upgrade the skills of a growing pool of mature and older workers in addition to making further progress in formal education.

Second, in several regions the growing size of the youth cohort will continue to challenge both education and training capacities and job creation rates as more young people enter the world of work. Everywhere, young people with low skill levels are finding it hard to secure jobs.

Third, international flows of migrant workers will continue to grow, raising challenges concerning fair access to training and how to fill skill gaps in some countries without creating them in others.

5.3 Educational attainment

Education has been identified as an important determinant of economic growth. Higher levels of educational attainment lead to a more skilled and productive workforce, producing more efficiently a higher standard of goods and services, which in turn forms the basis for faster economic growth and rising living standards.

As progress is made towards the goal of universal primary education – stimulated by the Millennium Development Goal and the Education for All initiative led by UNESCO – demand rises for secondary schooling, including vocational education and training. Countries in all regions and of all development levels seek to ensure that basic education is of sufficiently good quality to prepare students adequately for vocational and further training.

Data from the UNESCO Institute for Statistics, assembled by Barro and Lee, show major progress in educational attainment over time, but also major differences between countries. Average years of schooling for those aged 15–24 years in developing countries rose from 3.15 years in 1950 to over 8.5 years in 2010. Over that same period, average years of schooling for 15–24 year-olds in industrialized countries rose from almost seven years to over ten years. In 2010, the average number of years in school for girls reached 84 per cent of that for boys in developing countries and 98 per cent in advanced countries.

Good-quality basic education is closely correlated to economic growth, although it cannot definitively be stated to follow from it. Such education is a foundation for further skills development in productive employment, both initially and throughout adult life. Moreover, a wide distribution of educational attainment across society is a better indicator of likely future economic growth than a high average level. A country's capacity to pick up new technologies and turn them to economic advantage is greater if its education and

training system creates a broad base of adequately educated individuals able to continue learning throughout their careers. Literacy rates are a basic indicator of education coverage and vary widely across G20 countries. A low literacy rate signals an education system that is not preparing society as a whole for further learning and productive work.

It is increasingly acknowledged that training and skills development, whether in schools or elsewhere, is an essential complement to general education in equipping people to grasp opportunities in the world of work.

5.4 Equity and inclusive growth

G20 countries' commitments to inclusive and balanced growth, and the international community's commitments to a global reduction in poverty, also drive efforts to expand the availability of good education and training.

Women's rising rates of participation in the formal labor market and rising levels of educational attainment both contribute to greater social equality between women and men. The educational performance of women is generally better than that of men.

However, women face widespread barriers in seeking to achieve the goal of equality of opportunity and treatment in employment. Gaining new and higher-level skills can both help more women to enter the labor market and contribute to lowering gender disparities in the labor market.

Efforts to combat marginalization in working life are best focused on early education and youth employment. Young people who are not integrated into the labor market at an early age are at high risk of long-term lower wages and employment insecurity, and youth unemployment rates tend to be inversely proportional to level of educational attainment.

In many countries, the transition from school to work is a critical threshold. A successful transition is greatly facilitated by good access to vocational education and training and in-work experience.

Worldwide, 80 per cent of people with disabilities live below the poverty line. Evidence of skills deficits among persons with disabilities is most apparent in countries where quotas for employing disabled people cannot be met because of low education and skill levels.

5.5 Globalization of markets

The defining characteristic of the past 50 years of world economic growth has been the closer integration of markets across regions. This is observed most distinctly in the growth of world trade, foreign direct investment (FDI) and migration.

World trade grew 1.6 times as fast as world GDP between 1950 and 2007. Over the latter part of this period trade increased by 5 per cent annually while GDP grew by only 2.9 per cent. Between 1950–73 and 1974–2007 global FDI as a share of world GDP grew by a factor of five, reaching over 25 per cent in the latter period.

As world trade has grown, so the pattern of exports has changed. The share of industrialized countries in world exports of manufactures has been declining since the 1950s, and more sharply from the 1980s. This decline reflects the increasing specialization of the industrialized countries in services. The correlate is a rising share of developing countries in world manufactures exports to just over a third in 2006, twice the level of 25 years ago.

Shifts in the geographical origins and in the composition of trade have major consequences for skills requirements. Economic transformation, for example from agriculture into manufacturing and services, or changes within an economic sector, for example from more labour-intensive manufactures to higher value-added manufactures, change skill requirements. Adjusting the skills of the workforce to these changing requirements, whether in a country, a local area or a single enterprise, is a continuing challenge everywhere.

International movement of labor, from South to North, but also within the South and within the North, is another prominent feature of globalization The total number of international migrants has grown steadily to reach 214 million in 2010, of which the ILO estimates half are economically active or migrant workers.

The increase in migration within and among countries calls for special arrangements to be made for the education and skills training of immigrants, and for the recognition of the skills they bring with them. It also calls for policies to retain human capital and avoid brain drain. A separate concern is that curtailing the movement of skilled labor will constrain growth and innovation:8 this issue is receiving increasing attention in countries with ageing societies and projected labor shortages.

5.6 Technology and innovation

Innovation and technological change are powerful drivers of economic growth. This has been the case in the past, is a salient feature of the world today, and will no doubt continue to be so in the future. What is particularly notable about today's environment is the rapidity with which innovations spread into mass use.

There are few areas of modern life, from health to transport, and few workplaces and production processes, from agriculture to construction, where goods and services alike have not been subject to constant innovation and improvements. Possibly the most emblematic innovations of recent years are those linked to micro processing chips. The mobile phone appeared in the early 1980s. The International Telecommunications Union estimates that in 2008 mobile phone and fixed broadband penetration in developing countries had reached the level found in Sweden only a decade earlier. In 2009 an estimated 26 per cent of the world's population (1.7 billion people) was using the Internet.

These trends are reflected in both output and trade. The value of world trade in information and communication technology (ICT) goods increased from US$1,000 billion in 1996 to over US$3,500 billion in 2007. Non-OECD countries were responsible for nearly half the 2007 total, compared to just 15 per cent a decade earlier (OECD, 2008).

Innovation and technology translate into investment in fixed capital and in workforce and entrepreneurial skills which in turn lead to higher productivity. Countries with lower levels of economic development accordingly display lower levels of output per worker. However, these countries also tend to register more rapid increases in output.

Rapid innovation will continue to characterize investments as enterprises expand into new products and services. While the pace of change may be faster in emerging economies, the more advanced countries will seek to keep their competitive edge through investment in innovation.

In all countries the implications for skills development are momentous. Many of the jobs that will be generated over the next two decades do not exist today; yet most of the workforce of those years is already in education and training. Even so, the need to upgrade skills applies not only to young people in schools, universities and training institutions, but also to the current generation of workers.

5.7 Climate change and transition to the green economy

Climate change is a major driver of technological change and innovation in the search for measures and policies to mitigate or help adjust to its effects. Sustainable development and the integration of environmental protection into economic and social development objectives are among the most challenging issues on the national and international policy agenda.

The level and structure of employment and skill needs worldwide will be affected both by the direct impact of global warming (particularly in agriculture, fishing, tourism and mining) and by the policies adopted at the local, national and international levels to reduce carbon emissions.

The notion of "green jobs" has become an emblem of a more sustainable economy and society. Jobs in all economic sectors are subject to "greening", but six sectors have particular salience in this respect: energy supply, especially of renewable energy; construction; transportation; basic industry; agriculture; and forestry. Millions of green jobs already exist worldwide. The report launching the Green Jobs Initiative counted at least 2.3 million in the renewable energy sector alone in just six of the G20 countries.

The same report estimated that measures to reduce energy consumption and CO2 emissions in the residential building sector could generate 3.5 million new jobs by 2050.

Alarmingly, the lack of relevant skills may turn out to be a bottleneck in the "greening" of economies. There is an urgent need for training in the full complement of skills required across a broad range of jobs so that economies can both continue "greening" and realize the potential growth in employment the process offers.

Lessons from previous experiences of transition suggest that the transition to cleaner energy requires proactive steps to facilitate the adjustment of labor markets, both to maximize opportunities for new jobs and to address the problems associated with potential job losses. Skills development will play a prominent role in both aspects of this endeavor.

Several countries have reported that a "skills gap" already exists between available workers and the needs of green industries. A 2007 survey of Germany's renewable energy industry concluded that companies are suffering from a shortage of qualified employees, especially in knowledge-intensive occupations. The Confederation of British Industry has likewise expressed concern that sectors going green are struggling to find technical specialists, including designers, engineers and electricians. In the United States, the National Renewable Energy Laboratory has identified a shortage of skills and training as a leading barrier to energy-efficient growth. In Brazil, large biofuel refineries are constrained in their development by a shortage of highly skilled personnel (UNEP, ILO, IOE, ITUC, 2008).

5.8 Diverse realities, common and different challenges

Differences in demographics, economic structures and levels of economic development inform different countries' policies for training and skills development.

A key policy challenge confronting more developed countries is how to ensure that the skills of both job entrants and existing workers remain relevant throughout their careers. Skills gaps can retard enterprise growth and jeopardize workers' employability.

Structural changes in the economy and heightened competition between enterprises reduce the number of available jobs with low skill requirements. These challenges call for broader access to training at the point of entering the jobs market, improvements in the relevance and quality of that training, and expansion of lifelong learning opportunities, all combined with active labor market policies.

A large proportion of the working population requires more and better skills. In addition to specific technical skills, transversal competencies and 'soft' skills are increasingly important, including the ability to engage and interact effectively with others, build consensus, and provide assistance, direction and leadership as needed. As job and labor mobility increase, the portability of skills and international migration of talent become important issues.

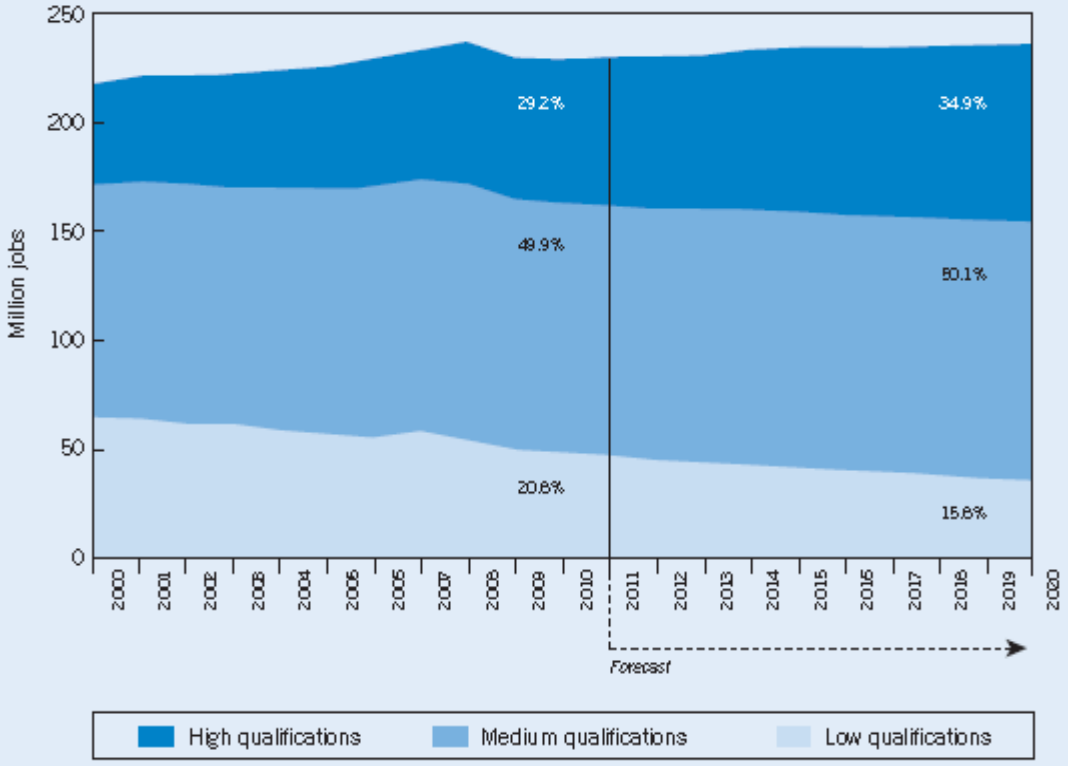
In countries in Central and Eastern Europe, efforts to reinvigorate skills development systems have included restructuring education and training systems to align them with the demands of the new market economy, using labor market institutions to mitigate the negative effects of economic restructuring, and targeting training and lifelong learning on increasing the adaptability and mobility of the workforce. Many countries share the experience of becoming both sending and receiving countries in the flow of migrant workers.

A significant characteristic of many countries in Asia and Latin America is the combination of high growth and productivity in some sectors and regions with low productivity and persistent poverty in rural and urban informal economies. Avoiding skills shortages in high-growth sectors requires improved coordination between prospective employers and providers of education and training, increased public provision of training and encouragement of workplace learning. In some countries, such as China and India, the shortage of high-skilled workers may make it hard to sustain high economic growth rates.

The role of training in promoting the transfer of activities from the informal to the formal economy involves broadening access to basic education, supporting informal means of developing skills, and combining vocational and entrepreneurship training to facilitate the formalization of small enterprises.

Figure no-5.1: Skill requirements in Europe by 2020

Projections for the 27 EU countries, plus Norway and Switzerland, suggest that between 2010 and 2020 some 80 million job opportunities will arise, including almost 7 million additional new jobs. Most of the net employment increase is expected to occur in higher-level occupations. Over the decade, the proportion of people employed in high-qualification jobs is projected to increase from 29 to 35 per cent. The proportion of jobs requiring medium-level qualifications will continue to be about half of total employment, and the proportion of jobs with low qualifications is expected to decline from 21 to 15 per cent.



Source: CEDEFOP, Skills supply and demand in Europe: Medium-term forecast up to 2020, Feb., CEDEFOP, 2010.

5.9 Workers' qualifications in India

In India, employment growth is almost exclusively concentrated in the informal economy, where more than 90 per cent of India's workers are employed at low levels of productivity and income.

Half of the country's population over the age of 25 has had no education and an additional third have at best primary schooling. Four out of five new entrants to the workforce have never had any opportunity for skills training. While enrolment in technical education institutions has increased (from 2.1 million in 2000 to some 3.8 million in 2005), there is a very high drop-out rate in these institutions. There is a huge shortage of teaching faculty in engineering colleges. At the same time, significant skills shortages are reported throughout the formal economy. In the information technology sector alone, the current deficit in engineers is estimated to be around half a million.

In order to address these challenges, India adopted an ambitious National Skills Development Policy in 2009. Its main aim, in the words of the Union Minister for Labor and Employment, is to empower all individuals through improved skills, knowledge and internationally recognized qualifications to give them access to decent employment and to promote inclusive national growth. It is envisaged, among other things, to increase vocational training capacity to 15 million students over the 11th Five Year Plan period (2007-12).

5.10 Meeting today's and tomorrow's skills needs

International experience shows that countries that have succeeded in linking skills development to gains in productivity, employment and development have targeted skills development policy towards three main objectives:

- Matching supply to current demand for skills;
- Helping workers and enterprises adjust to change; and
- Building and sustaining competencies for future labour market needs.

The first objective is about the relevance and quality of training. Matching the provision of skills with labor market demand requires labor market information systems to generate, analyze and disseminate reliable sectoral and occupational information, and institutions that connect employers with training providers. It is also about equality of opportunity in access to education, training, employment services and employment, in order that the demand for training from all sectors of society is met.

The second objective is about easing the movement of workers and enterprises from declining or low-productivity activities and sectors into expanding and higher productivity activities and sectors. Learning new skills, upgrading existing ones and lifelong learning can all help workers to maintain their employability and enterprises to adapt and remain competitive.

The third objective calls for a long-term perspective, anticipating the skills that will be needed in the future and engendering a virtuous circle in which more and better education and training fuels innovation, investment, technological change, economic diversification and competitiveness, and thus job growth.

5.11 A life-cycle perspective

Skills development can fruitfully be viewed from a life-cycle perspective of building, maintaining and improving skills. Policy interventions need to be designed accordingly.

The essential stages can be summarized as follows:

- **Children**: building important foundation skills through early childhood and initial education, keeping in mind that the benefits of these investments will be reaped in the longer term.
- **Young people***:* consolidating foundation skills and gaining important workplace skills and experience for a successful transition from school to work.
- **Mature and older workers**: maintaining and upgrading existing skills and gaining new skills while also certifying the skills and competencies acquired in the working life.

It is also important to recognize that skills build upon one another, and that acquiring foundation skills in literacy and numeracy, as well as "learning to learn", are absolutely essential for acquiring further skills and competencies.

Given the inevitable limitations on resources, difficult trade-offs will need to be made between different policy objectives in determining priorities in public investments in skills development.

5.12 Training and skills development strategies

Robust training and skills strategies and policies are constructed from a number of building blocks. These include anticipating future skills needs; participation of social partners; sector approaches; labor market information and employment services; training quality and relevance; gender equality; broad access to training; financing training; and assessing policy performance.

5.13 Anticipating future skills needs

Leaders of the G20 stressed in Pittsburgh that "it is no longer sufficient to train workers to meet their specific current needs; we should ensure access to training programs that support lifelong skills development and focus on future market needs".

It is therefore essential to be able to anticipate skills needs and to align training provision with changing needs in the labor market. This applies to change in the types and levels of skills needed as well as in occupational and technical areas.

Overall, demand is growing for non-routine analytical skills involving creativity, problem-solving, communication, teamwork and entrepreneurship – all skills that help workers to maintain their employability and enterprises their resilience in the face of change. Conversely, demand is decreasing for more routine skills in functions subject to automation, digitization and outsourcing.

A number of methods are used to forecast future skills needs. These include forecasting occupational and skills profiles at various levels of disaggregation; social dialogue; labor market information systems and employment services; and analysis of the performance of training institutions, including tracer studies.

An important element of the European Commission's "New Skills for New Jobs" initiative is its focus on forecasting future skills needs. The work includes forecasting supply and demand for skills at the EU level to 2020, improving member States' own forecasting systems, and producing skills needs assessments in 18 sectors. The aim is to use better cooperation with social partners and a common skills language (in terms of educational attainment and job content) to improve matching workers to jobs in current labor markets and preparing them for future jobs. The Commission estimates that providing all citizens with adequate skills will increase GDP by as much as 10 per cent in the long run (EC, 2010).

Experience from various countries provides important lessons on the limits of skills forecasting: crucially, that it is better to focus on providing adaptable core, transversal skills, and especially on building the capacity to learn, than on planning training to meet detailed forecasts of technical skill requirements, because these may change before curricula can adjust. Shorter training courses, which build on solid general technical and core skills, can minimize time lags between the emergence of skill needs and the provision of appropriate training. Quantitative analysis based on labour market information is good, but reliable only when complemented by qualitative information from employers and workers.

Alongside the complex process of anticipating what skills will be needed, it is important to take into account individuals' own educational and career aspirations.

Social expectations and stigma attached to different kinds and levels of training, and the quality of the jobs to which they lead, may trump the best supply and demand analysis.

Some economies are starting to see unintended consequences of their efforts to raise education rates while others have a balance across types and levels of education, providing high-quality training in non-academic fields and maintaining good remuneration and societal appreciation for related jobs.

5.14 Labor market information and employment services

Labor market information systems generate, update and disseminate information on current and future skill needs. This supply of critical information on an ongoing and timely basis is half the story.

The other half is the transmission mechanisms that make this continuous flow of timely information available to education and training institutions, private market trainers, employers, trade unions, young people and their families, and displaced workers.

Public employment services (PES) have a critical role to play in making information available in the form of career guidance, vocational counseling, and material on access to training and job-matching services. PES help workers and employers make transitions in the labor market through job-matching services, information and access to labor market programmes (on, for example, skills training or retraining, self-employment and starting a business); and they help jobseekers choose the best options to improve their individual employability, through dissemination of reliable labor market information, career guidance and counseling, and a spectrum of tools and techniques to assist in searching for jobs. Many PES also administer unemployment insurance programmes as a means of providing temporary financial support to workers.

Private employment agencies have an increasing role to play in improving labor market functions through job-matching and the provision of advice. Many countries have improved the regulation of private

employment agencies to enable and monitor their compliance with labor standards (including in areas of equal opportunity) and mobilize them to combat human trafficking and increase training services.

5.15 Training quality and relevance

A great deal of effort is required to make sure that skills development systems deliver both the quantity and the quality of training needed. This entails in the first instance an adequate supply of qualified teachers, trainers, directors of training institutions, and master crafts persons to take on apprentices; the provision of opportunities for them to periodically upgrade their own skills; and conditions of work comparable with those in industry so as to attract the most talented staff.

Well-staffed and adequately funded training institutions are essential to skills development strategies and policies. Periodic reviews may be necessary to assess their effectiveness in meeting their goals and their efficiency in using scarce resources.

Existing training infrastructure needs constant innovation to keep up with new technologies and learning methods. Flexibility and agility are vital to ensure that institutions remain able to respond to the evolving challenges posed by dynamic labour markets. Training institutions must have the capacity to periodically adapt curricula and update teachers' and trainers' skills to the changing needs of the world of work.

Good-quality training outcomes further depend on maintaining a high quality of training contents, methods, facilities and materials. Apprenticeships, and more generally the combination of classroom-based and work-based training, produce the best results.

Skills standards should be set and tested by involving stakeholders in the process. Lifelong learning critically depends on a strong integration between education, training and work.

A skills-based qualification system can accommodate multiple pathways through education, and between education and work.

Flexible workplace training and learning arrangements are conducive to development of a broad range of skills. Workplace training allows students not only to learn the technical skills related to a particular job, but also to develop soft skills, such as communication, ICT, teamwork, problem-solving and the ability to learn, that are ever more critical in changing market environments.

5.16 Gender equality

Training is an important means of pursuing the overall goal of equality of opportunity and treatment for women and men in employment and occupation. Opportunities in the labor market are important means for women to achieve greater equality with men; and the more skilled the female workforce is, the wider women's choices in labor markets will be, and the more likely they are to secure equal treatment.

Overcoming the challenges that confront women in gaining access to education and training and in using this training to secure better employment requires the adoption of a life-cycle approach. This includes improving girls' access to basic education; overcoming logistic, economic and cultural barriers to apprenticeships and to secondary and vocational training for young women – especially in non-traditional occupations; taking into account women's home and care responsibilities when scheduling workplace-based learning and entrepreneurship training; and meeting the training needs of women re-entering the labour market and of older women who have not had equal access to opportunities for lifelong learning.

5.17 Broad access to training

Equal access for all to education, vocational training and workplace learning is a fundamental principle of cohesive societies. Constant attention is required to ensure it is applied in reality.

Some groups of people may require more attention than others if they are to benefit from the opportunities to develop their capacities through education and training. These include under-represented groups; minorities; people with disabilities; immigrants; people from particularly disadvantaged communities; people who have been unemployed for long periods; and people caught up in large-scale redundancies as a result of restructuring.

CHAPTER - 6

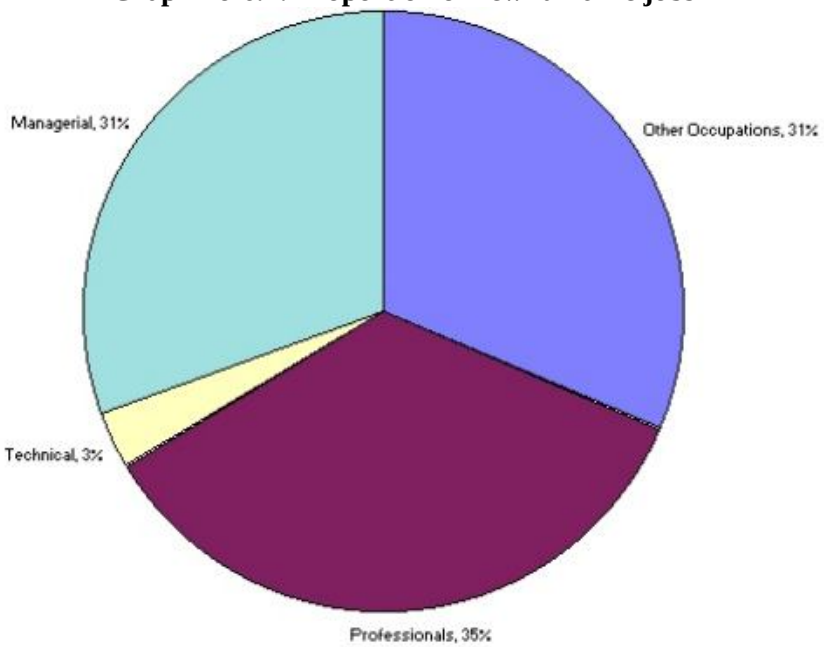
THE OVERALL IT JOB MARKET CONTEXT IN INDIA

6.1 Overseas IT market

The success of the US economy in generating jobs and in reducing unemployment rates without inducing inflation is now well known. But we should remember that until recently, the consensus among macroeconomists and monetary policy experts was that unemployment rates below 5% would set off high and rising rates of inflation. So far, the supplies of labor materialized with little pressure on unit labor costs or prices. Between January 1995 and January 1998, the number of jobs expanded by over 6 million, as over 5 million people joined the labor force and over 1 million left the ranks of the unemployed. The ability to fill these jobs without stimulating inflation is especially striking, given the fact that the economy has been generating mostly high-skill jobs. Nearly two out of three of the 17 million full-time jobs added since 1988 were in the professional, managerial, and technical occupations. In 1988, these occupations accounted for only about on in four jobs. "Up skilling" is taking place not only in the US but in other OECD countries and it is not entirely a recent phenomenon. In 1950, only one of six US workers were professionals, managers, or technical workers; by 1996, the proportion had reached nearly one in three. In addition, skill requirements have been rising for jobs in middle and lower level occupations.

Many of the new jobs are in fields involving creativity and critical thinking. Jobs for actors, college professors, social scientists, reporters, and lawyers have jumped at double and triple the rate of increase of nonprofessional jobs. For example, jobs as college professors rose from 125,000 in 1950 about 850,000 in 1995. Jobs in nonprofessional, non managerial occupations are requiring increasing levels of skill and training.

Graph no-6.1: Proportion of new full time jobs



One study of 56,000 production workers found significant upgrading in the last decade. A New York State study of 1,400 job holders in 300 large and small businesses looked at the skills required in career positions not requiring a college degree, such as practical nurse, auto body repair, inventory clerk, and salad chef. The jobs required skills well beyond minimum competency levels, including many not emphasized in schools, such as having knowledge of a system and its interrelated procedures, reacting constructively to positive or negative criticism, working well as a team member, using information systems, setting priorities, and having good personal work habits. Results from a recent survey of over 3,000 employers in four US metropolitan areas showed that the vast majority of non-college jobs had tasks requiring skills not possessed by many inner-city workers. The tasks required skills and experience in the relevant occupation as well as general skills, such as writing paragraphs and working with computers.

While the educational attainment of the work force has expanded along with the rising job requirements, the growth in college completion slowed considerably over the last decade. Today, too many young people still

lack the skills to perform well in the job market. Just over one in three young people between the ages of 25 and 34 earned any degree beyond high school. About 27% achieved the BA degrees while another 8% gained an AA degree. About one in five young people attended some college but never earned any degree. At the bottom end, 12% were high school dropouts and another 6% passed the General Equivalency Degree, but did not earn a high school diploma.

The evidence on test scores based on the National Assessment of Educational Progress tells a mixed story about 17 year-olds. On the one hand, science scores for 17 year-olds on the National Assessment of Educational Progress increased and math scores rose slightly, especially since the early 1980s. However, we have witnessed essentially no gains in the reading and writing scores of 17 year-olds or 11th graders. Perhaps for these reasons, even with increases in years of schooling, the country still faces an extremely tight job market for the most educated.

The unemployment rate of all college graduates has dropped below 2%, while the rate for high school graduates with no college was still nearly 5%. The average earnings gap between young college and high school graduates jumped from about a 25% to a 50% differential. Among workers at all ages over 18, the college wage premium rose from 41% in 1979 and 56% in 1995.

Although the widening pay differentials represent an unwelcome rise in inequality, a market in which employers willingly absorb skilled workers even at higher wage premiums is far more hopeful than the alternative. Were employers paying less for skill and having little use for extra skills, then educated workers could easily face academic unemployment or frustrations when their jobs require little of the capabilities they worked so hard to achieve. In this sense, we are fortunate that the new technologies are demanding more workers with knowledge and the ability to undertake lifelong learning. But now is a good time to take advantage of today's opportunities so that a broad segment of the work force benefit from the economy.

6.2 Trends in the Information Technology Labor Market in India compare to overseas

What does this general picture of rising demands for skill and tight job markets for the most educated mean for the information technology labor market? Are the employers facing serious shortages for workers in the IT occupations? Before we look specifically at the IT field, it is important to establish what is meant by a shortage. A shortage can be said to exist when the number of jobs requiring a particular type of worker exceeds the quantity of such workers available at the going wage; and when the market is not adjusting rapidly to this imbalance. This second part is critical.

Generally, free markets alleviate shortages through the price mechanism. When workers are scarce at current salaries, we expect employers to bid up wages, which both attracts workers into the field and deters the use of these more highly paid workers. Thus, in a shortage situation, we should observe rising employment and rising wages or some combination of the two. If the initial shortage is widespread and if additional supplies of qualified workers do not materialize, the effort to fill the job vacancies can stimulate inflation.

How do we know when the market is not adjusting? The answer is complicated. When there are many employers, labor market forces will generally raise relative wages enough to attract workers from other fields. In fields involving long lags between the onset of vacancies and the time it takes to train additional workers, rising demand for workers may initially raise wages without bringing additional supplies of workers. However, within a few years, the increased wages draw more workers into the field. A good example is the scientific and engineering occupations. The job market for natural scientists and engineers has fluctuated between large reductions in demand in the mid-1970s to large increases by the mid-1980s to moderating patterns in the early and mid-1990s. When demand fell, so did relative wages, and ultimately the number of students choosing to graduate with an engineering or science degree. When salary premiums increased, as in the mid-1980s, the proportion of students entering the field increased. Thus, market forces generally respond to increases in demand, even in professions requiring lengthy training periods.

Now, let us turn to the IT field. The three primary census occupational classifications for IT workers are: computer systems analysts and scientists, computer programmers, and operations and systems researchers. Computer engineers work with the hardware and software aspects of systems design and development and often work in teams that design new computing devices or computer-related equipment. Software engineers design and develop both packaged and systems software. Database administrators work with database

management systems software, reorganize and restructure data and are responsible for maintaining the efficiency of databases and system security. Computer support analysts provide assistance and advice to users, interpret problems and provide technical support for hardware, software, and systems. Systems analysts implement computer technology to meet the individual needs of an organization. Computer programmers write and maintain the detailed instructions that list in a logical order the steps that computers must execute to perform their functions.

Despite the extravagant claims of a shortage of IT workers, the indicators are mixed. The employment trends reveal rapid growth in the computer systems analysts and scientists, but no growth in the other professions until last year. Employment in operations research has actually declined since 1988 and the total number of computer programmers remained at about 560,000 workers between 1988 and 1996, a time in which employment of all professionals expanded by nearly 30 percent. Only in 1997 do we observe substantial growth in the employment of computer programmers, as jobs increased by 11.6%. One may speculate that the source of the recent sudden jump in programmer positions is the demand by companies, governments, and other organizations to solve the problems linked to the year 2,000 bug. If so, we can expect additional short-term pressures on the job market for programmers this year and perhaps next year, but perhaps even reductions in demand in future years. Data from occupational employment surveys (OES) taken among employers confirm these trends. Employment of computer programmers barely increased at all, while jobs in the higher level fields rose rapidly.

In spite of weak employment growth in two of the three IT occupations, one might still argue that a shortage of workers prevented employers from hiring in these fields. In addition, shortages might have limited the expansion of jobs in the rapidly growing occupation of computer systems analysts and scientists. But, if serious shortages were taking place in any of these fields, we would expect market pressures to raise salaries for IT workers more rapidly than for other professional workers. In fact, the weekly wage patterns show no evidence of a market experiencing a shortage. Except for the 1996-97 periods, real wages have been essentially flat since 1988, rising slightly above the slow growth in median wages experienced by professionals as a whole. Data from some private surveys indicate higher salary levels and higher rates of growth for IT workers, but public surveys show only modest growth.

A survey conducted for the Information Technology Association of American (ITAA) by William Mercer indicated salary increase of nearly 20% and salary levels of well over $50 per hour (equivalent to about $2,000 per week). Unfortunately, the Mercer data are inconsistent with other private surveys as well with public data sources. A survey conducted by Deloitte & Touche Consulting Group revealed that salaries for computer network professionals raised an average of 7.4% between 1996 and 1997. Coopers and Lybrand found average salary increases at 500 software companies were 7.7% in 1995 and almost 8% in 1996. The wage rates and wage growth reported in the Mercer study are far higher not only than the CPS weekly earnings data but also than other private surveys and the BLS employer survey data. The Coopers and Lybrand study estimated that senior software engineers earned $63,000 annually, far below the rates listed in the Mercer study. The BLS occupational compensation survey data show median weekly earnings of under $1,000 per week for jobs at the middle occupational level of computer systems analyst. On an hourly rate, this works out to about $25 per hour, a figure well below the hourly earnings reported by Mercer for middle to high level IT occupations.

Recent employer-based data collected by the Bureau of Labor Statistics indicates wage rates close to the $25-30 figure. Data on the wages paid to computer scientists are available for specific metropolitan areas from the National Compensation Survey (NCS). The NCS data come from employer reports and careful classification by BLS field economists of employees into selected occupations. Using the NCS, we can report hourly compensation paid to computer scientists in several metropolitan areas. One interesting comparison is between wages of computer scientists, a profession said to be in shortage, and wages of teachers, a profession whose workers are often said to be underpaid.

The mean rates of hourly compensation reported by employers for computer scientists and analysts in selected metropolitan areas are well above the wages paid to white collar but were generally below the wages paid to secondary school teachers. Overall, despite considerable recent evidence of spiraling salaries for computer workers appearing in newspaper and journal articles (sometimes based on employer salary

surveys), the data collected by the BLS for broad categories of IT workers through the end of 1996 show modest wage growth, evidence not consistent with rampant labor shortages. Certainly, the job market for IT workers is very tight, as is the market for highly skilled workers as a whole.

A recent study conducted by Virginia Polytechnic Institute (Virginia Tech) and reported jointly with the Information Technology Association of American (ITAA) argues the case for shortages of IT workers. The study surveyed 1,493 companies, of whom only 500 responded to the questionnaire. (This response rate is far lower than what the Bureau of Labor Statistics is able to achieve.) On the basis of these responses, the Virginia Tech than what the Bureau of Labor Statistics is able to achieve.) On the basis of these responses, the Virginia Tech authors estimated that:

1) The core IT workforce is 3,354,000 in the programming, systems analysts, and computer engineering fields; and

2) That vacancies amount to 346,000 or approximately 10 percent of positions.

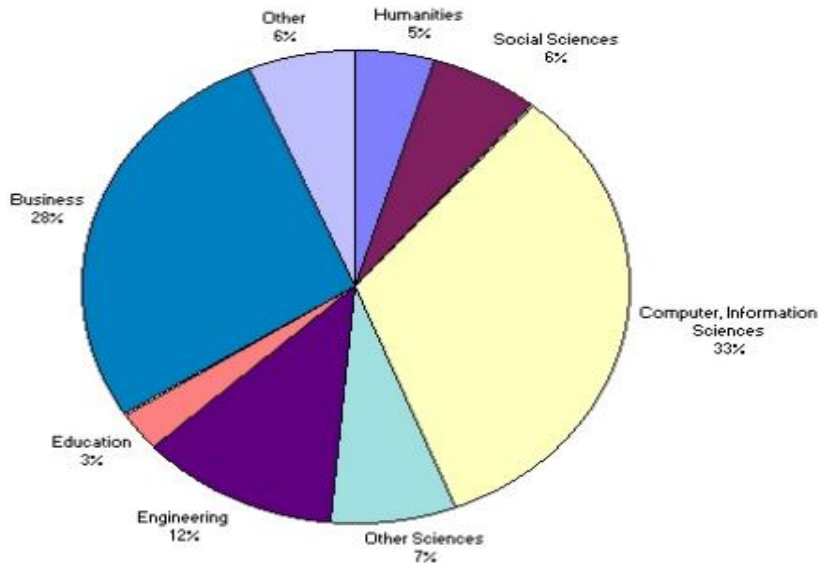
In comparison to the data collected by the Census Bureau both from households and from employers, the Virginia Tech study vastly overestimates the size of the core IT workforce. In 1996, employers reported only about 1.5 million employees working in these fields. Households reported a substantially higher figure, about 2 million, in 1997. Neither figure is close to the 3.3 number projected in the Virginia Tech study.

A second problem with the study is its lack of perspective about the presence of vacancies. In any industry with a rising demand and/or high turnover, the presence of vacancies does not necessarily demonstrate a shortage of workers. A vacancy simply means the firm has an open position it has not yet filled. Vacancies as a proportion of employment will depend on the employers turnover rate, how long it takes to fill a vacancy, and the extent to which the company is growing. Even among employers not expanding at all and in markets where there are no shortages, vacancies can easily reach the rates reported. For example, a company expecting turnover of 30% per year and expecting to take four months to fill a vacancy will have vacancies equal to 10% of employment. If the employer is expanding, vacancies would run at an even higher rate than the 10% figure cited in the Virginia Tech study. For these reasons, the Virginia Tech figure tells us nothing about the presence of a shortage of IT workers, the duration of any shortage, or the reasons for the shortage.

6.3 Meeting Potential Future Shortages

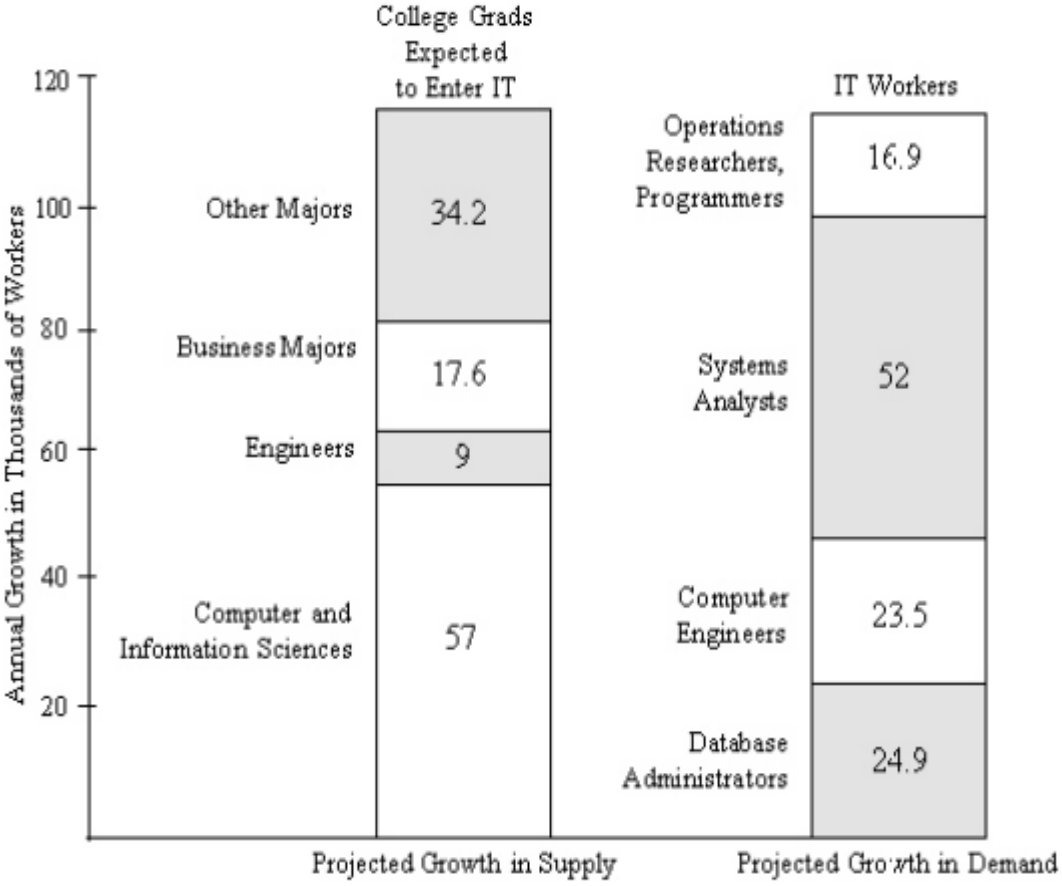
Even if one could be assured that there is no immediate shortage of IT workers, is there reason to be concerned about future shortages, that future demands will outstrip future supplies. The Bureau of Labor Statistics projects rapid rates of employment growth between 1996 and 2006 in IT occupation as follows: computer engineers, 235,000; data base administrators and computer support specialists, 240,000; systems analysts, 520,000; and computer programmers, 129,000. In the fields other than computer programming, the growth is estimated at about 1,000,000 new workers over ten years, or about 100,000 per year.

Graph no-6.2: College graduates entering computer related occupations



Although the numbers constitute very high percentage growth, the absolute number of openings in these fields is approximately the same as projected combined openings among registered nurses and therapists. The additional 1 million job openings in the IT fields other than computer programming represents about 12% of the 8.3 million openings projected for professionals and about 8% of 13.5 million openings among professionals and managers.

Graph no-6.3: Expected annual demands for IT workers and annual sources of supply



Whether the robust demand for computer specialists will outstrip supply depends partly on the ability of the industries employing IT workers to attract new entrants and to retain existing workers. In examining this question, we should recognize that the pool of potential applicants extends well beyond individuals with degrees in computer science. In 2012-13 cohort of college graduates, only one-third with jobs in computer science or programming jobs had degrees in computer science or information science. Nearly as large a share came from majors in business management (28 percent). Students with engineering degrees accounted for 12 percent of new graduates working in IT fields. At the same time, nearly half the computer science graduates entered jobs outside the computer field. The picture is similar for all workers in the computer and information science field. Data from a National Science Foundation study reveals that of the 1.2 million college graduates employed in 2013 in several information technology fields (computer sciences and operations researchers, computer programmers, computer science professors, software engineers, and hardware engineers), only about 31% had degrees in computer science. The largest other majors were business degrees (19%), engineering degrees (10%), math (9%), and a variety of social science degrees (8%). In the case of computer programmers, about 76,000 or 38% of the 200,000 employed in the field had computer science degrees. Another 13,000 had electrical, electronic, and computer degrees. Still, over half the working programmers with BA degrees earned their degrees in non-computer related fields.

A reasonable forward projection would suggest that employers could well meet the expected demand so long as they retain a high share of the existing stock of IT workers. The expected flows from colleges and universities should come close to meeting the expected demand.

6.4 Newly Emerging Training Opportunities

Proprietary schools as well as colleges and universities offer training for IT workers in moderate skill positions. Interviews with officials at three proprietary schools in the Washington, DC area report high growth in enrollments and very high placement rates among those who complete the program. Many of the courses last about 4-5 months and equip workers to take jobs in computer programming in such languages as C++ and JAVA, as computer technicians, and network administrators. The tuition typically ranges from $1,000 to $5,000. The schools are open to students of any background. No prior programming or network experience is necessary. Although the quality of the graduates from these programs is uncertain, there are certification exams in some of the relevant fields. A recent Washington Post story described proposed legislation going through the Virginia House that would provide community colleges with funding to tailor courses to specific industries in the information technology field. Cooperating companies apparently believe that they can fill many of their positions with people trained in the community college system. The story points out how four year universities are also gearing up to meet the demand for IT workers.

While sketchy, the evidence from training programs and emerging post-secondary programs suggests that workers with reasonably good academic skills can gain access to IT professions in a relatively short period of time. On the other hand, these programs are unlikely to serve as the source of workers in the most advanced IT professions.

6.5 Public and Private Responses to Tight Labor Markets for Skilled Workers

Before choosing a response, we must wisely consider what we want to accomplish. Those advocating a policy of expanding temporary visas do so as a means of addressing a serious labor shortage. Unfortunately, the data do not suggest the labor market is substantially tighter in the IT fields than for other skilled occupations. Second, past experience suggests that actions to reduce a shortage often end up producing a surplus in the future. Some professions, including engineers, have been subject to boom and bust cycles. When demand has been robust, salaries have increased and government subsidies have expanded, thereby stimulating a large increase in the supply of engineers. Unfortunately, often just as new entrants have joined the engineering work force, demand for engineers declined.

The combined impact of the expansion in supply and the reduction in demand has sometimes led to an enormous glut of engineers. Ironically, a policy of expanding immigrant visas for IT positions is potentially counter-productive because it can increase uncertainty and reduce the incentive to enter the field. Prospective US students may choose not to prepare for the IT field if they see that foreigners will gain easy access to visas simply by entering an IT occupation.

Do we then do nothing and leave it to the markets to adjust? In my view, the answer is no. The key issue is how more of our citizens can take advantage of the welcome demand for skilled workers and obtain good jobs. In this context, one benefit of today's tight labor market for all workers and for IT workers is the impetus to private-public efforts to expand and improve training, to attract new workers to fields requiring significant skills, and to retain existing workers. A good example of a collaborative private-public initiative is the Applied Information Management (AIM) Institute in Omaha, Nebraska. AIM has brought industry and higher education together in ways that expand the sources of labor. In addition to promoting continuing education, AIM has developed internships and curriculum and has worked to attract high school students to IT careers. For several IT occupations, training is readily available for those who wish to enter the field and the courses can be completed in well under one year. While no doubt market imperfections exist, the capacity to train mid-level IT workers is expanding rapidly. It is important that we promote those efforts and avoid policies that reduce the incentives of employers to undertake sensible long-term strategies that can widen access of American workers to good jobs.

6.6 Using School-Career Initiatives Effectively

Public and private programs could attract some prospective entrants into the field when they are young enough to make adequate preparation in schools and on the job for advanced work in computer science. Currently, few students in high school are aware of what it is that computer scientists do, what academic skills are required, the challenges and activities on the job, and what the economic rewards are. Companies and even governments as employers could promote internships and apprenticeships for high school and college students to give them a taste for the skills required and the content of the jobs in IT careers as well as

allowing students to learn whether they like or dislike the field. Simply making the career ladders transparent and giving students a chance to work and learn at the same time can be very effective.

The Autodesk Foundation is spearheading an effort that includes coordinating internships across the entire San Francisco Bay area not only in the IT field but in others as well. Internships provided by the Autodesk Corporation itself achieved benefits that apparently outweighed the costs during the internship period. These internship experiences are likely to spur many young people to obtain the necessary training to enter high level IT positions.

The government could encourage private firms, the school systems, and foundation officials to work together to expand these opportunities. Some of these efforts have been promoted and funded in part through the School-to-Work Opportunities Act (STWOA) of 1994. Although the 1994 School-to-Work Opportunities Act (STWOA) encourages new combinations of work-based and school-based learning toward the achievement of occupational certifications. it has been almost entirely a decentralized effort, with too minimal a role for the national government or other national institutions. We have little in the way of national or even regional standards. We have set no national targets, certainly none that carry consequences. The results are so far uneven.

6.7 Developing Career Pathways

In the IT field and in others as well, it is important to develop clear career pathways for young people to see and feel. Expanding the school-to-work approach would involve creating more Career Academies and youth apprenticeships in several fields, including the computer field. Career Academies are usually schools within schools oriented around a career theme. As students move through their last 2-3 years of high school, they stay with their own teacher, take extra courses in the theme field, learn directly from industry staff, and go on internships. Students in schools that focus on an occupational area often do better than other students and certainly have higher satisfaction with school and work and stimulate students to learn more about the industry and its requirements. Often, such Career Academies have close links with industry. Students would hear industry leaders pointing out the shortage areas and the rewarding careers in the IT field. One example is the Computer Academy in pune. Students within the academy not only learn about computer hardware and software but they gain valuable work experience. As volunteers working with donated equipment, they are able to earn their own computers as well as produce enough computers to use in classrooms in their own academy as well as throughout the pune district. It would greatly enhance not only the learning by students but also their sense of accomplishment.

6.8 Integrate Work and School-Based Learning

Equally if not more critical are efforts to integrate work-based and school-based learning. A few states, notably Michigan, Maine, and Wisconsin, use the youth apprenticeship approach, has students and employers agree to a program of school-based and work-based learning to achieve a well-designed and broad occupational certification. This approach motivates students not only with strong incentives to learn for future jobs but also for what they produce today in a work context.

Young people want to be able to demonstrate they can accomplish something produce today in a work context. Young people want to be able to demonstrate they can accomplish something that has value. Workplaces are better able to provide these experiences than schools. In addition, youth apprenticeship does more to connect young people with natural adult mentors, to lessen the chance of a mismatch between training and career positions, and to increase the likelihood that students will learn current practice rather than old approaches. Certification can reduce the uncertainty concerning the skills a worker obtains and thus increases the portability and the market value of the training. A natural mentoring process often arises at the workplace in apprenticeship situations. This type of mentoring can teach young people the value of learning, the informal skills required in the field, and the maturity needed for a good life.

6.9 Encourage Business-Government Partnerships

A few state governments have worked with employer groups to define certifications, curricula, and testing. The largest effort in the youth apprenticeship field is taking place in India, where 16-20 occupational standards have been developed in collaboration between the state government, community colleges, and associations of employers. Already, the state has over 1,200 apprentices in fields such as financial services,

health services, printing, auto technology, and biotechnology. Initial results as in printing, demonstrate high levels of success. Unfortunately, youth apprenticeship has developed slowly in most areas.

The virtual abandonment of a national role has weakened the ability to develop national or regional occupational standards. Public-private partnerships could disseminate information to employers on the benefits of training and of supplying student internships or apprenticeships. Many skill certifications already exist, but they are often narrow and might well induce workers not have the flexibility to adapt to future trends. Modernizing and coordinating the current certification system would help workers understand what he or she needs to learn contribute to enter the field and would help firms recognize the capabilities of those achieving a certification.

6.10 Encourage Employer-Sponsored Training

Another approach is to stimulate additional company-sponsored training. There is evidence that company spending on training is going up. However, one deterrent to additional spending is the legitimate fear that spending money on general training for a worker today might yield little benefit if the worker leaves the job market or moves to a competitor. One way to reduce the uncertainty companies' face about their ability of companies to recoup training costs would be to have workers sign a pledge to pay back the firm for training expenses in the event the worker moves to another firm. Before implementing a policy on this subject, it is important to determine why such approaches are not used extensively today. What are the barriers that currently face firms attempting to implement such an approach? Is it the potential difficulty collecting from movers? If so, perhaps a third party could assist firms and workers in formulating and finalizing such agreements.

6.11 Improve Academic Achievement

For the school-to-career initiatives to succeed, we must improve academic achievement of students. One important direction for reform is the establishment of clear standards, examples of what is meant by meeting the standards, and methods of assessing competencies that do not lend themselves to teaching to a test. A promising effort in this direction, financed in part with Federal grants from the National Science Foundation, is the New Standards Project developed by the National Center for Education and the Economy. This project has created standards in math, science, language arts, and applied learning for the 4th, 8th, and 10th grades. The applied learning standards are especially interesting because they require students to develop specific projects that demonstrate problem-solving, teaching and working with others, self-management, communication, and use of computer technologies. For example, meeting the problem-solving standard requires students to plan an event, design a system, or improve a system; students would typically work toward achieving other standards as well, including those in academic subjects.

CHAPTER – 7

DATA ANALYSIS & INTERPRETATION

7.1 Background of Pune region (Study area)

Pune is the eighth largest city in India and the second largest city in the state of Maharashtra. With a name that descends from the Sanskrit word 'Punya', literally meaning 'Virtue', the city leads as the 'veritable heartland' of cultural Maharashtra. Pune also has made its mark the educational epicenter of the country, winning itself the sobriquet, 'The Oxford of the East'.

With a name that descends from the Sanskrit word 'Punya', which literally meaning virtue; Pune is the 'veritable heartland' of cultural Maharashtra. Pune also has made its mark the educational epicenter of the country, winning itself the sobriquet, 'The Oxford of the East'.

Pune is the ninth largest city in India and the second largest city in the state of Maharashtra. Although the city has existed even before 1000 AD, it gained political importance rule of Chhatrapati of Satara during the eighteenth century. During the British rule, it was the monsoon capital of the region. In the 1990s, several foreign multinationals started investing in the city; the information technology and the engineering sector saw a boom. Now there are many IT parks in the city.

Located at the confluence of Mula and Mutha rivers, the city has gained importance over the years. A few decades ago, the city was hailed as the pensioner’s paradise; now the scene has gone a complete makeover. Pune has become one of the happening cities. Thousands of students and employment seekers come to the city for better opportunity and to settle here.

7.2 Data Analysis

Analysis of data is a process of inspecting, cleaning, transforming the data with the objective of highlighting the most useful information and based on it suggesting conclusion which will help in decision making. Data analysis has many facts and approaches, encompassing diverse techniques under a array of names.

The process of data analysis

The hypothesis formed and questionnaire was prepared. For in-depth analysis further hypothesis were formed and tested using appropriate statistical tool. The area of research is Pune City. Sample is drawn using Stratified random sampling. Pilot survey was done and questionnaire was further improved. The response then collected. Final number of response which were complete and without any error was selected for data analysis. Response from 465 respondents was used for final data analysis

7.2.1 Validity and Reliability

Validity

Validity can be defined as the ability of an instrument to actually measure what it is supposed to. A data collecting instrument is considered valid if it is free from both systematic and random error. In this research, a direct contact was made with the respondents in connection with the measure. Thus, researcher was able to safely determine that the measuring results give an indication of what research intended to examine. Researcher has carefully designed the questionnaire, which was then reviewed, commented upon, modified by experts on the subject who have experience within this type of research area. In this way researcher can ensure the face validity of this research. Construct validity is establishing that correct theoretical constructs are being linked to the problems and the results of study. Content validity is high, since a lot of information was gathered to cover as many dimensions as possible.

Reliability

If a measurement scale is reliable, then repeated measurements of the same characteristics will yield similar score over the time and across the situation. Reliability is a tendency in a respondent to respond in the same or in a very similar manner to an identical or near-identical question. According to Sekaran (2003)[1] the reliability of a measure indicates the extent to which the measure is without bias (error free) and free hence offers consistent measurement across time and across the various items in the instrument.

In this study reliability coefficient tested by using Cronbach‟s alpha (α) analysis. Since, Cronbach alpha is commonly used method to measure the reliability for a set of two or more construct where alpha coefficient values range between 0 and 1. Higher values indicate higher reliability among the indicators (Hair, e t al., 1992)[2]. Hence, 1 is the highest value that can be achieved. According to the results of Cronbach alpha test total scale of reliability for this study varied from .814 to .929. This result indicated an overall higher reliability factor. As a result, reliability of this study is substantial, as the highest reliability value that can be achieved is 1.0.

Reliability Coefficient

Table no 7.1 Reliability Coefficients

Variables	Number of items	N	Cronbach's Alpha
‘skill set of students’ and ‘employability’	2	465	0.839
‘conventional education system’ and ‘lack of skill set responsible to cope up with the emerging need in IT industry’	2	465	0.875
‘industry- academic collaboration’ and ‘creating employable talent pool of trained and skilled IT professional’	2	465	0.929
‘Simulating Work Experience’ and ‘enhancing skill set to face the real business world.’	2	465	0.814
‘skilled, industry-ready candidates’ and ‘growth of IT industry’	2	465	0.827
‘enhancing the skills of trainer’ and ‘creating employable talent pool of trained and skilled IT professional’	2	465	0.884

Data analysis was done using appropriate tools.

Demographic Characteristics Of The Respondents:

The term demography indicates the general and allied information about Population, its structure and composition in a particular territory more in particular the socio-economic factors. Demographic information

[1] Sekaran, U. (2003). *Research methods for business: a skill-building approach*(4th ed.). New York: Wiley

[2] Hair J.F., Anderson R.E., Tatham R.L., Black, W.C., 1992. Multivariate Data Analysis with Readings, 3rd edn. Macmillan, New York.

is useful to understand the constituents of a particular territory in terms of age, gender, occupation, income group, educational qualification as well as other cultural factors, which the organization uses for formulating the strategies thereby attaining the ultimate goal of profit maximization.

Demographic description of the respondent

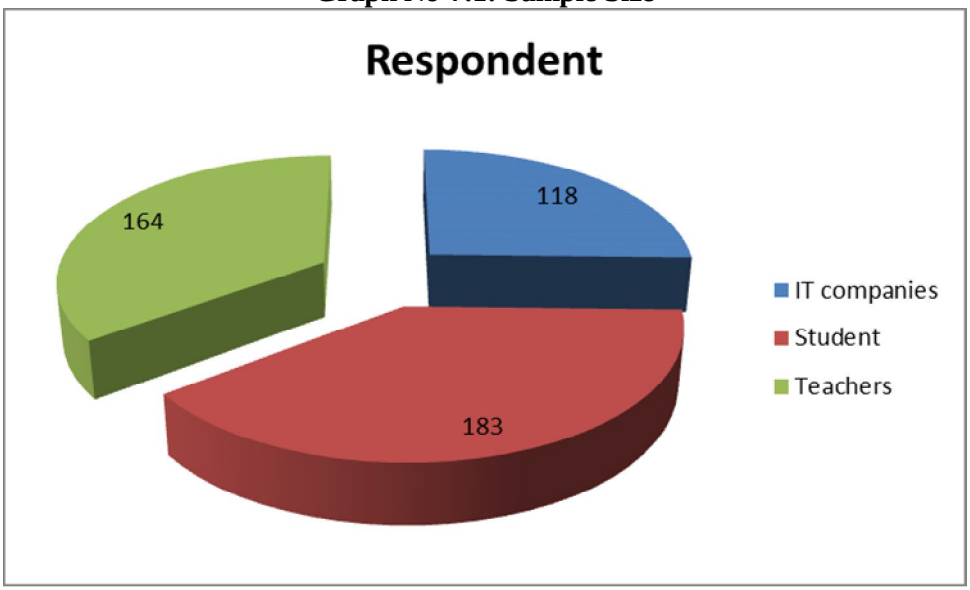
A] Sample Size: 465

Table No 7.2 Sample Size

Sampling Unit	Respondent	Percentage
IT companies	118	25.38
Student	183	39.35
Teachers	164	35.27
Total	465	100.00

Three strata's of population was made and then sample is selected from each strata so as to have the complete representation of sample. In this 118 respondents are from IT companies Head or senior managers are selected. 118 Students are selected from various Technical Institute are selected who are providing degree diploma on IT related subjects and 164 Teachers are selected who are working in various computer institutes on different grades like Trainer and tutor etc. The total sample size is 465

Graph No-7.1: Sample Size



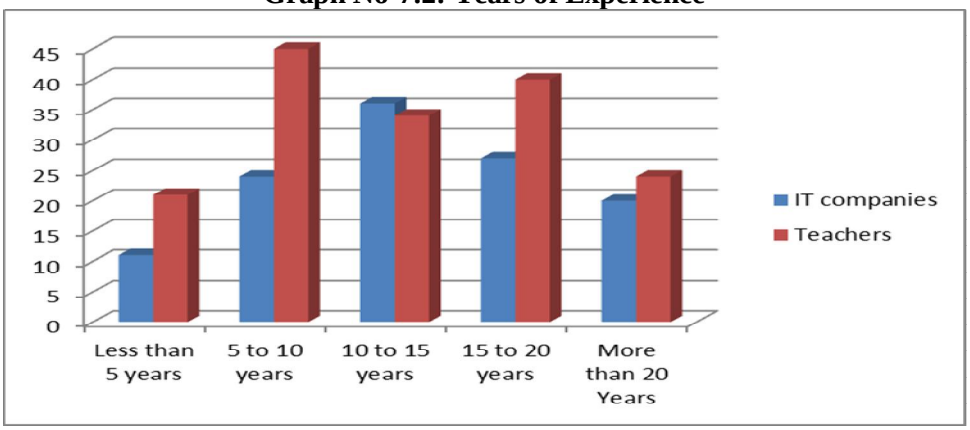
Respondents Years of Experience

Table No-7.3: Years of Experience

Respondent Unit	IT companies	Teachers
Less than 5 years	11	21
5 to 10 years	24	45
10 to 15 years	36	34
15 to 20 years	27	40
More than 20 Years	20	24
Total	118	164

The sample is having respondents with experiences ranging from 5 year to more than 30 years also. Here sample size is divided in five categories which is experience of less than 5 years, 5 to 10 years, 10 to 15 years, 15 to 20 years and more than 20 years. From figures it can be seen that the total sample size is having a range of experience and so it gives a holistic approach to over all study.

Graph No-7.2: Years of Experience



Respondents Age

Table no-7.4: Respondents Age

Age	IT companies		Teachers		Student	
	No of respondents	Percentage	No of respondents	Percentage	No of respondents	Percentage
Less than 25	15	12.71	6	3.66	137	74.86
25 to 35	42	35.59	45	27.44	35	19.13
35 to 45	38	32.20	52	31.71	6	3.28
45 to 55	16	13.56	39	23.78	4	2.19
55 and above	7	5.93	22	13.41	1	0.55
Total	118	100.00	164	100.00	183	100.00

The average age of respondents from IT companies is 25 years to 45 years. The average age of teacher of IT institutes is 35 to 45 years. And average age of students is less than 25 years.

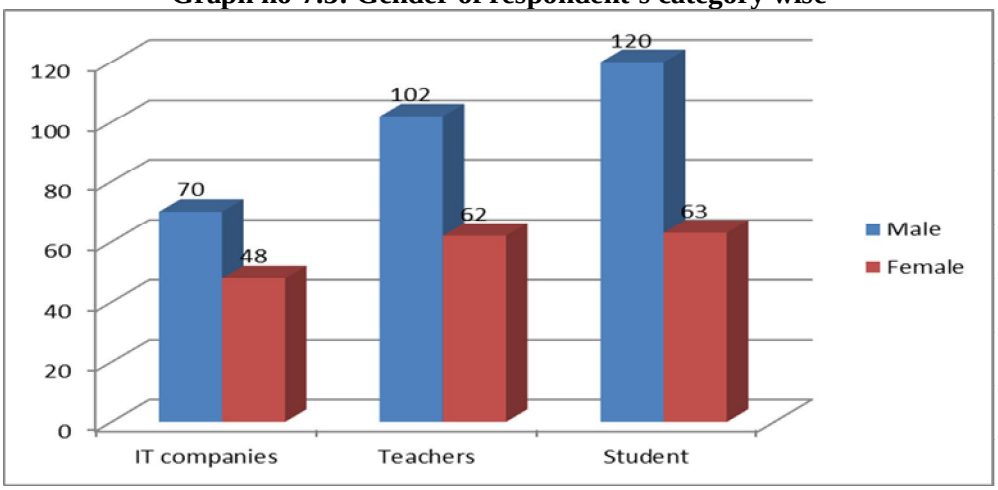
Thus sample represents the population with all age group and major age groups are as above.

Respondents Gender

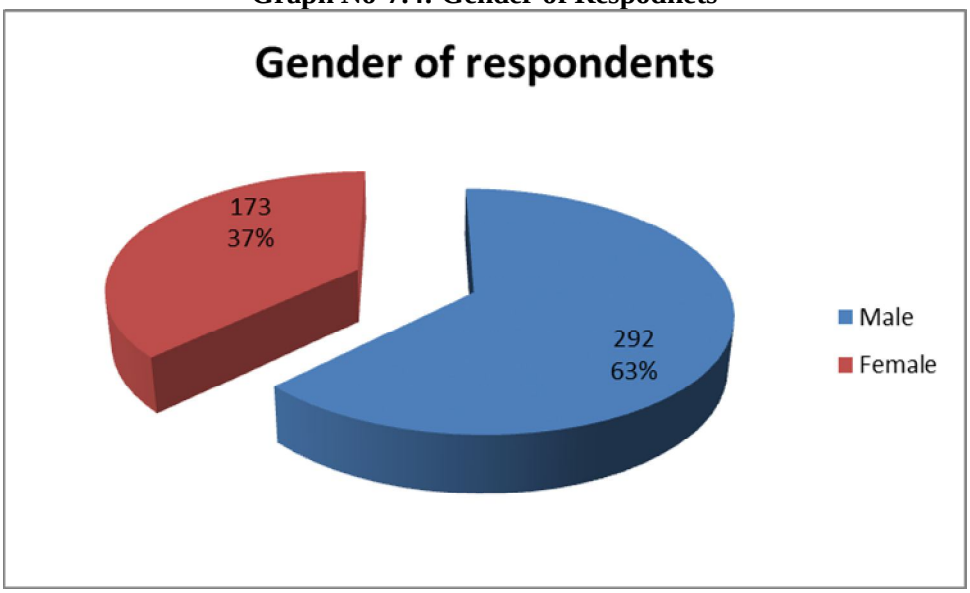
Table no-7.5: Respondents Gender

Gender	IT companies		Teachers		Student	
	No of respondents	Percentage	No of respondents	Percentage	No of respondents	Percentage
Male	70	59.32	102	62.20	120	65.57
Female	48	40.68	62	37.80	63	34.43
Total	118	100.00	164	100.00	183	100.00

Graph no-7.3: Gender of respondent's category wise



Graph No-7.4: Gender of Respodnets



Out of total 465 respondents male to female ratio for IT companies respondent is 60: 40 where as in teachers its 62: 38 and that of students is 66 : 34. When we see sample of all 465 respondents there are total male 173 Female respondents and 292 male respondents. Though it can be said that total female respondents are less than the male respondents, however when compared with other industry the presence of female employees and students in IT industry is higher. And sample represents very closely to the overall population.

Students level of IT course

Table No 7.6 Students Educational level

Level of IT Course	Students	Percentage
UG IT Courses	56	30.60
PG IT courses	45	24.59
Diploma Courses	46	25.14
Certificate courses	36	19.67
Total	183	100.00

The sample size of student respondents is from various level of education. 31 % Students are from undergraduate courses like BCA, B.Sc. IT and few are also from BE and B.Tech IT, 26% are from Postgraduate IT courses like M.Sc. MCM, MCA, and MBA IT etc. 25% student respondents are doing various Diploma in IT and 20% students are doing certification courses in IT. Only those certificate courses students are selected where duration of course is more than one year.

Preferred Employability skills in students Employer looking for

Table no-7.7: Most Important Employability skills

Variables Employer looking for	Scale	5	4	3	2	1	Total	Weighted Average	Ranking
Aptitude for chosen work	Frequency	159	290	10	2	4	465	85.72	1
	Weighted	795	1160	30	4	4	1993		
Foundational professional skills in core domain	Frequency	166	220	65	12	2	465	83.05	2
	Weighted	830	880	195	24	2	1931		
Communication skills	Frequency	149	248	42	22	4	465	82.19	3
	Weighted	745	992	126	44	4	1911		
Knowledge of Technology.	Frequency	161	143	79	61	21	465	75.57	4
	Weighted	805	572	237	122	21	1757		
Problem Solving Abilities.	Frequency	172	144	41	74	34	465	74.88	5
	Weighted	860	576	123	148	34	1741		

Willingness to Learn	Frequency	137	132	149	27	20	465	74.58	6
	Weighted	685	528	447	54	20	1734		
Teamwork	Frequency	104	165	127	44	25	465	72.00	7
	Weighted	520	660	381	88	25	1674		
Integrity	Frequency	101	170	122	44	28	465	71.70	8
	Weighted	505	680	366	88	28	1667		
Self-motivated	Frequency	145	100	105	80	35	465	70.32	9
	Weighted	725	400	315	160	35	1635		
Self-discipline	Frequency	142	93	121	74	35	465	70.02	10
	Weighted	710	372	363	148	35	1628		
Coping with stress	Frequency	97	144	134	66	24	465	69.63	11
	Weighted	485	576	402	132	24	1619		
Decision-making	Frequency	118	123	106	81	37	465	68.77	12
	Weighted	590	492	318	162	37	1599		

Being good at the one skill cannot facilitate the competency in other. The applicant who is multi-tasking can sustain and gain in the employment. We can only make priority and importance however it doesn't means the last skill is not important at all, only priority has to be set accordingly.

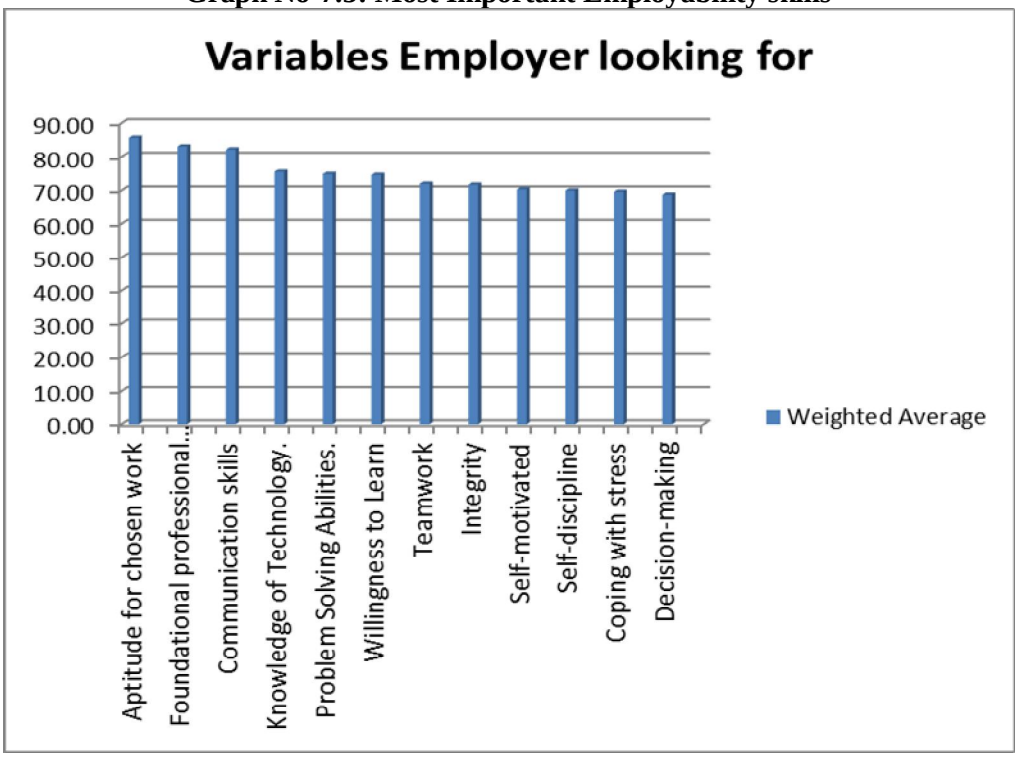
Above table shows that most important employability skills are 'Aptitude for chosen work', 'Foundational professional skills in core domain' and 'Communication skills'

Though feedback is taken for employability skills for IT industry it is interesting to note that communication skills come in top important skills. This is observed that students in technical education sometimes ignore the importance of communications skills and soft skills. Expressing oneself is one of the important skills and in corporate world communication is a key to success.

Also skill 'Foundational professional skills in core domain' is important. Here it is expected that basics should be good and students should also have Aptitude for chosen work.

Next important skills set are 'Knowledge of Technology', Problem Solving Abilities. And 'Willingness to Learn' followed by Teamwork, Integrity.

Graph No-7.5: Most Important Employability skills



Developing future workforce relies on the current students' mastery of competencies that are needed in the workplace. It is known that the educational system mainly responsible for preparing qualified workforce by providing them with knowledge, skills, and attitudes upon completion of education. Institutes should produce graduates with the skills that are highly regarded by employers and are seen to contribute to the country's prosperity and social capital. This will ultimately results in development of IT industry as well.

7.3 HYPOTHESIS TESTING

H_1: There is significant relationship between the skill set of students and employability.
The relationship between the two variables which are 'skill set of students' and 'employability' were selected and response was taken on 5 point scale where 5 being Strongly agree to 1 being strongly disagree. And there correlation is tested using Pearson Correlation

Table 7.3.1 Reliability Statistics for H1

Cronbach's Alpha	N of Items
.839	2

The table shows the alpha coefficient for the two items is .839, suggesting that the items have relatively high internal consistency.

Table No 7.3.2 Correlations – H1

		Skill set of students	Employability
Skill set of students	Pearson Correlation	1	.724**
	Sig. (2-tailed)		.000
	N	465	465
Employability	Pearson Correlation	.724**	1
	Sig. (2-tailed)	.000	
	N	465	465

**. Correlation is significant at the 0.01 level (2-tailed).

From Table we can see that the correlation coefficient between the 'skill set of students' and 'employability' is 0.724 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'skill set of students' and 'employability' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between the 'skill set of students' and 'employability'

H_2: There is significant relationship between the conventional education system and lack of skill set responsible to cope up with the emerging need in IT industry.
The relationship between the two variables which are 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry' were selected and response was taken on 5 point scale where 5 being Strongly agree to 1 being strongly disagree. And there correlation is tested using Pearson Correlation

Table No 7.3.3 Reliability Statistics for H2

Cronbach's Alpha	N of Items
.875	2

The table shows the alpha coefficient for the two items is .818, suggesting that the items have relatively high internal consistency.

Table No 7.3.4 Correlations – H2

		Conventional education system	Lack of skill set to cope up with need in IT industry
Conventional education system	Pearson Correlation	1	.778**
	Sig. (2-tailed)		.000
	N	465	465

Lack of skill set to cope up with need in IT industry	Pearson Correlation	.778**	1
	Sig. (2-tailed)	.000	
	N	465	465
**. Correlation is significant at the 0.01 level (2-tailed).			

From Table we can see that the correlation coefficient between the 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry' is 0.778 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry'

H_3: There is a significant difference between the perception of industry and academia about the employability skills of IT students.

Table No-7.3.5: Independent Samples Test for H3

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Employability skills of IT students.	Equal variances assumed	33.814	.000	-2.839	280	.005	-.14479	.05099	-.24517	-.04441
	Equal variances not assumed			-2.564	156.43	.011	-.14479	.05648	-.25635	-.03324

Table gives the value of F as 33.814 with significance (probability) 0.000. As probability reported here is 0.00 signifies that chances of variance being equal are Zero and so null hypothesis is rejected. As two groups do not have equal variance statistic associated with *'equal variance not assumed'* will be used for t-test for equality of means.

The t-test result shows t statistic of -2.564 with 156.43 degree of freedom. The corresponding two-tailed p value is 0.011 which is less than 0.05 **so we reject the null hypothesis at 5% significance level** and **accept the alternate hypothesis** that there is a significant difference between the perception of industry and academia about the employability skills of IT students.

H_4: There is a significant relationship between 'industry- academic collaboration' and creating employable talent pool of trained and skilled IT professional

The relationship between the two variables which are 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional' were selected and response was taken on 5 point scale where 5 being Strongly agree to 1 being strongly disagree. And there correlation is tested using Pearson Correlation

Table No 7.3.6 Reliability Statistics for H4

Cronbach's Alpha	N of Items
.929	2

The table shows the alpha coefficient for the two items is .929, suggesting that the items have relatively high internal consistency.

Table No-7.3.7: Correlations – H4			
		Industry- academic collaboration	**IAC Creating employable talent pool**
Industry- academic collaboration	Pearson Correlation	1	.868**
	Sig. (2-tailed)		.000
	N	465	465
IAC Creating employable talent pool	Pearson Correlation	.868**	1
	Sig. (2-tailed)	.000	
	N	465	465
**. Correlation is significant at the 0.01 level (2-tailed).			

From Table we can see that the correlation coefficient between the 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional' is 0.868 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional'.

H_5: There is a significant relationship between 'Simulating Work Experience' and enhancing skill set to face the real business world.

The relationship between the two variables which are 'Simulating Work Experience' and enhancing skill set to face the real business world. were selected and response was taken on 5 point scale where 5 being Strongly agree to 1 being strongly disagree. And there correlation is tested using Pearson Correlation

Table No 7.3.8 Reliability Statistics fo H5	
Cronbach's Alpha	N of Items
.814	2

The table shows the alpha coefficient for the two items is .814, suggesting that the items have relatively high internal consistency.

Table 7.3.9 Correlations – H5			
		Simulating Work Experience	**Enhancing skill set to face the real business world.**
Simulating Work Experience	Pearson Correlation	1	.689**
	Sig. (2-tailed)		.000
	N	465	465
Enhancing skill set to face the real business world.	Pearson Correlation	.689**	1
	Sig. (2-tailed)	.000	
	N	465	465
**. Correlation is significant at the 0.01 level (2-tailed).			

From Table we can see that the correlation coefficient between the 'Simulating Work Experience' and enhancing skill set to face the real business world is 0.689 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'Simulating Work Experience' and enhancing skill set to face the real business world. And that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between 'Simulating Work Experience' and enhancing skill set to face the real business world.

H_6: There is a significant relationship between skilled, industry-ready candidates and growth of IT industry.

The relationship between the two variables which are 'skilled, industry-ready candidates' and 'growth of IT industry' were selected and response was taken on 5 point scale where 5 being Strongly agree to 1 being strongly disagree. And there correlation is tested using Pearson Correlation

Table No 7.3.10 Reliability Statistics for H6	
Cronbach's Alpha	N of Items
.827	2

The table shows the alpha coefficient for the two items is .827, suggesting that the items have relatively high internal consistency.

Table no 7.3.11 Correlations – H6			
		Skilled, industry-ready candidates	**Growth of IT industry**
Skilled, industry-ready candidates	Pearson Correlation	1	.705**
	Sig. (2-tailed)		.000
	N	465	465
Growth of IT industry	Pearson Correlation	.705**	1
	Sig. (2-tailed)	.000	
	N	465	465
**. Correlation is significant at the 0.01 level (2-tailed).			

From Table we can see that the correlation coefficient between the 'skilled, industry-ready candidates' and 'growth of IT industry' is 0.705 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'skilled, industry-ready candidates' and 'growth of IT industry' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between skilled, industry-ready candidates and growth of IT industry.

H_7: There is a significant relationship between enhancing the skills of trainer and creating employable talent pool of trained and skilled IT professional

The relationship between the two variables which are 'enhancing the skills of trainer' and 'creating employable talent pool of trained and skilled IT professional' were selected and response was taken on 5 point scale where 5 being Strongly agree to 1 being strongly disagree. And there correlation is tested using Pearson Correlation

Table No 7.3.12 Reliability Statistics for H7	
Cronbach's Alpha	N of Items
.884	2

The table shows the alpha coefficient for the two items is .884, suggesting that the items have relatively high internal consistency.

Table no 7.3.13 Correlations - H7			
		Enhancing the skills of trainer	**Skills creating employable talent pool**
Enhancing the skills of trainer	Pearson Correlation	1	.795**
	Sig. (2-tailed)		.000
	N	465	465
Skills creating employable talent pool	Pearson Correlation	.795**	1
	Sig. (2-tailed)	.000	
	N	465	465
**. Correlation is significant at the 0.01 level (2-tailed).			

From Table we can see that the correlation coefficient between the 'enhancing the skills of trainer' and 'creating employable talent pool of trained and skilled IT professional' is 0.795 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'enhancing the skills of trainer' and 'creating employable talent pool of trained and skilled IT professional' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between enhancing the skills of trainer and creating employable talent pool of trained and skilled IT professional.

7.4 Summary Of Hypothesis testing

Table No-7.4.1: Summary of Hypothesis testing

Hypothesis	Results
H1: There is significant relationship between the skill set of students and employability.	Accepted
H2: There is significant relationship between the conventional education system and lack of skill set responsible to cope up with the emerging need in IT industry	Accepted
H3: There is a significant difference between the perception of industry and academic about the employability skills of IT students.	Accepted
H4: There is a significant relationship between 'industry- academic collaboration' and creating employable talent pool of trained and skilled IT professional	Accepted
H5: There is a significant relationship between 'Simulating Work Experience' and enhancing skill set to face the real business world.	Accepted
H6: There is a significant relationship between skilled, industry-ready candidates and growth of IT industry..	Accepted
H7: There is a significant relationship between enhancing the skills of trainer and creating employable talent pool of trained and skilled IT professional	Accepted

CHAPTER-8

FINDINGS, CONCLUSIONS, SUGGESTIONS AND RECOMMENDATIONS

Major findings of A Study Of Training Institutes For Creating Talent Pool Of Trained And Skilled It Professional To Cope Up With The Emerging Need In IT Industry – Challenges And Potentials' are as follows:

- The correlation coefficient between the 'skill set of students' and 'employability' is 0.724 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'skill set of students' and 'employability' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between the 'skill set of students' and 'employability'
- The correlation coefficient between the 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry' is 0.778 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between 'conventional education system' and 'lack of skill set responsible to cope up with the emerging need in IT industry'
- The value of F as 33.814 with significance (probability) 0.000. As probability reported here is 0.00 signifies that chances of variance being equal are Zero and so null hypothesis is rejected. As two groups do not have equal variance statistic associated with *'equal variance not assumed'* will be used for t-test for equality of means.
- The t-test result shows t statistic of -2.564 with 156.43 degree of freedom. The corresponding two-tailed p value is 0.011 which is less than 0.05 **so we reject the null hypothesis at 5% significance level** and **accept the alternate hypothesis** that there is a significant difference between the perception of industry and academia about the employability skills of IT students.
- The correlation coefficient between the 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional' is 0.868 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between 'industry- academic collaboration' and 'creating employable talent pool of trained and skilled IT professional'.
- The correlation coefficient between the 'Simulating Work Experience' and enhancing skill set to face the real business world is 0.689 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'Simulating Work Experience' and enhancing skill set to face the real business world. And that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between 'Simulating Work Experience' and enhancing skill set to face the real business world.
- The correlation coefficient between the 'skilled, industry-ready candidates' and 'growth of IT industry' is 0.705 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between 'skilled, industry-ready candidates' and 'growth of IT industry' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between skilled, industry-ready candidates and growth of IT industry.
- The correlation coefficient between the 'enhancing the skills of trainer' and 'creating employable talent pool of trained and skilled IT professional' is 0.795 and the *p* value for two tailed test of significance is less than 0.0005. From these figures we can conclude that there is strong positive correlation between

'enhancing the skills of trainer' and 'creating employable talent pool of trained and skilled IT professional' and that this correlation is significant at the significance level of 0.01. Thus the Null hypothesis is rejected and we can accept the hypothesis that there is significant relationship between enhancing the skills of trainer and creating employable talent pool of trained and skilled IT professional.

Conclusion

- Several studies have reported that a "skills gap" already exists between available workers and the needs of industries.
- IT skill standards constitute a common-language framework for educators, employers, and corporate trainers to develop the educational and training tools necessary to prepare students and incumbent workers for today's workplace challenges.
- Both IT educators and HR professionals are realizing that these standards can be used effectively as a foundation tool for developing educational curriculum, profiling jobs, recruiting and evaluating employees, and designing academic and professional certification.
- All major stakeholders in IT workforce development business, IT professionals, students, educators, government policymakers benefit from IT skill standards.
- The demand for IT graduates continues to grow because of the growth and expansion of IT infrastructures and application.
- Many businesses and the government are expected to continue automating their business processes. Advertisements in the local and international media show that there is a strong demand for IT graduates in all areas and this is probably driving the demand for IT degree programs.
- Consequently, all training institutes have introduced many degree program in the areas of information systems, computer science, electronic engineering, software engineering, computer engineering, and other variations of IT degree programs.
- Most of these programs are developed without explicit reference to the model curricula developed by professional IT associations (e.g., ACM, AIS, and IEEE) in collaboration with the academic community.
- In many cases, the programs are structured in ways that are similar to similar programs in other countries especially UK, US or Japan.
- In some cases, the curricula of some of the older IT degree programs in electronic engineering or computer science have not been reviewed in response to global trends. Neither have the teaching labs been modernized nor the older IT faculty trained in emerging technologies and teaching methods.
- Many IT degree programs are not achieving the desired learning outcomes in general and this could affect the innovativeness of the graduates.
- One of the problems for IT students, graduates is to determine the relative needs of different IT skills and knowledge elements.
- The problem is that there is a shortage of IT faculty in all these areas who have the relevant academic qualifications as well as professional industry experience.
- The IT profession is portable and global. It will continue to attract the best students. Training institutes need to offer the best IT education to the bright students because of the impact on performance of businesses and government.

Suggestions and recommendations

- There is therefore an urgent need to develop local accreditation standards using a participative process involving the Commission for Higher Education as the accreditation body, professional ICT associations, and local industry, and IT departments.

- Apart from the local drivers for demand for the high demand for IT graduates, this study has shown that the emerging knowledge economy will increase the demand for IT graduates in the future.
- Apart from developing IT faculty, training institutes will have to create world-class specialized labs for educating innovative IT professionals. Industry links could support such facilities.

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- https://www.cipd.co.uk/Images/learning-and-talent-development_2013_tcm18-11297.pdf
- https://www.oecd.org/g20/summits/toronto/G20-Skills-Strategy.pdf
- https://www.capgemini.com/resource-file-access/resource/pdf/the_digital_talent_gap27-09_0.pdf
- http://groups.itu.int/LinkClick.aspx?fileticket=HLju6vFJJ5o%3D&tabid=1862
- https://su-plus.strathmore.edu/bitstream/handle/11071/3179/Emerging%20Trends%20in%20Information%20and%20Communications%20Technology.pdf?sequence=2&isAllowed=y
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- https://www.comptia.org/resources/it-industry-outlook-2016-final
- http://www.globalization101.org/uploads/File/Technology/tech.pdf
- https://www.thedti.gov.za/industrial_development/docs/Final_Technology_Trends.pdf
- https://www.urban.org/sites/default/files/publication/66831/900276-Emerging-Trends-in-the-Information-Technology-Job-Market-How-Should-the-Public-and-Private-Sectors-Respond-.pdf
- https://www.bls.gov/careeroutlook/2009/spring/art04.pdf
- http://www.jff.org/sites/default/files/publications/materials/CTW_ExaminationInfoTechnJobMarket_071212.pdf

ANNEXURE-I-LIST OF IT COMPANIES IN PUNE

- Tata Consultancy Services / TCS, Pune
- Infosys Technologies, Pune India
- Tata Technologies, Pune
- KPIT Cummins Infosystems Ltd., Pune
- Wipro Technologies, Pune
- Tech Mahindra Limited, Pune
- Capgemini India, Pune
- Satyam Computer Services Ltd., Pune
- 3DPLM Software Solutions Limited, Pune India
- Fluent India Pvt Ltd., Pune
- Persistent Systems Limited, Pune
- Synechron Technologies Pvt Ltd, Pune. India
- Honeywell Automation India Ltd, Pune India
- Sybase India, Pune
- Axis Software Pvt. Ltd. Pune India
- C-DAC Pune India
- Zensar Technologies Ltd. Pune India
- Accenture Services Pvt Ltd. Pune
- IBM India Pvt. Limited. Pune
- Selectica India Pvt Ltd
- Patni Computer Systems Ltd., Pune India
- CECsoft
- MphasiS
- Red Hat Software Services (India) Private Limited, Pune
- Hindavi Technologies & Consulting Services (HTCS), Pune India
- Ecotech IT Solutions Pvt. Ltd.
- AccelTree Software Private Limited, Pune
- Upside Learning Solutions Pvt. Ltd. Pune India
- Geometric Limited, Pune
- JoyTree Software, Pune India
- Syntel, Talwade Pune India
- BMC Software, Pune
- American Home Mortgage Servicing India Private Limited (AHMSI) Pune
- L&T Infotech, Pune India

- Tieto Software Technologies Pvt. Ltd
- PTC Software (India) Pvt. Ltd. / Parametric Technology (India) Ltd R&D - Pune
- Artificial Machines Pvt. Ltd. Pune India
- Panacea Infotech Pvt. Ltd.
- softUsvista, Pune India
- Fundtech Ltd. Pune India
- RevoSolution, Pune India
- Radix Business Models Pvt.Ltd. Pune India
- XNet Inc. Pune India
- Cygnus Software Pvt Ltd
- Vatsa Solutions, Pune India
- Kakasoft, Pune
- Kale Consultants Ltd., Pune
- Harbinger Systems, Pune
- Harbinger Knowledge Products, Pune
- e-Zest Solutions Ltd. Pune
- Aftek Limited, Pune
- Cognizant Technology Solutions, Pune India
- Advent Software Pvt. Ltd., Pune
- Amdocs
- Brainvisa Technologies Pvt. Ltd.
- CalSoft Pvt. Ltd. Pune
- Compulink Systems Ltd. Pune
- Cybage Software Pvt. Ltd. , Pune India
- 01 Synergy, Pune
- Vavni, Pune India
- DSS Systems & Software Technologies Limited.
- Suma Soft Private Limited, Pune India
- eInfochips Limited. Pune
- Pesh-Infotech Pvt. Ltd. Pune
- Siemens PLM Software, Pune
- Digital Group InfoTech Pvt. Ltd, Pune India
- FIRST INSIGHT SOFTWARE SOLUTIONS (I) PVT LTD.
- Websym Technologies Pvt. Ltd., Pune India
- Starent Networks (India) Pvt. Ltd.

- INDICUS SOFTWARE PVT. LTD. Pune
- ZenSOFT Services Pvt. Ltd, Pune
- Simple Solutions
- QualEx Systems Private Limited, Pune India
- YASH Technologies Pvt Ltd, Pune India
- Fifth Elementz Technologies Pvt. Ltd. Pune India
- e2orb Technologies
- Invengence Technologies Pvt. Ltd., Pune India
- TPS360°
- Fidel Softech Pvt. Ltd. Pune India
- Futurism Technologies Pvt Ltd, Pune India
- HSBC Software Development (India) Private Limited, Pune India
- Sonata Information Technology Limited, Pune India
- TIBCO Software India Pvt. Ltd., Pune India
- BitWise Solutions Pvt. Ltd Pune India
- SunBeam Computing Technologies Pvt. Ltd.
- Saitech Datasystems Pvt. Ltd. Pune India
- NVIDIA, Pune India
- Survik Software Ltd. Pune India
- Nihilent Technologies Pvt. Ltd. Pune India
- BioEnable Technologies Pvt. Ltd. Pune India
- Cross Country Infotech Pvt. Ltd. Pune India
- Cympac Software Solutions Pvt. Ltd. Pune India
- Sankalp Computer & Systems Pvt. Ltd. Pune India
- Yardi Software India Pvt Ltd Pune
- SpadeWorx Software Services
- Ignify, Pune India
- Synygy India Pvt. Ltd. Pune India
- Verve Communications Pvt. Ltd. Pune
- C3IT Software Solutions Pvt. Ltd. Pune India
- Saama Technologies (India) Pvt. Ltd. Pune India
- Clogeny Technologies
- Vercingetorix Technologies Pvt. Ltd. Pune India
- Opus Software Solutions Private Limited, Pune India
- Saband Software Technologies Pvt. Ltd. Pune India

- vemployee
- Leo TechnoSoft Pvt Ltd Pune India
- Clarion Technologies Pune
- Tashw Solutions Pune
- TSQUARE Software Pvt. Ltd. Pune
- SanSoft Services Pune
- Sellcraft Softech Pvt. Ltd.
- SAS Research & Development, India
- Cerillion Technologies (I) Pvt. Ltd.
- Reflexis Systems India Private Limited Pune
- John Deere Technology Center, Pune
- ZS Associates India Private Ltd., Pune
- Spectraforce Technologies, Pune
- AGS Technologies
- Ameya Software Pune
- Decos Software Development, Pune India
- SEED Solutions Pune
- WYSE Biometrics Systems Pvt. Ltd. Pune
- eVision Infotech, Pune India
- Quagnitia Systems Pvt. Ltd. Pune
- Synise Technologies Ltd. Pune India
- Qseap Technologies Pvt. Ltd. Pune India
- Kalyani Infotech Pune India
- Quicsolv Software Pune India
- Golden Ball Technologies Pune
- Texnovate Solutions Private Limited, Pune India
- Opel IT Services, Pune India
- Avsar Info Tech Pvt. Ltd. Pune India
- Indenture Technologies, Pune India
- Binary Computer Systems, Pune India
- mRova Solutions, Pune India
- Hoonar Tekwurks Consulting LLP, Pune India
- ComPos Pune India
- Urjit Technologies, Pune India
- Vsoft Solutions & Consultancy Pvt. Ltd.

- Xento Systems Pvt. Ltd. Pune
- TechnoPENTA Software Solutions
- XTPL Pune India
- GreenFrog IT Solutions Private Limited Pune
- Newton Software Pvt Ltd. Pune India
- Enzigma Software Pvt. Ltd. Pune India
- Affinity Express, Pune India
- SOFTAiD SYSTEMS, Pune India
- Amarya Technologies, Pune India
- Aikon Labs, Pune India
- Maqbit Technologies, Pune India
- Graphinet Solutions Pvt. Ltd. Pune India
- Cytel Statistical Software & Services Pvt. Ltd. Pune
- Worldwide infosoft services pvt ltd (WIS), Pune India
- Infotek Software & Systems (P) Ltd / i-Tek, Pune India
- AFour Technologies, Pune India
- VJ Coresoft Pvt. Ltd. Pune India
- VarIT Information Technology Pvt. Ltd. Pune India
- Amalan Technologies, Pune India
- Omesa Systems Pvt. Ltd. Pune India
- SQTL Integrated Solutions Pvt. Ltd.
- QTRA
- CashTech Solutions India Ltd. Pune
- COLOGICX Systems Ltd.
- Silicus Technologies India Pvt. Ltd. Pune
- Eilisys Technologies Pvt. Ltd. Pune India
- Nita Ideas
- CRG Solutions (India) - Pvt. Ltd. Pune India
- Protus Systems
- SoftCrop Technology
- NADSOFT
- Lohit Softech Pvt.Ltd. Pune India
- WebDefenders Consulting Pvt Ltd, Pune India
- eDreamz, Pune
- Binary IT Services Pvt Ltd, Pune India

- Prorigo Software Pvt. Ltd. Pune India
- Gridlogics Technologies Pvt. Ltd. Pune
- Inteliment Technologies (India) Pvt. Ltd. Pune. India
- Josh Software Pvt. Ltd. Pune
- Idhasoft Ltd Pune India
- AIPL Ascent Informatics (India) Pvt. Ltd. Pune India
- EpiComm Technologies Limited, Pune
- Sunbridge Software Services, Pune
- Omniscient Software Pvt. Ltd. Pune
- ShimBi Computing Laboratories Private Limited. Pune
- Kopera Software Private Limited, Pune
- Guardbook Technologies Pvt. Ltd. Pune
- Precision Technical Analysis Pvt. Ltd. Pune India
- INTUITIVE Technologies Private Limited, Pune India
- Minmax Software Pvt. Ltd. Pune
- Netwin Infosolutions Pvt Ltd Pune
- Merit Software and Services Pvt. Ltd Pune
- Computer Technologies Pvt. Ltd. Pune India
- Regenesys Technologies, Pune
- neXus Technologies, Pune India
- Pioneer Solutions, Pune India
- Aashaste Infosolutions Pvt. Ltd. Pune India
- IBN Technologies Limited, Pune India
- TechnoWings Pvt Ltd, Pune India
- uspvm software services
- Netfotech Solutions

ANNEXURE – II- SOFTWARE TRAINING INSTITUTES IN PUNE

- Seed Infotech Ltd
- Computech IT Classes
- Imarticus Learning
- PSK Education & Training Pv..
- Decode Classes
- Cadcamguru
- Optimized Infotech
- Opulent Infotech Pvt Ltd
- Excellencea Digital Technol..
- Waves Institute
- Encryption Technology
- Proactive It Services Pvt L..
- Excellence Technovision Au..
- 3 R I Technologies
- Livewire Training
- Z Axis 3d Visualizers
- Tech Hub
- Blend Infotech
- Tcil It Education & Trainin..
- IT Help
- APTECH COMPUTER EDUCATION
- Excellent Multimedia Classe..
- Techbys Software
- Unique System Skills India ..
- Arena Animation
- Elect. Info Computer Traini..
- Max Edutech Solutions
- Proactive It Services Pvt L..
- Apollo Institute
- SCOOPEN School of Program E..
- Prakshal IT Academy
- AICT
- The British Institutes Hada..
- ITpreneur Data System Pvt L..

- Innnovativeminds
- Newgen Infotech
- Horizon Infotek
- Aptech Learning
- Disha Computer Institute
- Envision Computer Training ..
- Genius Computer Academy
- Kotech Software
- Disha Computer Institute
- Livewire Training Center
- Kinsys Business Services ..
- Tech Bodhi Solutions Llp
- Disha Computer Institute
- Pc Ware Computer Training I..
- SDS computer institutes
- Seed Infotech Ltd
- Vinca Institute
- Cms Computer Institute
- Prime Infotech Solutions
- Learn Well Technocraft
- Sandat IT Training Center
- Proxeus IT Solutions
- Peafowl Designs
- Systems And Networks Techno..
- Techrel Technologies Pvt Lt..
- technogrowth software solu..
- Prolution Systems Computer ..
- Ascii Coaching And Computer..
- Vinda Classes
- Om Computer Services
- Raj Computers
- IIHT Viman Nagar
- Infocentre Computer Institu..
- SLZinfotech Pvt.Ltd.
- National Computer And Techn..

- Career Studio
- Job4skill.com
- SAI Computers And Classes
- Global Infotech
- QJ Technologies
- Vivekananda Academy
- Apples Academy
- Vertex IT Services
- Floating Infotech
- IIPE
- It Solution & Computer Acad..
- Arena Animation
- Enosis Solutions Pvt Ltd
- Confia Infotech
- Waves Institute
- APTECH COMPUTER EDUCATION
- Excellent Multimedia Classe..
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- Kotech Software

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- Protek Solutions
- NIIT Ltd
- Disha Computer Institute
- Bitzdoor Softwares
- Mitcon E School
- Genius Academy
- Prakshal IT Academy
- AICT
- The British Institutes Hada..
- ITpreneur Data System Pvt L..
- Seed Infotech Ltd
- Innnovativeminds
- Newgen Infotech
- Horizon Infotek
- Aptech Learning
- Envision Computer Training ..
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- Livewire Training Center
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- Waves Institute
- Dnyanm Technosolutions
- Protek Solutions
- NIIT Ltd
- Bitzdoor Softwares
- Mitcon E School
- Genius Academy

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ABOUT THE BOOK

Creating talent pool of Skilled and Trained IT professionals to cope with emerging needs of IT industry is one of the important issues in terms of institutes and industries. There is a huge skill gap between institutes and IT industry, lack of Skilled and trained Staff, High Demand in IT industry. With this book we try to reach the outcome and reasons of skill gap, remedies to overcome this problem and practical approach towards it. And which skills standards are required in IT industry? Three elements are taken into consideration in this study i.e. IT industries, Students and Trainers from various institutes.

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