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# What Constitutes Intellectual Capital for IT-Software Industry? A Delphi Study

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There is a great focus on the value of Intellectual Capital-IC in relation to the long-term sustainability and success of businesses. Considering Pakistan, better IC could provide the needed thrust to the growing software industry. The industry has the potential to significantly contribute to the exports and economic development of Pakistan. The software industry is a skill-intensive industry and formal Computer Science-CS education could play an important role to build required skills. This paper explores the perceptions of IT professionals to better understand the skill requirements of CS graduates and provides relative importance to these skills by means of the Delphi method. Further, it also relates to the current situation on a skill set of fresh CS graduates and provides policy implications for educational institutes to conform to industry requirements and align their educational initiatives accordingly.
***Keywords:*** Intellectual Capital, Software Industry, Delphi Study, Computer Sciences, Resource-Based View Theory.

## INTRODUCTION

The world has witnessed a dynamic shift towards digitalization and information technology has emerged as an important segment of the economy. This industry is considered a promising avenue to boost economic growth and improves exports of any economy. Considering Pakistan, the IT industry is one of the fastest-growing industries of the country (Iftikhar & Ali, 2015) and it also has good growth prospects in the future (Shamsi & Nasir, 2016). Ghauri (2013) argued that the industry has positive implications for the economy and software exports of the country have witnessed a substantial growth trend in the last decade (Sulaiman, 2015). Further, the industry also employs a substantial part of the skilled and educated workforce of the country (More Desk, 2015). The promising outlook of the industry calls for its better alignment with economic goals and international trends. Despite the growth of the industry, the industry suffers from high project failure rates (Gardazi & Shahid, 2009). Most of the firms in the industry could be categorized as small and medium enterprises (SMEs) and SMEs in the country are alleged to have severe structural issues like incompetent workforce, low technical abilities, low access to financial resources, mismanagement of intangible assets and lower managerial capabilities (Khan & Khalique, 2014; Dar, Ahmad, & Raziq, 2017). Ullah (2011) estimated that SMEs in Pakistan have a failure rate of above 90%, which is quite high. These notions of high project failure rates were also endorsed by Gardazi and Shahid (2009) for the IT sector of the country, which is alleged to the intellectual capital of the firms working in Pakistan. This situation indicates that SMEs in the IT sector lacks adequate intellectual capital to sustain their success and survival in the country.

Intellectual capital is related to the talent and skills of the employees of a firm, which could be used to build a competitive advantage in the market and support organizational success. Considering the IT-Software sector, it has predominant importance as the industry is skill sensitive. Seleim et al. (2007) related that designers, developers and programmers are valued human resources of IT firms as better developers could develop more efficient and effective software programs (Brooks, 1987). It has been widely argued that talented developers are critical to the growth and survival of a software firm (Dooley, 2000) as such technical personals can translate unique requirements of the clients into workable software (Wynekoop & Walz, 2000). Thus, better intellectual capital could ensure better performance of the IT-Software industry and vice versa. As indicated earlier, the situation in the IT-Software industry of Pakistan is not very encouraging and issues pertaining to high project failure rates could be addressed by supplying better intellectual capital to the industry. This study in this regard explores the current situation of intellectual capital in the IT-Software SMEs of the country to better understand the skill requirements in the industry. Special attention is paid to the skill basis of the fresh CS graduates from Pakistani graduates so that better intellectual capital could be harvested in the educational institutes of Pakistan.

## LITERATURE REVIEW

Capitalism has encouraged the emergence of commercialization, which took many shapes in the past. Firstly, the industrial revolution caused the rise of the mass production industry; subsequently, the services industry rose to become more profitable and after that information technology emerged as a viable option for capitalists. The emergence of the services industry highlighted the value of a better workforce, particularly in a competitive environment. Penrose (1959), in this regard, provided Resource-Based View (RBV) of the firm and proposed that a unique set of resources enables the firm to

build a competitive advantage, which is much critical for organizational success in a competitive industry. RBV was further developed by Wernerfelt (1984), who stressed the value of intellectual capital for building a competitive advantage. These notions have stronger implications for the smaller firms (SMEs) and for the firms venturing in the IT-Software industry. The modern connotations of the knowledge economy are related to the elements of human capital, innovation, technology and knowledge (Kimiagari, Keivanpour, & Mohiuddin, 2013). Asongu (2017) on the other hand related that knowledge economy is based on the elements of information & communication technology, innovation, education and economic incentives. Thus, it is widely propagated that knowledge is a core element of an economy or society and it is embodied in the human resource (Khalique, Shaari, Abdul, Isa, & Ageel 2011). So, it could be deduced that intellectual capital could be a source of competitive advantage in the contemporary context of capitalization for economic units; both large and small (Hsu & Fang, 2009; Davis & Davis, 2017).

**Intellectual Capital and Software Industry**

This knowledge sensitivity is higher for the skill-based segment of industry like for IT-Software companies. Seleim, Ashour, and Bontis (2004) opined that the software industry is the best avenue to understand the implications of the knowledge economy. Subsequently, Seleim, Ashour, and Bontis (2006) confirmed that better intellectual capital in the shape of talented developers having better education, more experience and a high skill base is critical for the success of organizational success in the IT industry. Nowak and Grantham (2000) related a software program to 'economic value of intellectual capital'. In the software industry, the human capital element of intellectual capital is defined as the sum of experience and competence of the technical persons like developers, programmers and system analysts, who drive creativity and innovation in the software firm (Seleim et al., 2004). Subsequetly, Seleim et al. (2006) argued that formal education along with professional education could be useful for the development of a strong aptitude for professional knowledge in the software industry. It has been argued in the literature that quality education is one of the most important aspects of the growth of the software industry. According to Chaminade and Vang (2008), there is a lack of good educational and research institutes in third world countries; and existing educational institutes have limited competence and capacity, which results in poor knowledge and skill transfusion among the human capital. Such human capital is unable to meet the skill requirements of the industry and causes suboptimal growth in the industry. Asheim and Coenen (2005) related that higher education institutes play an important role in the innovation performance of the software industry. Studies like Athreye (2005) acknowledged the role of a better educational institute in the development of the software industry in Bangalore, India. Arora and Gambardella (2005) related to the growth of software industries in developing countries like India, China, and Egypt and related this growth to the number of IT graduates in these countries. Carmel (2003) in this regard provided that building human capital in a specific domain requires multigenerational tradition of education in that specific discipline, so strong institutes of higher education are the most critical support to build human capital for the software industry. This might require substantial investments and long-term commitment of the policymakers. Arora and Bagde (2010) pointed out that the capacity of a nation to provide skilled graduates is an important element of the growth of the software industry. They made the point by relating to the Indian software industry, which witnessed exponential growth after private institutes could step in to provide higher education.

**Higher Education and Skill Development**

Considering developing countries like Pakistan, it is argued that producing more skillful programmers will help the software industry to grow (Abid et al., 2016). However, the educational sector of the country presents a dismal state; where enrolment rates are low, better teachers are unavailable, physical infrastructure is inadequate, and teaching materials are obsolete (Memon, 2007). Hayward (2015) pointed out that the higher education sector in Pakistan has suffered from 'decades of neglect', where infrastructure is deteriorated, teaching is not a prime focus, research work is scarce and much of the faculty do not have a Ph.D. Relating all this to the specialized courses of computer sciences make us conclude that human resource being developed by a broken higher education system does not meet the requirements of IT industry, which is to compete in international market as most of its which are repeatedly pointed out that these courses are much technical and require unconventional educational paradigms. Saeli et al. (2011) related that technical subjects like computer programming require students to master the skills relating to mathematics, problem-solving, abstraction, troubleshooting and debugging. Thus, the conventional educational paradigm of knowledge delivery through lectures is not deemed effective for effective teaching in computer sciences discipline. Forte and Guzdail (2005) related to this conventional paradigm and found that such educational practices focus more on the syntax of the programming languages and fail to relate to the underlying logic, which leads students to fail in solving coding problems. So, the conventional educational paradigm is not effective in building skills in the students and such students lack required problem solving and analytical skills, necessary to code in an effective manner. Dasuki and Quaye (2016) pointed out that most of developing countries follow conventional educational paradigm to teach technical computer sciences, which leads towards inferior teaching quality of computer programming courses in the universities of developing countries. They found that teachers were unable to engage and communicate with the students in an effective manner; course delivery was poor and teachers seemed to be unprepared for the effective course delivery.

**Computer Science Education**

Various studies in Pakistan have highlighted the difficult nature of technical subjects of computer sciences like Abid et al. (2015) commented that teaching and grasping computer programming is difficult. These notions were subsequently endorsed by Abdi et al. (2016) and Gul, Asif, and Ahmad

(2017), who recommended that special skills and methods are required to teach technical courses in computer sciences. Mahmood (2011) mentioned that the course of software engineering, even if well designed, is difficult for the students to master. Arshad (2009) found that computer programming is a tricky subject to master and even if a student knows, how to code, he may face difficulty to solve a new problem. Due to the difficulty of the computer programming course, authors have denounced the idea of teaching this course in one or two semesters, rather they recommended to teach this course from high school level (Abid et al., 2015; Khan & Siddiqi, 2005). Khan and Siddiqi (2005) recommended that an appropriate learning environment and specific teaching techniques could be helpful to teach computer programming at the beginner's level in junior classes. Although much of the focus of literature remains on the courses relevant to computer programming, some authors have pointed out towards the other courses for their difficulty and other issues like Khan (2016) highlighted the issues of teaching the course of Human-Computer Interaction (HCI) and demanded that more credit hours along with formal lab learning should be allocated to teach this subject to the students. Issues relating to the technological advancement of the students and their personal preferences for certain subjects were also highlighted in this regard.

The domain of computer science is quite practical, and it has been recommended that the curriculum of IT and computer science subjects should be devised in accordance with the needs and demands of the industry (Kofahi, 2004). On the contrary, there is consistent evidence of misalignment of the IT curriculum and industry requirements (Lawless et al., 2006; Jaakkola, Henno, & Rudas, 2006; Subrahmanyam, 2009). Astigarraga et al. (2010) deemed this misalignment to be one of the most common risks to the software industry. Almi et al. (2011) related that software graduates lack the abilities required in the industry because university education mostly focuses on the theoretical abstractions of generic nature and such education is deprived of creativity and practicality (Karunasekera & Bedse, 2007; Jaakkola, Henno, & Rudas, 2006). Karunasekera and Bedse (2007) further commented that students tend to focus on their strong areas and ignore the skills required in the industry. By and large, there exists a huge gap between the scope of what is taught to computer sciences students and what is required in the software industry. Similar findings were put forward by Garousi et al. (2017), who noted a disparate interest of academia and professionals on the avenues of software testing, where academic scholars were interested in theoretically challenging issues, while practitioners wanted to boast effectiveness and efficiency of software testing process. Lastly, Ayofe and Ajetola (2009) commented that the university curriculum of computer science programs remains static, while industry requirements and applications of computer science are dynamic. This situation indicates a lack of collaboration between industry and academics (Dey & Sobhan, 2006). Begel and Simons (2008) if students entering the software industry lack a complete set of software development skills, that enable them to be productive. Thus, it is being deemed important to consult industry to align the curriculum of computer science and software engineering programs (Ayof & Ajetola, 2009). The same situation could be related to Pakistan, where universities are producing many graduates each year, but the skill gap among computer-related graduates is quite higher (Rahman & Haleem, 2018). Previously Arain, Tunio, and Shah (2014) have also indicated that Pakistani educational institutes are producing computer science graduates in large quantities, but their capabilities and skills were lowered compared to the graduates in neighboring countries like India and China. and it is recommended to realign the educational curriculum to the scope of the industry.

**Skill Requirement in IT-Software Industry**

Dey and Sobhan (2006) ascertained the opinion of the employers of software industry and found that employers were mostly dissatisfied with the skills of new computer science graduates as they were found to lack critical skills like software testing, project management, team collaboration, software quality assurance, high-level design, requirements engineering and development modeling. Begal and Simons (2008) related to the skill requirement of the software developers and argued that graduates should be able to program, solve the problems, and write design specifications. They further found that novice software developers get stuck due to skills like orientation, cognition, technical, collaboration and communication. Much of the required skills in the industry were soft skills, like Vaughn and Carver (2006) pointed out that project management skills, better work ethics, good communication and stress handling are among the required skills in the software industry. Similarly, Clear et al. (2016) named skills like industry collaboration, project management, creativity, and teamwork. Almi et al. (2011) also mentioned that fresh computer science graduates lack the basic knowledge of their specialized area, analytical thinking, problem rectification and creative abilities. The student was encouraged to develop themselves beyond their academic endeavors. They also indicated that fresh graduates also lack the soft skills like teamwork and communication. Ethiraj et al. (2005) also related to the important capabilities required in the software industry. They found that two broad categories i.e. client-specific capabilities and project management capabilities. Client-specific capabilities were deemed important for the establishment of a meaningful working relationship with the clients and also reduces the costs of the firm. Software development and project management capabilities include capabilities pertaining to software design & development, resource management & estimation capabilities, and scheduling capabilities. The study found that both types of capabilities contributed towards performance, while project management capabilities had stronger relevance to firm performance in the software industry.

**RESEARCH METHODOLOGY**

This research adopts the qualitative design of data collection, whereby interviews were used to sought in-depth opinions of respondents. Further, in order to identify the important capabilities in the software industry of Pakistan, the Delphi consensus method was used to identify the skill requirements of

graduates in relation to the IT-Software industry in Pakistan. Delphi technique is a structured process, adopted to answer the questions which have no definite answer. The process is proceeded by selecting a panel of knowledgeable people, who subsequently are asked to provide their opinion on the subject matter. Their individual responses are aggregated, and a list of identified factors is compiled from these aggregated responses. The list is then presented to each respondent and they are requested to rank these factors. Rankings are collated and a list of factors is again circulated among the respondents along with the computed ranks and their individual ranking and again respondents are requested to rank the factors again. This process is repeated until a reasonable degree of consensus is achieved. This process is outlined by Schmidt (1997). Delphi technique has been applied to the IT and software sectors in previous research (Keil et al. 2002; Keil, Lee, & Deng, 2013; Nakatus & Iacovou, 2009; Schmidt et al., 2001).

**Data Collection & Analysis**

A total of 15 panelists were identified and contacted for the identification of skills in the first phase of the Delphi study i.e. brainstorming. The panelists were identified through snowball sampling on the criteria that they must have at least five years of experience in the software industry. The panelists had various key job positions i.e. HR manager, project manager, chief operating officer, team lead, and partner. Table 1 provides the demographical distribution of the respondents. In the brainstorming step, each panelist was requested to list at least five important skills for computer science graduates and relate to the importance of the skill in the software industry. Initially, 44 skills were put forward by the respondents. These skills were collated and checked for duplication and a final list of 31 skills was prepared. In the second step, the list of skills was presented to the panelists and they were requested to identify the most important skills for computer science graduates. The skills that were deemed important by most of the panelists were retained, yielding a list of 16 most important skills. In the third step, the list of most important skills was presented to the panelists and they were requested to rank the skills in accordance with their importance. Mean ranks were calculated, and skills were sorted. Kendall's W score was calculated through SPSS to assess the degree of consensus. The panelists were presented with the mean ranks along with their own rankings and were requested to rank skills again. Reasonable consensus score is attained after repeating the process.

Subsequently, a total of five respondents agreed for a short interview afterward. These respondents were probed on their perception of the quality of computer science graduates and how universities could play their role in an effective manner. This part of the analysis is provided after the analysis pertaining to the Delphi technique.

## ANALYSIS & DISCUSSION

### *Delphi Technique Results*

Table 1 provides demographical information of the respondents, who participated in this Delphi study. A total of 15 respondents participated in this study, out of these 15 respondents, 14 were male and one was female. The respondents had various senior job positions; 4 were HR manager, 5 were project management, 2 were COO, 3 were team lead and one was a partner. The mean experience of the respondents in the software industry was 8.13 years. The job positions and experience indicate that the respondent selection was appropriate as these respondents have required information and expertise to relate to the skill requirements of the software industry.

**Table 1: Demographics of Panel**

| | | |
|---|---|---|
| **Gender** | Male | 14 |
| | Female | 1 |
| **Job Position** | HR Manager | 4 |
| | Project Manager | 5 |
| | Chief Operating Officer (COO) | 2 |
| | Team Lead | 3 |
| | Partner | 1 |
| **Average Experience in the software industry** | | 8.13 Years |

Along with the demographical information, respondents were requested to provide a list of important skills required in computer science. A total of 44 skills were identified by the respondents. These skills were collated, aggregated and duplicates were removed. A final list of 31 factors was compiled. The complete list is provided in the Appendix. Subsequently, they were asked to choose the most important skills among these 31 skills and skills most repeated were retained for final consideration, narrowing the choice to 16 skills. Subsequently, respondents were requested to rank these skills. Means ranks were calculated for the skills and Kendall's W consensus score was calculated. The score was quite lower in the first round, so means ranks along with the original rank of the respondents were circulated again and respondents were again requested to rank the skills. The second round yielded Kendall's W value of .894, which deemed the consensus to be appropriate (Schmidt, 1997). The results of the first and second rounds are provided in table 2.

**Table 2: Ranking Results**

| Rank | Skill | Round 1 - Mean Ranks | Round 2 - Mean Ranks |
|---|---|---|---|
| 1 | Coding/ Ability of program | 2.13 | 1.53 |
| 2 | Debugging/ Software testing/ Quality Assurance | 3.11 | 2.53 |
| 3 | Software design/ development skills | 2.52 | 2.73 |
| 4 | Ability to follow instruction | 4.15 | 4.73 |
| 5 | Communication | 6.13 | 5.73 |
| 6 | Project documentation | 5.93 | 6.20 |
| 7 | Problem-solving | 6.91 | 6.27 |
| 8 | Ability to understand the requirement | 7.73 | 7.13 |
| 9 | IT skills | 9.33 | 9.93 |

| | | | |
|---|---|---|---|
| 10 | Creativity/ Innovation ability | 8.63 | 10.07 |
| 11 | Quick learning | 10.73 | 10.40 |
| 12 | Managing follow-ups with clients | 11.33 | 11.87 |
| 13 | Research ability | 14.47 | 13.20 |
| 14 | Team Player | 13.20 | 13.80 |
| 15 | Flexibility | 14.33 | 14.73 |
| 16 | Time management | 14.73 | 15.13 |
| 17 | Kendall's W | 0.43 | 0.89 |

The first and foremost important skill in the IT-Software sector of Pakistan is the coding or the ability to program, which is quite obvious. A computer science graduate studies programming courses in almost every semester. Different languages are taught to the students so that they can write code. The second important skill was related to debugging, software quality assurance and software testing. Initially, students are given tasks pertaining to quality assurance or debugging, which is a time-consuming and difficult thing. Main programmers and developers are busy doing development work and they hand over such petty tasks to the newcomers. Subsequently, software design and development skills are deemed important. Students are expected to have technical knowledge of the software development process and provide support in this regard. So, the first three skills that are required in the industry are technical skills that are quite practical. These three skills are the core of the software industry and having good human resources in this regard is quite important in the context of the human capital aspect of intellectual capital. Subsequently, the skill of ability to follow instruction, communication and project documentation was deemed important. These aspects are related to the structural capital aspect of intellectual capital, these aspects enable an organization to build a strong knowledge sharing and learning environment. Individuals having a better ability to communicate, coordinate and float information create a better environment and also learn fast. Subsequently, problem-solving, ability to understand requirements, IT skills and creativity were deemed important. Again these are human capital skills that enable an individual to learn fast and also provide creative solutions to the problems. Subsequently, quick learning, flexibility, and time management were also related to human capital, managing follow up with clients and research ability are related to the customer capital and being a team player is also related to the structural capital.

Overall, technical skills like software development, coding, and quality assurance were among the top required skills, which were followed by the communication, documentation and ability to follow instructions that were related to the cultural aspect of the organization. It could be inferred that technical skills were among the top required skills in the software industry, while soft skills like communication, documentation, creativity, and problem solving were also deemed important but at second rank after technical skills. Customer skills and other soft skills like being team player, time management and flexibility were deemed least important by the respondents.

**Interview Results**

Five of the respondents were requested to take part in the interview after participating in the Delphi study. The interview questions were related to their perceptions of the skills of fresh computer sciences graduates. The first question asked was related to the importance of human resources in the software industry. The main perception of the respondents in this regard was that human resource is the most important asset of a software organization. One of the respondents in this regard related that

> *"Software industry is a skill sensitive industry and it is growing and there is a huge demand for skilled personnel in the industry. We are often short of skilled people. We solely rely on the skills and experience of our human resources. The tragedy is that we are unable to find the required talent and good people have high demand, so it is difficult to retain them. A good developer has the ability to provide you amazing solutions to complex problems. So, the software industry has huge potential, but it is still dependent, and it has become difficult to find good people."*

Subsequently, respondents were asked about their perceptions of the fresh graduates in the software industry. They if they can easily hire computer science fresh graduates and often at low cost, but these new hires have no practical skills and they lack the working attitude. One of the respondents related that,

> *"Almost all of the universities in the country are producing computer science graduates and software engineers. One can easily recruit through on-campus hiring services, but the problem is with their attitude. Fresh graduates have low skills in programming and they often seek short cuts to do the things. Most of such students have not undergone any practical training and have not spent much of the time coding. They always relate to their academic projects, which are copy-paste most of the time. They do not have real skills and they are also not interested to learn and work hard and the biggest problem in this regard is that once we have invested our time and resources on them and after they are able to handle routine tasks, they leave".*

These notions were also endorsed by another respondent by stating that,

> *"Fresh software engineering graduates could be hired with a meagre salary and they do not know much. You have to teach them things from scratch and it causes extra effort from our experienced staff, who already are overloaded with work and deadlines."*

Another respondent related that,

> *"The real problem is most of the computer science graduates do not have any talent in the field, they do not work hard, they just have a degree and know basic terminology. They just have the ability to find ready-made codes and templates online and modify them to the*

*requirement. They are unable to build anything new, and also lack creativity."*

Subsequently, respondents were asked to indicate shortcomings of computer science graduates. They indicated that fresh graduates do not have real skills; complaints like they are unable to code effectively, their products have bugs, they take more time to develop things, they can just copy and paste things, they do not have aesthetic sense for development, they remain reactive, they are slow and the like were evident from their responses. Further, respondents also indicated that fresh graduates do not have the skills to handle the clients, develop something up to client's satisfaction, work in a team, collaborate in a meaningful manner, build a meaningful relationship with seniors, and even work hard. One of the respondents lamented,

*"I hired a fresh graduate recently; he comes late and on it had had a quarrel with his team lead. The team lead was giving extra time to that person and after the incident, he is disappointed with the recruit and the new recruit resigned. There are serious issues concerning attitudes of the fresh graduates, they do not have the skill and yet they expect higher salaries and other privileges."*

Another respondent related to the situation by stating,

*"We have to recruit fresh graduates to do the time-consuming non-productive work. According to my estimation, only one in four computer science graduates shows some promise and it takes almost two years to train that novice programmer into a developer. Initially, we assign manual work to the new recruit, after that he is inducted in a team to handle basic tasks, many new recruits are unable to cope up with the nature of burdensome work in the industry. The young generation does not seem hardworking enough. Late sittings, workloads and stress are common characteristics of the software industry and new recruits often find it difficult to cope up with the new stressful routines."*

Lastly, one respondent iterated that,

*"In the software industry, learning happens with time and hard work. Most of the students have never worked in real-time situations to solve unique development and coding problems. They just have practiced with standard examples of building a calculator, developing some Pakman games and the like. The client sometimes requires nonsense things, which are unique. Fresh graduates know the basics of coding, but they lack the ability to apply their knowledge to real-time situations. This is the real problem, and fresh graduates learn this thing with time."*

Lastly, respondents were asked about the role of educational institutes in the development of the skills of computer science graduates. It was noted that educational institutes although we're doing good in providing basic skills to the students, these basic skills are less than the requirement of the growing and competitive software industry. The respondents recommended that there is a need to provide practical training to the students and students should also take the responsibility to learn things on their own. Respondents related that apprenticeship setting of learning works best in the software industry, whereby some skilled and experienced master shares his craft to novice student wants to learn something. Respondents recommended blending theory with the practice. They further stressed the need for teaching soft skills to the students like communication, stress management, time management, working in the teams and effective collaboration. One respondent in this regard related that,

*"Courses of universities are much focused on the basics of coding, and other advanced courses like artificial intelligence, algorithms and the like. However, these advanced courses have limited value in the industry. Universities should ensure practice. I as HR manager offer internships to the students in their final year and we often recruit these students, if they show potential. There is a lack of practical application of knowledge in curricula and technical courses requiring innovation are taught like traditional courses – learning the content by heart and producing the same on the paper."*

Considering the soft skills, one of the respondents deemed,

*"I like my team to be collaborative. Being funny and talkative carries extra marks. We have stressful work and we cannot afford a stressed environment. I like people with good nature in my team. Over time, I have come to know that creative people crack very good jokes. So, collaboration, communication, sharing and being ethical are very much important. I think that universities should teach some courses on ethics, communication and working in teams to better highlight the value of collaborative working."*

Lastly, it was argued by one respondent that universities should also prepare students for practical life. He stated,

*"Teaching course on professional practices is not enough. The course content mostly relates to the foreign country and nobody knows what is going on in the industry in actual. Whenever we recruit any fresh graduate, we know that he will feel difficulty adjusting with the tough and stressful routine. Some of the fresh graduates leave the job because of this tough routine. So, what I think is that universities should prepare their graduates in accordance with the peculiarities of the market, only providing knowledge is not enough."*

Overall, respondents indicated that although there is an appropriate supply of fresh graduates in the market, these fresh graduates are not equipped with the skills of the industry. They lack the basic technical skills and ability to apply their knowledge to unique situations. Another problem pertained to the attitude of the fresh graduates, who were not much interested to learn and had higher expectations. It was recommended that universities should play their role to provide practical education to the students and apart from mere knowledge, other skills like communication, collaboration and teamwork should also be taught to them. Further, universities should also clarify the demands and issues of the industry to the students to clarify their expectations and requirements of the industry.

## CONCLUSION

The software industry is one of the fastest-growing segments of the local economy. Considering the nature of the industry, it is argued that skillful human resource is essential for the success and growth of IT-Software industry. This study in this regard provides a reflection on the skill requirements of the industry and explores the perceptions of the professionals in the industry pertaining to the skills of fresh computer science graduates. Using Delphi method, it was found that technical skills were among the highest required skills in the industry, which relate to the human capital of intellectual capital; further, communication, collaboration and documentation were second highest-ranked skills, which relate to the structural capital element of the intellectual capital and after that comes handling client requests, which correspond to the customer capital of the intellectual capital. Further, it was related that fresh graduates of computer science discipline although have basic knowledge, but they are unable to apply this knowledge to practical problems. Further, apart from the technical skills, the industry requires them to be collaborative, communicative and to be able to work in the teams. Considering the situation, it is recommended that the curriculum of the universities should be adjusted to meet the practical demands of the industry. There is a need to incorporate internships in the formal curriculum of the educational programs in the computer science disciplines. Further, students should also take some responsibility to develop their practical skills. It is also recommended that universities should arrange workshops and interactive sessions with the industry personnel and the voice of industry representatives should be incorporated into the curriculum development committee. Further, there also seems a need to reduce the focus on the advance courses and focus more on the regular practical aspects. Students may be given the option to study additional courses on the domain of their specialization. It is recommended that industry and academia must go further in a unified manner if the software industry is to grow in a substantial manner to be able to become a significant part of the economy.

## REFERENCES


Abid, A., Farooq, M. S., Farooq, U., Abid, K., & Shafiq, M. (2015). A strategy for the design of introductory computer programming course in high school. *Journal of Elementary Education*, *25*(1), 145-165.

Abid, K., Abid, A., Farooq, M. S., Farooq, U., & Abbas, A. (2016). A strategy for the promotion of computer programming using Urdu language in Pakistan. *South Asian Studies (1026-678X)*, *31*(1).

Almi, N. E. A. M., Rahman, N. A., Purusothaman, D., & Sulaiman, S. (2011, March). Software engineering education: The gap between the industry's requirements and graduates' readiness. In *Computers & Informatics (ISCI), 2011 IEEE Symposium on* (542-547). IEEE.

Arain, S. A., Tunio, A., & Shah, A. (2014). Software firm-level innovation in Pakistan. *International Journal of Management Sciences*, *3*(2), 65-72.

Arora, A., & Bagde, S. K. (2010). *Human capital and the Indian software industry* (No. w16167). National Bureau of Economic Research.

Arora, A., & Gambardella, A. (2005). The globalization of the software industry: Perspectives and opportunities for developed and developing countries. *Innovation Policy and the Economy*, *5*, 1-32.

Arshad, N. (2009). Teaching programming and problem solving to CS2 students using think-aloud. *ACM SIGCSE Bulletin*, *41*(1), 372-376.

Asheim, B. T., & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. *Research Policy*, *34*(8), 1173-1190.

Asongu, S. A. (2017). Knowledge-Economy gaps, policy syndromes, and catch-up strategies: Fresh South Korean lessons to Africa. *Journal of the Knowledge Economy*, *8*(1), 211-253.

Astigarraga, T., Dow, E. M., Lara, C., Prewitt, R., & Ward, M. R. (2010, April). The emerging role of software testing in curricula. In *Transforming Engineering Education: Creating Interdisciplinary Skills for Complex Global Environments, 2010 IEEE* (1-26). IEEE.

Athreye, S. (2003). The Indian software industry. Carnegie-Mellon Software Industry Centre. Working paper 03-04.

Ayofe, A. N., & Ajetola, A. R. (2009). Exploration of the gap between computer science curriculum and industrial IT skills requirements. *arXiv preprint arXiv:0908.4353*.

Batjargal, B. (2007). Internet entrepreneurship: Social capital, human capital, and performance of internet ventures in China. *Research Policy*, *36*(5), 605-618.

Bolinger, J., Yackovich, K., Ramnath, R., Ramanathan, J., & Soundarajan, N. (2010). From student to teacher: Transforming industry-sponsored student projects into relevant, engaging, and practical curricular materials. In *Transforming Engineering Education: Creating Interdisciplinary Skills for Complex Global Environments, 2010 IEEE* (1-21). IEEE.

Bolinger, J., Yackovich, K., Ramnath, R., Ramanathan, J., & Soundarajan, N. (2010). From student to teacher: Transforming industry-sponsored student projects into relevant, engaging, and practical curricular materials. In *Transforming Engineering Education: Creating Interdisciplinary Skills for Complex Global Environments, 2010 IEEE* (1-21). IEEE.

Brooks, F. (1987). *No silver bullet* (1-14). April.

Carmel, E. (2003). The new software exporting nations: success factors. *The Electronic Journal of Information Systems in Developing Countries*, *13*(1), 1-12.

Chaminade, C., & Vang, J. (2008). The globalization of knowledge production and regional innovation policy: Supporting specialized hubs in the Bangalore software industry. *Research Policy*, *37*(10), 1684-1696.

Clear, T., Beecham, S., Barr, J., Daniels, M., Oudshoorn, M., & Noll, J. (2016). Developments in Global Software Engineering Education. In *2016 IEEE Frontiers in Education Conference (FIE)* (1-4). IEEE.

Dar, M. S., Ahmed, S., & Raziq, A. (2017). Small and medium-size enterprises in Pakistan: Definition and critical issues. *Pakistan Business Review*, *19*(1), 46-70.

Dasuki, S., & Quaye, A. (2016). Undergraduate students' failure in programming courses in institutions of higher education in developing countries: A Nigerian perspective. *The Electronic Journal of Information Systems in Developing Countries*, *76*(1), 1-18.

Davis, P. J., & Davis, P. J. (2017). How HR can create a competitive advantage for the firm: Applying the principles of resource-based theory. *Human Resource Management International Digest*, *25*(2), 4-6.

Dey, S. K., & Sobhan, M. A. (2007, December). Guidelines for preparing a standard software engineering curriculum: Bangladesh and global perspective. In *Computer and information technology, 2007. ICCIT 2007. 10th International Conference on* (1-6). IEEE.

Dooley, E. (2000). *Intellectual capital in the software industry: an empirical test*. Ph.D. dissertation, College of Business Administration, University of Washington, Tacoma, WA.

Ethiraj, S. K., Kale, P., Krishnan, M. S., & Singh, J. V. (2005). Where do capabilities come from and how do they matter? A study in the software services industry. *Strategic Management Journal*, *26*(1), 25-45.

Ethiraj, S. K., Kale, P., Krishnan, M. S., & Singh, J. V. (2005). Where do capabilities come from and how do they matter? A study in the software services industry. *Strategic Management Journal*, *26*(1), 25-45.

Forte, A., & Guzdial, M. (2005). Motivation and nonmajors in computer science: identifying discrete audiences for introductory courses. *IEEE Transactions on Education*, *48*(2), 248-253.

Garousi, V., Felderer, M., Kuhrmann, M., & Herkiloğlu, K. (2017, June). What industry wants from academia in software testing? Hearing practitioners' opinions. In *Proceedings of the 21st International Conference on Evaluation and Assessment in Software Engineering* (65-69). ACM.

Ghauri, S. (2013). Rol of IT industry in Pakistan's economy. *Pakistan Press Foundation*. Retrieved from http://www.pakistanpressfoundation.org/2013/06/role-of-it-industry-in-pakistans-economy/

Hayward, F. (2015). Higher education transformation in Pakistan: Political and economic instability. *International Higher Education*, (54).

Hsu, Y. H., & Fang, W. (2009). Intellectual capital and new product development performance: The mediating role of organizational learning capability. *Technological Forecasting and Social Change*, *76*(5), 664-677.

Iftikhar, A., & Ali, S. M. (2015). Software quality assurance a study based on Pakistan's software industry. *Pakistan Journal of Engineering, Technology & Science*, *1*(2).

Jaakkola, H., Henno, J., & Rudas, I. J. (2006, August). IT Curriculum as a complex emerging process. In *Computational Cybernetics, 2006. ICCC 2006. IEEE International Conference on* (1-5). IEEE.

Karunasekera, S., & Bedse, K. (2007, July). Preparing software engineering graduates for an industry career. *In Software Engineering Education & Training, 2007. CSEET'07. 20th Conference on* (97-106). IEEE.

Keil, M., Lee, H. K., & Deng, T. (2013). Understanding the most critical skills for managing IT projects: A Delphi study of IT project managers. *Information & Management*, *50*(7), 398-414.

Keil, M., Tiwana, A., & Bush, A. (2002). Reconciling user and project manager perceptions of IT project risk: a Delphi study 1. *Information Systems Journal*, *12*(2), 103-119.

Khalique, M., Shaari, N., Abdul, J., Isa, A. H. B. M., & Ageel, A. (2011). Relationship of intellectual capital with the organizational performance of pharmaceutical companies in Pakistan. *Australian Journal of Basic and Applied Sciences*, *5*(12), 1964-1969.

Khan, A. W., & Siddiqi, A. (2005, August). Teaching Visual Programming to High School Students, Experience from Pakistan. *Information and Communication Technologies, 2005. ICICT 2005. First International Conference on* (210-216). IEEE.

Khan, M. W. J., & Khalique, M. (2014). An overview of small and medium enterprises in Malaysia and Pakistan: Past, present and future scenario. *Business and Management Horizons*, *2*(2), 38.

Kimiagari, S., Keivanpour, S. & Mohiuddin, M. (2013). International Strategic Alliances and Knowledge Transfer in Upstream 83 Oil and Gas Sector: Case of National Iranian Oil Company[SEP], 2013 Annual Conference of the Academy of International Business.

Kofahi, N. A. (2004). The impact of computer science and information technology teaching on the growth of the software industry. *Journal of Discrete Mathematical Sciences and Cryptography*, *7*(3), 371-386.

Krafft, M. F., Stol, K. J., & Fitzgerald, B. (2016, May). How do free/open source developers pick their tools? a Delphi study of the Debian project. In *Proceedings of the 38th International Conference on Software Engineering Companion* (232-241). ACM.

Lawless, D., Gordon, D., Haifeng, L., & Bechkoum, K. (2006, April). Developing a software engineering curriculum for the emerging software industry in China. In *null* (115-122). IEEE.

Mahmood, Z. (2011). Teaching software engineering to undergraduate computing students. *International Journal of Teaching and Case Studies*, *3*(2-4), 112-122.

Memon, G. R. (2007). Education in Pakistan: The key issues, problems, and new challenges. *Journal of Management and Social Sciences*, *3*(1), 47-55.

More Desk (2015). Pakistan exports over 90% of its IT services: Saleem Ghauri. Retrieved from http://www.moremag.pk/2015/04/01/pakistan-exports-over-90-of-its-it-services-saleem-ghauri/

Nakatsu, R. T., & Iacovou, C. L. (2009). A comparative study of important risk factors involved in offshore and domestic

outsourcing of software development projects: A two-panel Delphi study. *Information & Management*, *46*(1), 57-68.

Nowak, M. J., & Grantham, C. E. (2000). The virtual incubator: Managing human capital in the software industry. *Research Policy*, *29*(2), 125-134.

Rahman, M. K. U., & Haleem, F. (2018). Information and communication technology workforce employability, Khyber Pukhtunkhwa, Pakistan. *Middle East Journal of Business*, *13*(1).

Saeli, M., Perrenet, J., Jochems, W. M., & Zwaneveld, B. (2011). Teaching programming in Secondary school: A pedagogical content knowledge perspective. *Informatics in Education*, *10*(1), 73-88.

Schmidt, R. C. (1997). Managing Delphi surveys using nonparametric statistical techniques. *Decision Sciences*, *28*(3), 763-774.

Schmidt, R., Lyytinen, K., Keil, M., & Cule, P. (2001). Identifying software project risks: An international Delphi study. *Journal of Management Information Systems*, *17*(4), 5-36.

Seleim, A., Ashour, A., & Bontis, N. (2004). Intellectual capital in Egyptian software firms. *The Learning Organization*, *11*(4/5), 332-346.

Seleim, A., Ashour, A., & Bontis, N. (2007). Human capital and organizational performance: A study of Egyptian software companies. *Management Decision*, *45*(4), 789-801.

Shamsi, J. A., & Nasir, Z. (2016). Unleashing the Pakistan software industry: Growth prospects and challenges. *IT Professional*, *18*(5), 12-14.

Subrahmanyam, G. V. B. (2009). A dynamic framework for software engineering education curriculum to reduce the gap between the software organizations and software educational institutions. In *Software Engineering Education and Training, 2009. CSEET'09. 22nd Conference on* (248-254). IEEE.

Sulaiman, R. (2015). PSEB: Making Pakistan's IT Industry the Country's Fastest-Growing Export Sector, Ministry of Information Technology, Government of Pakistan. Retrieved from http://www.moitt.gov.pk/gop/index.php?q=aHR0cDovLzE5Mi4xNjguNzAuMTM2L21vaXQvZnJtRGV0YWlscy5hc3B4P2lkPTcyNyZhbXA7b3B0PW5ld3NldmVudHM%3D

Ullah, H. (2011). The impact of owner psychological factors on entrepreneurial orientation: Evidence from Khyber Pakhtunkhwa-Pakistan. *International Journal of Education and Social Sciences (IJESS)*, *1*(1).

Vaughn, R. B., & Carver, J. (2006). Position paper: The importance of experience with industry in software engineering education. In *Software Engineering Education and Training Workshops, 2006. CSEETW'06. 19th Conference on* (19-19). IEEE.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171-180.

Wynekoop, J. & Walz, D. (2000). Investigating traits of top-performing software developers. *Information Technology & People*, *13*(1), 186-95.