

# The Role of Technology Entrepreneurship in Higher Education Sector of Developing Countries: A Case Study of Pakistan

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## Abstract

In modern theories of growth and development, technological innovation has taken the focus stage and such innovations are commercialized by technology entrepreneurs. Colleges and universities are investing heavily in the development of their student's entrepreneurial skills and have tremendous impact on innovation and entrepreneurial development. Universities today equally function as an important driving force to enhance economic value by creation of networks with innovators across a region through their incubators and scientific and technology parks. In developed countries many entrepreneurs start up their companies at their universities but in developing countries there are so many challenges yet to be faced by new starts up. Technology entrepreneurship in education basically explores how technology entrepreneurs are applying business practices or technology innovations to transform education to lead to higher performance. As higher education industry is changing radically and that transformation is worth for commercial benefits of businesses and also for innovative startups. Today the presence of colleges and universities are not only meant to be the gatekeeper of knowledge and information instead various innovators are in flowing as entrepreneurs in education industry. This study will explore that in what ways technology entrepreneurship is facilitating the educator sector of the emerging economies specifically in Pakistan.

**Keywords:** Technology entrepreneurship, High Education Sector, Developing economies, Business Incubation Centers.

## 1. Introduction

Technology entrepreneurship is basically a combination of two separate terms from two different disciplines, technology came from the discipline of innovation and entrepreneurship came from the business or commercial discipline. Hence it is an integration of technological and entrepreneurial domains. Technology entrepreneur is a person having specific knowledge and expertise vital for any entrepreneur in order to carry out technology centered entrepreneurial activities effectively and efficiently. Bailetti (2012) explained that collaborative research and development activities, producing innovative products, evolving new resources and their attributes which leads toward progression in scientific and technological expertise basically discriminates technology entrepreneurship from other entrepreneurship domains.

Today is the era where technology entrepreneurship has turn out to be an important global portent. It is considered as essential for progression, distinction and a vital tool to attain competitive benefit at organizational, local and national levels. It is becoming a central point of debate which involves initiating new business as well as rising of new startups, regional profitable progressions, opting out the most suitable stakeholders or investors to bring ideas to marketplaces and also educating and give training to managers, scientists, supervisors, engineers, and technologists (Petti & Zhang, 2011). Practitioners and researchers claim that technology entrepreneurship is basically an investment in creating a new venture that accumulates and organizes particular individuals and divergent resources in order to catch value for the organization. According to Shane (2003), this concept is more concerned with combined production grounded on a mutual vision of upcoming technological changes. The mutual vision of variation in technology effects why, when, and in what ways any firm can produces and grasp value. Change in technology can be characterized in numerous ways. For that reason, it is essential to cultivate a shared opinion of any change in technology (Shane & Venkataraman, 2000). This value creating concept is not only about to identify the technology or market opportunities but basically about investing, exploiting that opportunity and generating high profit margins for the firm.

According to Abdullah & Ahcene (2011) Technology entrepreneurship is certainly becoming vigorous in the contemporary globalization and liberalization economy as it delivers countless opportunities and empowers effective optimization of the resources to achieve high profit margins. Technology entrepreneurship also has a great influence on developed nations and takes a special attention from developing economies as the technology access and availability blowout with digital economy. Developing nations have used clustering strategy to promote their technology entrepreneurial process. There are several factors that have a significant impact on this process specifically globalization of procedures and standards that were previously used in particular country or any area (Scott, 2001). Other factors to support entrepreneurial process in developed economies includes the relationships between universities, human aptitude and their competencies that can bring

innovative ideas and products further move those innovative products to the market and joint ventures which basically financially assist this process. This successful strategy of developed nations led many developing economies to follow this methodology but on the other hand, to take after this methodology does not infer to recreate as it is on account of what happened in the US will not be the same as it is in Pakistan or any developing nation. In order to execute the clustering method, developing nations need to analyze their social and cultural environment and not just focus on economic gains. For that reason when considering to execute this methodology, do not rely on only institutional elements but also consider the societal and cultural ones (Athreye, 2002). One of the researchers have claimed that there are two main elements which boots up the global competition are natural resources and intellectual skills or talent in individual (Ghodbane, 2011). The basic aim of this study concerns with how to teach students that they will be able to put theory into practical activities and also to understand what actually entrepreneurship is about. In this way students are expected to increase their morale and self-confidence, inspiration, get to be proactive and more imaginative, its helps students to figure out how to function in a group (Junior Achievement Young Enterprise annual report, 2006).

Universities are an essential component of the knowledge economy both internationally and locally. They deliver the intellectual assets such as patents or licenses, intensive knowledge, innovators at the pioneering stage of their field, provide resources by which entrepreneurs can derive benefits from the opportunities (Florida, 2002). Technical entrepreneurship carries more uniqueness, innovations and Research and Development (R&D) products on the marketplaces. For an entrepreneur in the arena of technology, opportunity acknowledgement begins with the identification of a need or a variation and ends with innovative solutions in which future commercial value is validated and acknowledged. The purpose of this paper is to study the effect of a technology entrepreneurship on high education sector of Pakistan and analyze its contribution in different educational programs leading students in order to cultivate their entrepreneurship abilities and stimulates motivation.

## **2. Entrepreneurship and Theoretical Framework**

The basic idea of the entrepreneur has been emerging for hundreds of years. The word "entrepreneur" originates from the French verb "entreprendre" with the meaning "to do something". According to Haque (2007) entrepreneurship means carrying out innovative combinations with old being taken away by the new ones. This concept was later characterized as innovation through the process of creative destruction. In other words it can be understood responsibility of creating a new business venture to generate maximum revenue by innovating and comprehend all involving risks and uncertainties. Therin (2007) defined entrepreneurship as an action and a procedure linking the discovery of new idea, creation and utilization of opportunities in order to produce value with the introduction of new products, practices and also creating new ventures. It is entrepreneurship that transforms an innovation into a viable initiative that breeds value progressions in information technology (Cressy, 2006) and else improved communication mediums have played a vital role in disseminating the worldwide trend of entrepreneurship to other areas or countries of the world including Pakistan. Important elements to become an entrepreneur includes the enthusiasm towards risks, the skill to formulate an operative venture team, the proficiency to organize required resources and essential talent of developing an effective and efficient business plan and finally the vision to identify opportunity where others see confusion, conflict and misperception (Kuratko, 2003). Most of the researchers and practitioners have defined the field of entrepreneurship as the intellectual investigation of by what means and by whom opportunities should be traced in order to generate creative ideas for production of innovative products and services (Braunerhjelm et al., 2010).

### **2.1 Technological Entrepreneurship**

Technological entrepreneurship is defined as a style of commercial management and control that basically includes identification and human resource high latent qualities capitalization, technology concentrated profitable opportunities, managing enhanced growth and substantial risk enchanting (Dorf and Byers, 2005). The most important element of technology entrepreneurial system is the entrepreneur itself because entrepreneur is the key substance in the development of businesses and startups progression. Shane and Venkataraman (2004) explored techno entrepreneurship as the practices of collecting resources, technical systems and policies by an entrepreneurial endeavor to follow the opportunities. Technology based entrepreneurs have more technical and practical expertise and capabilities than non-technical ones. One significant factor in the new business accomplishment is the conversion of the entrepreneurial attitude into the managerial approach. Techno entrepreneurs have to understand that in what ways their new businesses will progress and they should have significant managerial abilities and most essential they should have strategic focus. Oakley (2003) has given the three significant motivational elements of the technology entrepreneurs which are individuality, opportunities utilization and value creation. Aderemi et al., (2008) placed technological entrepreneurship as being desirable to make complete use of knowledge related to science and technology presently accessible in meeting the market needs as it ultimately will make the country more industrious and more competitive. According to researchers, Technological entrepreneurship is originated in design, development, creation, trading and commercialization of

cutting edge new products and processes. However the challenge of growing the frequency and pace of technological innovation in all sectors of the country's economy, they observed that it can lead to efficient productivity and progression if only more entrepreneurs set up new businesses to commercialize the innovations (Shane and Venkataraman, 2003). Technological entrepreneurs will have to experience a series of other activities related to management, creative thinking, incubating, validating, endorsing and sustaining. Technology entrepreneurs will also outspread their capitals and awareness about technology, markets, managerial skills and capabilities but all these are restricted by their absorptive capability and aptitude to understand the components of entrepreneurial system and associations between them (Van et al., 2005).

## 2.2 Interplay of Technology Entrepreneurship and High Education Sector

In 21<sup>st</sup> century the growth of knowledge based economy has produced new global structures with information technology playing imperative role in the global economy. The level of acceptance and distinction of information technology (IT) not only deviate the nature of knowledge but also reform higher education system, research activities and learning approaches. Technology has been one of the rapid rising sectors in the economy of any country. A large number of new technology endeavors were started to optimize full advantage of e-commerce opportunities such as business to consumer and business to business etc. Variations and advancements in various technology sections such as personal computers and digital subordinates, integrated circuits, several storage mediums and devices, the software applications, broadcastings (emails, telecommunication), Internet and Web and biotechnology fashioned thrilling potentials for creation of new businesses and also for the extension of existing industries (Van Parag et al., 2007). Moreover major developments in the country's technology infrastructure facilitates businesses with enriched environments from which to contend both in national and worldwide markets that are being changed by technological innovation and also boosts up the opportunities to perform entrepreneurial activities. But the main challenge is that in what ways and by what means such entrepreneurial based competencies should be attained. An economy must encounter this challenge that in what ways they can train, educate and prepare their entrepreneurs in the domain of innovation and management of the technology with proper skills, knowledge and appropriate approaches that enables them to cope up with emerging hurdles (Groen and Walsh, 2013). In this context if a general objective is to upsurge the number of academically educated entrepreneurs then educational ways and means should also be modified and adapted accordingly (Pittaway and Cope, 2007). The knowledge gained through higher education can be used to maintain pace with the changing trends in the technical and business environments. Today the presence of colleges and universities are not only meant to be the gatekeeper of knowledge and information instead various innovators are inflowing as entrepreneurs in education industry (Romer & Pekkala, 2008). In modern theories of growth and development, technological innovation has taken the focus stage and such innovations are commercialized by technology entrepreneurs. Colleges and universities are investing heavily in the development of their student's entrepreneurial skills and have tremendous impact on innovation and entrepreneurial development. Over the last eras, entrepreneurship has proven its position as the most compelling economic strength (Kuratko, 2005) and an efficient tool of advancement across the globe. Therefore many countries are in direction to introduce several policy structures to provision entrepreneurship education and training in order to endorse entrepreneurial activities (Cheung, 2008). Some of the researchers have shared mutual thought that the basic education and training towards entrepreneurial activities are divided into three classes in the era of knowledge economy, i.e. education about, education for and education in (Herrmann et al., 2008). They have also discussed that to promote entrepreneurial education and training for entrepreneurial activities, there must be a shift from the communication or transferable prototypes of teaching that is "Learning about" into the practical learning that is "learning for" intended to facilitate students with the techniques that can be useful in real world. For taking technology entrepreneurship initiatives the focus of high education sectors should be on two factors. First is education and training for innovative capabilities which is basically concerns with the provision for career in self-employment and second is education in innovativeness which concerns with the management exercises for established entrepreneurs (Henry et al., 2005).

## 2.3 The Transformational Power of Technology Entrepreneurship and High Education for Emerging Markets

Emergence of technology entrepreneurship in emergent markets is very different from developed market. This difference is due to greater resource limitations and high levels of firm informality in emerging economies. As developing markets endure to cultivate around the world, there is also a rising recognition that entrepreneurship and market driven solutions in these countries are extremely effective tools for stimulating people from poverty. In this context technology is eventually about empowerment as it offers humans the tools to directly shape their surroundings in dramatic ways. It is almost expressing that when technology is widely adopted has a long term influence on society which is greater than any other social force to cultivate the society. Both entrepreneurship and technology are considered as strong positive transformational tools in emerging economies specifically for their university based research communities in order to support technology entrepreneurship in developing

markets (Siqueira & Bruton, 2010). TE is an important source for diversity. Technology entrepreneurship empowers the capacity of country in order to generate and export new innovative products. TE provides an environment in which advanced education, international, combined networks and global perspectives essentially have a dominant place. This concept not only focuses on to address the country's present needs but also engage in forming the future (Ayrikyan & Lee, n.d). Understanding and addressing local market situations is certainly the only way to disseminate the suitable technology where it is needed the most. It is basically a method of learn by doing. Connecting students with case based teaching empowers students to start their own venture (Erikson & Gjellan, 2003).

Naude & Szirmai (2013) expressed that technology based entrepreneurship in developing markets offer ways in which entrepreneurs consumes resources and organizes to exploit emerging technology opportunities. Because TE contributes in operating businesses owned by tech entrepreneurs with the collaborative approach with scientists and engineers, discovery of problems or develop applications for a particular technology. It could be initiation of new ventures, announcing new applications or exploiting opportunities that depend on scientific and technical knowledge or else working with others to harvest technology change. Technology entrepreneurship deals with the exceptional development opportunities for societies in order to educate and propagate local talent, build diversity and maintain sustainable economic health. To avail those opportunities high education sector plays a vital role as university education is now consider as driving force for education and learning process. Hendel & Lewis (2005) has claimed that in developing countries high education gains even more importance because it delivers not only the skills essential for any industry but also the provides training necessary for professors, doctors, public employers, entrepreneurs, engineers, technologists, researchers and several countless workforces. Basically they serves as the trained workers who attained high education and responsible to cultivate the capability with technical skills that motivates local markets, upkeep the changing trends, make children learn and also help to make significant decisions which have strong influence on the entire environment. The education also makes emerging economies realize that a state can rise of the vicious economic cycle only if education, learning and hard work is sustain. If developing nation got this awareness than all the members of the society will attract towards attaining high education, increase learning processes and also work hard to put the nation on path to progress which will eventually take the nation out of vicious ring in which almost all the developing countries are struck up (Ranis et al., 2000). A survey conducted by Pew research center (2014) has come to the result that in developing countries acquiring good education and hard work are considered as the sources to succeed in life and boosts up the position of the country as shown in figure 1.

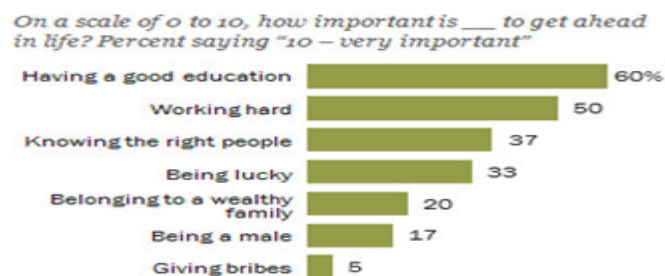


Figure 1. Education important for getting ahead. Adopted From: PEW research. Spring 2014 Global Attitudes Survey.

This view is particularly predominant in emerging and developing countries where most see economic opportunity increasing. Still many also consider success can be determined by other things such as good fortune or having an existing well established family.

Yamada (2015) has shown in one of his research study that Gross enrollment ratios in higher education which includes university and other postsecondary programs in developing economies are now more than doubled over from 1999 to 2013, increasing from 12% to 26% shown in Figure 2. He declared the two main operational reasons inspire this boom in higher education in developing countries. First is the rates of high school registration have been increasing in all regions increasing the pool of potential higher education students. Second is the growth in income per capita in modern times also predicts higher demand for higher education.

Region	1999	2013	Percentage point difference	Percentage increase
World	18	32	14	78
Developed countries	54	76	22	41
Developing countries	12	26	14	117
Caucasus and Central Asia	20	23	3	15
East Asia	10	29	19	190
Latin America and the Caribbean	21	43	22	105
North Africa	23	29	6	26
Southeast Asia	18	30	12	67
South Asia	8	23	15	188
Sub-Saharan Africa	4	8	4	100
West Asia	19	40	21	111

Note: Higher education refers to university and other postsecondary programs.

Figure 2. Gross Enrollment Ratio in Higher Education in the World. Adopted From: UNESCO Institute for Statistics.

The control of a successful higher education institution is predominantly hooked on by what means the institution generates, accomplishes and consumes knowledge. In the developed as well as emerging markets globally, the entrepreneurial focused universities benefits in developing the knowledge workforce, knowledge organization and also build sustainable knowledge economy (Husain, 2005).

Most of the developing economies have started universities based incubators (UBIs) in order to stimulate technology based entrepreneurship and enhance the student's skills and capabilities. University based incubators (UBIs) are turn out to be most popular and effective approach to foster entrepreneurship concept as they tend to deliver exceptional opportunities to emerging entrepreneurs to assist the young talent and provide suitable resources embedded in the university (Lee & Osteryoung, 2004). The aim of any university or higher education institute is basically to serve as a core for higher learning and education in numerous fields and shape academic basics. On the other hand, universities are also under stress from government and the industry in order to aid in economic progress. Hence government authorities anticipate universities to provide resources, time and absorptive capacity to the economic development efforts (Grimaldi & Grandi, 2005). High education sector should also play a substantial role in creating relationships with the market which ultimately provide their faculty a stage to conduct research and offers great opportunity for their students to pursue jobs (Huffman & Quigley, 2002). The university incubators associate both the higher education and private sector enterprises for creation of profitable margins. They not only generate new products but at the same time also reduce the related risks. Figure 3 depicts that development of business incubators worldwide from year 1960 to 2013 has been growing rapidly.

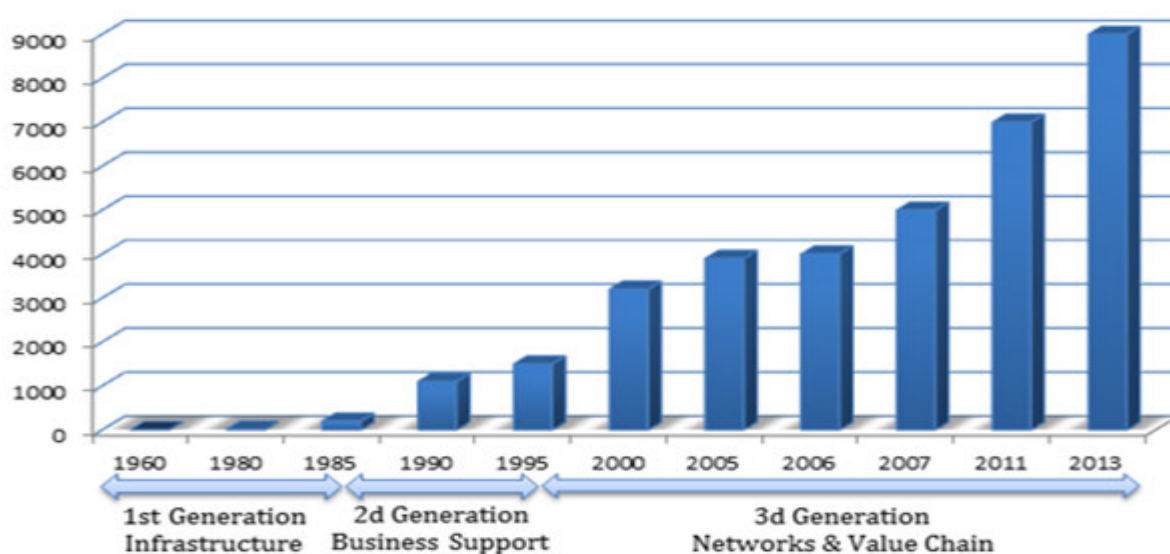


Figure 3: Number of Business Incubators Worldwide. Adopted from Crowed Synergy.

#### 2.4 Technology Entrepreneurship in High Education Sector of Pakistan

Today is the era of knowledge economy and despite of any doubt the intellectual asset is a significant force for

the prosperity of organizations which basically concerns with transmitting conceptual ideas into commercial products (Khalique et al., 2011). Pakistan is rising exceptionally in core of education, technology developments and general capabilities. Action based education has played an essential part by pulling out the extra ordinary creative minds, polishing them in their particular fields and also preparing them to lead the succeeding generation (Rasmussen & Sorheim, 2006). Concept of entrepreneurship is firming in Pakistan as societal acceptance of entrepreneurship as a career is increasing. While on the other hand, increased social media practice and easy accessibility to technology have make Pakistanis being more linked to worldwide entrepreneurial activities and technological tendencies and also prospers the value of learning. It has been declared that the future of Pakistan depends on its youth particularly young entrepreneurs. As IT industry of Pakistan is evolving on the world map rapidly now it requires some home developed public and private venture capital fund executives to boost up the entrepreneurial activities. Over the past several years higher education scholars have led a significant amount of research marked at understanding the inferences of enhanced interactions between the academic education and the practical market. Martin et al., (2013) have described that the balancing role played by the public and private region is the motivating force behind developing an environment favorable to the growth and advancement of industry. Furthermore academic institutions which refer as high education institutes are also delivering a supportive part for technology based entrepreneurs. In Pakistan attainment of a job in any big company is the utmost desire and logical decision for a graduate. But in some way people of Pakistan has to change their mindset. Being an entrepreneur is not bad choice. This mind shift can only be done by educating people about entrepreneurial education. High education from universities are basically responsible for educating students that in what manner they can exploit technological opportunities and take full advantage from those opportunities in order to achieve the desire of self-employment. In the view of West et al., (2009) Universities provide education about exploiting technological entrepreneurship education because this relative education is an effective way to upsurge the supply of entrepreneurs both in quality and quantity. The acceptance of education related to new startups is reflected in the large number of institutes of higher education. Tierney et al., (2013) acknowledged the significance of technology centered entrepreneurship as the driver of vibrant capitalism and strength behind dynamic developments. In the meantime Pakistan equipped great specialists and entrepreneurs in the field of technology. It also supports in growth and development, creating the opportunities of acquiring new jobs, better advance market, competition and improved lifestyle. Technology entrepreneurship education is necessary because it transforms traditional economy into knowledge based economy which is the main element facilitating organization in order to survive in 21st century. The basic difference between knowledge economies from the conventional economy is that it concerns with land, manual labor and capital, whereas the current knowledge based economy concerns with intellectual assets, human resources and innovative expertise (Gardner, Verma and Payne 2006). The main function of various entrepreneurial based programs is to play an essential role as originators for entrepreneurial activities. The business based programs contribute students to gain experience in a real world and technology focused programs cultivate the culture to bring innovations and advancement in technology with initiating new technology ventures (Etzkowitz, 2002).

## 2.5 Promoting Technology Entrepreneurship Initiatives by Higher Education Commission (HEC) Pakistan

Pakistan high education had a revolutionary change after the formation of Higher Education Commission (HEC). In the rapidly changing world the key element to growth lies in the aptitudes of states to unleash the inventive and innovative potential of their youth to cultivate strong knowledge economies. It is the environment, value and competences of the interactions between the three major components, universities, industries and government that regulate how a knowledge economy progresses. The developing states can progress only if they shift to knowledge based economies by instituting high quality centers focusing on dynamic plans and procedures on scientific knowledge, advancing technology and focus on entrepreneurship that produce employment opportunities for the youth (Usmani et al., 2012).

### 2.5.1 Offices of Research, Innovation & Commercialization (ORICs)

Understanding the need to organize research efforts by universities in order to promote innovation and commercialization of ideas and technology based entrepreneurship, the HEC has taken several initiatives such as establishment of Offices of Research, Innovation & Commercialization (ORICs) at its acknowledged and recognized universities. ORIC will facilitate the University's research activities or programs with strategic and operational support and it will also have a fundamental role in assisting the university and industry connections for commercialization of their research (Higher Education Commission, 2010). As an outcome, it will lead to transfer of knowledge and encouragement of innovation in the area of entrepreneurship

### 2.5.2 Technology Business Incubators (TBIs)

It is hospitable that the Higher Education Commission (HEC) of Pakistan has recognized the importance of entrepreneurial education and need of practicality of that education with the fluctuating global economic developments and also has started taking initiatives in this respect. HEC launched a major program to encourage innovation and technology based entrepreneurship which involve amendment of programs, introduction of

courses in innovation and entrepreneurship within universities, formation of several technology parks and business technology incubators. HEC also provides access to venture capital and loans for new start-up.

### 2.5.3 Stimulating Technology Entrepreneurship Initiatives by Universities based Incubators (UBIs)

Universities are the nerve hubs of technology entrepreneurship ecosystems which consist of inventors, innovators, entrepreneurs, business scholars and learners, financiers, government and industry. They have a miscellaneous, intensely networked international group of faculty, students, alums and their networks keen to make a positive impact globally. There are some economic forces that have led several sectors of HEIs to embrace entrepreneurial mockups of funding and provide services. Whatsoever the universities are doing, it is required to go in the direction of entrepreneurship innovation and technology entrepreneurship commercialization. This is because the HEIs are designed for three significant assets: (a) they need to generate knowledge (b) they have to communicate knowledge (c) they have to integrate that knowledge with the society. Basically grasping above characteristics the UBIs facilitates with the employment opportunities for their own student and also provides facilitation to private sectors and consistent nursing till firm graduation. Johannisson & Halvarsson (2001) have claimed that universities are the main components of the entrepreneurial ecosystem in Pakistan as universities are meant to be producers of competent workforce. High education institutes are basically act as a node in the system between organizations, incubators, research centers, clusters and technology parks. The relationship between universities, industries and government has been considered as the triple helix of innovation with the formation of science and technological parks as a hybrid approach in which universities are observed as an essential element of knowledge creation in contemporary knowledge based economy (Etzkowitz, 2008). Triple helix represents the paradigm shift from the traditional university practices of teaching and research to the modern operation of socioeconomic progress. The formation of new organizations, funds and high education institutes (HEIs) to support entrepreneurial activity related to technological or non-technological entrepreneurship in Pakistan is underlined in Pakistan Entrepreneurship Ecosystem Report 2014, a reaction to the global trend of entrepreneurship (Invest2Innovate, 2014). Some of the universities are discussed below which contributes information science and technology parks and incubation systems:

Lahore University of Management Sciences (LUMS) has launched LUMS Center for Entrepreneurship (LCE) in early 2014. The newly established LCE has been formed with the objective to turn out to be the country's most widespread experimental development platform for growing entrepreneurs that reinforces the process of exploring, training and facilitating passionate startup initiators (Invest2innovate, 2014). The basic aim of this center is to pick favorable business ideas offered by the talented youth. Bring the particular teams together for mentorship under the umbrella of the institution's business incubator named as 'The Foundation' which basically provides an appropriate environment essential for the startup's development. It also delivers professional advice for improvement of the particular business models and guides the participants to polish their related expertise (Lahore University of Management Sciences, 2014). Mobilink under the vision of its "Make Your Mark" initiative has joined with LUMS Center for Entrepreneurship (LCE) in order to contribute concerns with the empowerment of startup network in the country. Senior Director for Corporate Communications at Mobilink, Mr. Omar Manzur said that his business had extended financial aid of \$45,000 in cash to LCE to endure its incubation competency for new startups (Atta, 2015).

National University of Science & Technology (NUST) Islamabad launched Technology incubation center (TIC) in 2005. NUST Centre for Innovation and Entrepreneurship is the very first institution of high education in the country which has taken a persistent initiative for science park establishment with the support of HEC in Pakistan. The aim of this center is to facilitate and upkeep the innovation of the University. This incubator model basically provides an environment to the students that fascinates and cultivates the technology focused start-up businesses and transforms into commercially practical enterprises (Hashim & Shah, 2013). The aim of TIC is to promote an entrepreneurial culture by providing the students and faculty of NUST, an opportunity to convert their technological business ideas to practical ones. These facilities are also exposed to the general public.

COMSATS Institute of Technology a university in Islamabad delivers students incubation and business facility through the Business Incubation Centre (BIC) in 2010 with the mutual effort with HEC. The basic aim is to commercialize the research that originates from BIC.

USPCAS-E UET Peshawar was planned by USAID and the Higher Education Commission of Pakistan (HEC) to upkeep the Pakistan's economic expansion by strengthening the significance and responsiveness of the university products which includes practical and policy research and prepares graduates according to the needs of the public and private region of Pakistan.

### 2.5.4. Promoting Technology Entrepreneurship Initiatives by Technology based Incubators (TBIs) in Pakistan

A technology incubator is a unit that helps in stimulating innovation. Technology business Incubators pursue to combine technology, resources, capital and knowledge in order to progress entrepreneurial capacity, boost up the development of emerging business and consequently accelerate up the commercialization of technology. Technology business incubators are an initiative to offer a fostering environment for technology-based business,

innovation is carried to the marketplace producing innovative products and services for the technology industry. In developing nations TBIs are playing central role to increase economies with the support of entrepreneurial and technology base initiatives. TBIs are the units where knowledge is changed into innovative products and has a main task to encourage and secure the start-up. There are number of TBIs working in Pakistan efficiently some of them are: Karachi Institute of Technology & Entrepreneurship (KITE) established in Karachi also provides students real world technology education and have network with capable entrepreneurs and experienced individuals. Plan 9 Tech Incubator is sponsored by the Punjab Information Technology Board (PITB) in 2012. It is the leading technology incubator accommodated at Arfa Software Park located in Lahore. Its vision is to flourish the culture of technology based entrepreneurship and attain sustainable progress for early stage product ideas by providing particular mentorship and venture opportunities to produce commercially practicable technology startups from Pakistan. Institute of Space Technology sponsored by HEC in 2013 for entrepreneurial development is technology based solutions and many more (Mahmood et al., 2015). University based initiatives and efforts for flourishing technology industry can potentially spread idea of entrepreneurship among fresh Pakistani graduates that the entrepreneurial choice is not a dreadful idea. Self-employment is better than salaried employment and also it promotes that entrepreneurship enhances the employment opportunities for other as well (Naeem, 2014).

#### 2.5.5 The Ministry of Science and Technology (MOST)

In Pakistan it is the national central point and empowering factor of government for developing, synchronizing and guiding efforts to start science and technology based programs according to the national needs. The MOST programs are mainly implemented by the following 15 institutions and organizations functioning under its managerial control. These organizations are stimulated and reinforced to transfer technology and knowledge to the local industry and commercialize their products and developments in order to become sustainable with the objective to accomplish Knowledge Based Economic Development. Those institutions include Pakistan Council of Scientific and Industrial Research (PCSIR), Science and Technological Development Corporation (STEDEC), Pakistan Science Foundation (PSF), Pakistan Council for Science and Technology (PCST), Pakistan Council for Renewable Energy Technologies (PCRET), National Institute of Electronics (NIE), National Institute of Oceanography (NIO), Pakistan Standards and Quality Control Authority (PSQCA), Pakistan Engineering Council (PEC), Council for Works and Housing Research (CWHR), National University of Sciences and Technology (NUST), COMSATS Institute of Information Technology (CIIT), Pakistan Council of Research in Water Resources (PCRWR), Pakistan National Accreditation Council (PNAC).

The Global Competitiveness Index analyzed the performance review of 2014-2015 (as shown in figure 3) with respect to science and technology. It elaborates the technological keenness, volume for innovation, higher education training and learning, availability of technologist, scientists and engineers, university and industry relationships, investment in Research and Development (R&D) and quality of scientific institutions of the country. According to this review Pakistan is lagging behind than other developing economies due to which it will become problematic to attain benefits of the new growing opportunities.

Parameters	Pakistan	China	India	Malaysia	Turkey
Technological Readiness	2.8	3.5	2.8	4.2	4.3
Capacity for Innovation	4	4.2	4	5.2	3.7
Higher Education & Training	2.8	4.4	3.9	4.8	4.7
Availability of Scientists & Engineers	4.3	4.4	4.4	5.2	4.2
University Industry Collaboration in R&D	3.2	4.4	3.9	5.3	3.7
Company Spending on R&D	2.9	4.3	3.8	4.9	2.9
Quality of Scientific Research Institutions	3.4	4.3	4	5.2	3.9

Scale of 1-7: 1=Very poor, 7=Very good

Figure.4. Adopted from: Global Competitiveness Index: Performance Review 2014-2015 (World Economic Forum).

Pakistan offers a massive potential of youth in county which can be consumed for the growth and development through the facility of real time applicable knowledge and preparing youth to bring out entrepreneurial change with respect to creativity, innovation and problem solving capabilities. But unfortunately the contents related to entrepreneurial education are still unfamiliar to the current talent and prospectuses of high education system are only limited to only few subjects in Business Administration degree programs offered by few universities. Both in research programs and teaching approaches it is significant to observe that education



improvement and exposure has arose over the years in the field of both business entrepreneurship or technology based entrepreneurship. Nowadays the trend in most universities is to expand and promote the need of entrepreneurship education for students and also design distinctive and inspiring programs specially designed for entrepreneurship students.

## 2.6 THEORETICAL FRAMEWORK

This study concerns with by what means technology entrepreneurship can facilitate the growth and development of higher education industry of developing countries. The purpose of techno entrepreneurship is to expedite the students who are intended towards self-employment and start something inventive and innovative which ultimately creates value and wealth in individual capacity and subsequently for the society (Husain, 2005). In this scenario the basic role of higher education institute is to groom the competent students to learn the essential skills with the help of rapid prototyping by which they can rapidly transform their innovative ideas into marketable goods and services. It is globally accepted that when technology is adopted, it has a massive influence on nurturing the society. Both entrepreneurship and technology are considered as strong positive transformational tools in emerging economies specifically for their universities research system and other industrial research and development communities to support technology entrepreneurship in developing markets (Siqueiran & Bruton, 2010). There is a strong interplay between techno entrepreneurship and HEIs as both forces have direct and concrete impact on each other and consequently help each other to cultivate and flourish. The growth of HEIs is depending on certain independent variables which are:

### 2.6.1 Information and Communication Technology (ICT)

Most of the researchers and practitioners are of view that emerging trends of information technology has concrete implications on individual and societal growth. The acceleration of new technological advancements has outpaced the traditional prototypes of learning and teaching into more innovative perspectives. Dorf & Byers (2005) have stated in their study that the changing spectrum of information technology (IT) not only deviates the traditional methods of learning but it also transforms the whole system of higher education as well as the research and development activities. There is a relative relationship between the higher education institutions and Information and Communication Technology. Technology at one hand considered as one of the most vital tool in accelerating the economy, demands equalizing role of HEIs in preparing and educating the entrepreneurs in areas of technological innovations and their management. It empowers the higher education institutes in providing the proper skills, knowledge and most accurately applicable methods to the students which enables them to meet the emerging challenges (Groen and Walsh, 2013).

### 2.6.2 Entrepreneurship Education and Training

Colleges and universities are now focusing on the development of their student's entrepreneurial skills. In knowledge based economy, researchers believed that in order to promote the basic education and training toward entrepreneurial activities, there has to be a shift from transferable prototypes of teaching from Communication based Teaching to Case Based Teaching and further into Action based teaching which facilitates the real world integration (Herrmann et al., 2008). There is a complementary relationship between higher education sectors and entrepreneurship education (EE) and training. The knowledge and training acquired through universities can be used to sustain business with the technological and market changing environments. In theories of growth and development, technology innovation has the focal attention and such innovations are commercialized by technology entrepreneurs. Therefore many countries are introducing several policy structures in their education system to promote entrepreneurship education and training in order to endorse entrepreneurial activities (Cheung, 2008).

### 2.6.3 Business Incubators

Business and technology incubators are basically a pooled platform in which students are welcome to share their innovative ideas, procure advice and mentorship, and provide the facilities of technology transfer, utilizing resources and funds to convert their ideas into commercialized product. Incubators are considered as one of the responsible force in developing the economy of any country especially when they make bond with educational institutes (Etzkowitz, 2002). They have strong impact on the three significant clusters of the country which includes students, their entrepreneurial behaviors and universities. There is a strong compelling relationship between incubators and high education institutions as HEIs provide university and technology based incubators. The basic aim of HEIs are to pull out the creative minds and polishing them in their particular fields (Rasmussen & Sorheim, 2006) while incubators nurtures the entrepreneurial actions and provides remarkable opportunities for the emerging entrepreneurs (Lee & Osteryoung, 2004).

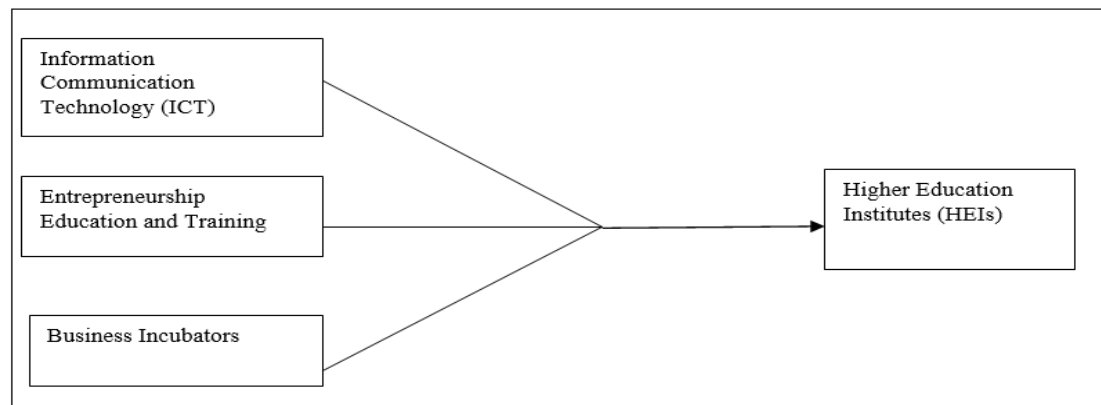


Figure 5: Conceptual Model- Impact of Technology entrepreneurship on HEIs

### 3. Research Methodology:

This research study is based exclusively on the secondary data that is drawn from the different existing databases and literatures, indexes and reports, publications, magazines and internet for the purpose of investigating how technology entrepreneurship (TE) impacts on higher education institutes (HEIs) and help them towards growth and development.

Boslaugh (2007) defined secondary data as the evaluation of data this is being collected by other researchers. Collection of data by secondary approach is economical, easily accessible as well as it provides a comprehensive and necessary background which helps to refine and better understand the research problem (Andersen et al., 2011). It can be reused in different perspectives in order to solve a research problem as it provides the better interpretation of information.

#### 3.1 Barriers in Existing Entrepreneurial Environment in Pakistan

In 21st century the knowledge workforce efficiency will be the most difficult managerial challenge for the organizations to accomplish the competitive and sustainable advantages. Producing innovative knowledge depends on the organization's capability and knowledge workforces. In this context Khalique et al. (2011) stated that in current environment intellectual assets are the most important elements for the achievement and success of any country. There is several intensity of challenges Pakistan is facing today in encouraging entrepreneurial environment. Incompetent government is one of the core barriers in nurturing entrepreneurial environment in Pakistan because government is not enough capable to carry out particular laws and regulations. This situation is provoked by poor law and order position, lack of regulation and vague property rights leading to prolonged legal processes. The multifaceted governing environment and increasing obscurity not only blocks the growth of tech or business entrepreneurship but it also creates problems for investing in the business in Pakistan. In last few years the growth of entrepreneur focused organizations such as incubators, co-working platforms, accelerators, industry relations and forums are helping in reducing risk for financiers. There is a need to supervise the quality of such programs and organizations. The focus should be on quality not just on quantity. New startups upsurge the economy of the state but here focus should be on long term sustainable strategies to bring and manage the change. In Pakistan lack of advanced human capital considered as a major difficulty in order to empower entrepreneurial network. Usually the policy structure, access to venture capitals, and the improvement of business support facilities have grasp the attention of researchers which has left human assets out of the focus. High education sector should emphasis on mentoring students and integrate their knowledge with strategic planning and strong skills to prepare them for employments in value added sectors. In Pakistan, there is still a lack of awareness about entrepreneurial benefits which disturbs the talent recognition and formation of strong human capital. Furthermore even if organizations discover competent individuals but keeping them is also a big challenge because workers often join highly paid positions at firms or other international corporations. There was a survey conducted by invest2innovate (2014) in Pakistan, in which it is stated that entrepreneurial network activities in Pakistan are still encouraging but several governing and funding challenges exists. In the survey respondents termed external factors such as (51%) instable government position, high rate of corruption in the state is marked as 59%, and crime or disorder is almost calculated 42% as major hurdles towards establishing a business. In Pakistan low level of innovation and poor patent system is also one of the most serious challenges in existing environment.

### 4. Conclusion

It is concluded that entrepreneurship has made its exceptional place in economics and business environments but today the situation has been changed. Now it is considered as a main key for any country in order to create

advancements in socioeconomic and enhances the technology startup culture within the region. Technology entrepreneurship is certainly becoming vital force in the contemporary globalizing environment as it delivers numerous opportunities and empowers effective optimization of the resources which ultimately leads to high profits. It also has a great influence on developed nations and takes a special attention from developing economies as the technology access and availability is becoming easy with digital economy. In Pakistan the youth is evolving as the generation of entrepreneurs in 21st century which is commonly known as knowledge based economy. Exploring the potential power of Techno entrepreneurship basically recognizes the forcing drivers that guide to the identification and utilization of value created opportunities.

This study explores that technology entrepreneurship and HEIs are the most significant elements in order to achieve rapid increase in economy. According to this research TE and HEIs have a vice versa relationship and have strong positive association with each other. HEIs are responsible for creation, dissemination and integration of knowledge while Technology entrepreneurship is providing the facilities to real world integration with the knowledge attained by universities. TE helps in exploiting the opportunities and also boosts the job creation as well as self-employment. Universities are the main components of the entrepreneurial ecosystem of any economy as they are meant to produce the competent workforce. There are many factors which enable such environments which complements in bringing innovative culture like entrepreneurship education and training, adoption of advance level of information technology (IT), business incubators, and strong government policies. Without such forces the entrepreneurial environment cannot be endorsed. This research discovers that high education sectors contributes in providing the intellectual assets, demanding knowledge and also provide resources by which entrepreneurs can derive benefits from the opportunities. Technical entrepreneurship carries more uniqueness and innovation. For an entrepreneur opportunity recognition begins with the identification of a future need and ends with innovative solutions. It is initiated in the design, development, trading and commercialization of new products and processes by using ICTs. Pakistan offers a massive potential of youth which can be consumed for the growth and development through the facility of real time applicable knowledge and preparing youth to bring out entrepreneurial change. Nowadays the basic focus of most of the universities is to develop and promote the need of entrepreneurship education for students and also design distinctive programs specially designed for entrepreneurship students.

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