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# Contributions of Science and Technology Parks Towards Firms' Performance in Pakistan

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## ABSTRACT

Several countries have adopted different strategies, models and policies to assist companies to develop their technological capabilities. These include high tech cluster development, creation of venture capital fund, establishment of technology incubation center, and Science & Technology parks. In turn, the creation of knowledge base industries, regional development, improves the technological infrastructure and life standard of the people. This paper discusses the contribution of science and technology parks in firms' performance in particularly employment, sales and profitability and also in creation of new businesses in information technology sector in Pakistan. This study is based on the case study of STPs (Software Technology Parks) of Islamabad. The results revealed that the establishment of STPs could be helpful in the creation of new companies as half of firms located at the STPs were startup enterprises. It helps firms to enhance its growth performance in the first five years after starting their business at these STPs. By developing software parks in three major cities, Pakistan Software Export Board have achieved partially its objectives.

**Key Words:** Science & Technology Parks, Software Technology Parks, Pakistan Software Export Board, Employment, Sales, Profitability.

## 1. INTRODUCTION

In last three decades, countries from Asia pacific region have adopted a highly targeted approach for economic development by accerlating their scientific and technological capacity. These countries have focused in areas such as ICT (Information and Communication Technology), biotechnology, nanotechnology and bioinformatics. After success of science and research parks in western countries, Asian countries such as South Korea, Taiwan, Hong Kong, Malaysia and India have

developed S&T Parks (Science & Technology Parks) for creation of knowledge based industries and boost up their national economy.

The International Association of Science Parks defines the science parks as:

"A Science Park is an organization managed by specialized professional whose main aim is to increase the wealth of

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its community by providing the culture of innovation and competitiveness of its associated businesses and knowledge based institutions. To enable these goals to be met a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institution, companies and markets. It facilitates the creation and growth of innovation-based companies through incubation and spins-off processes; and provides other value added services together with high quality space and facilities [1].

The concept of science and technology parks was originated about 55 years ago and the Stanford Research Parks, established in 1951 in United States, was the first such establishment. Cambridge Park, established in 1970, was the first in the United Kingdom [2]. In 1970s, Japan established science city in Tsukuba city, while other Asian countries (Taiwan, China) developed these parks after 1980s. Hsinchu Industrial Park is one of the most successful paradigms from Asia. The overall goals of S&T Parks are to boost local economy and regional development. Other aims include encouraging cooperation and flow of knowledge between universities and industries, creating high tech jobs, encouraging the creation of innovative firms, supporting spin-off firms started by academics and attracting foreign investment & enterprises involved in innovative technologies [3].

In Pakistan, government has established software technology parks in three capital cities Karachi, Lahore and Islamabad. This paper discusses contributions of science and technology parks in Pakistan both in terms of its firms' size (number of employees) and its performance (in terms of sales and profitability) and also in creation of new businesses in information technology sector. This paper is organized as follows: Section 2 explores the

literature of review on S&T Parks; information technology sector and software technology parks development in Pakistan. In Section 3 research methodology has been discussed and Section 4 analyses the results of survey of software technology parks of Islamabad and in last section the conclusions of the research are presented.

## **2. LITERATURE REVIEW**

After 1970, many countries including developing have established science and technology parks at national and regional levels for economic and regional development by providing high standard infrastructure to firms for creating new employment and high-tech businesses [4-6].

The main aims of technology parks include encouraging cooperation and flow of knowledge between universities and industries, creating high tech jobs, encouraging the creation of innovative firms, supporting spin-off firms started by academics and attracting foreign investment & enterprises involved in innovative technologies [3].

The research on science and technology parks have been carried out frequently in last 20 years. These studies can be categorized into four areas; an evaluation of the performance of the S&T Parks [7-9], assessing their operation [2,10], fulfillment of their stated objectives [3,11-12] and mechanism to promote university - industry interaction [13-16].

The major part of literature on technology parks covered advanced nations i.e. United States of America, Europe (UK, Sweden, France, Italy and Spain), Australia etc. After 1990s, Research on science and technology park also focused on asian tigers (South Korea and Taiwan) and newly industrialized countries such as Brazil, China, Malaysia, Turkey, etc. Developing countries have

emulated somewhat similar type of approach for boosting their economy through launching new enterprises and generating new jobs in various sectors (Information and Communication Technology, Biotechnology, etc.) [17]. However, these S&T Parks have never been evaluated in the context of Pakistan in terms of their contributions for their said objectives. Therefore, this research study attempts to investigate the contribution of science and technology parks in establishing new businesses and enhancing firms' performance for developing country like Pakistan in the Information Technology Sector.

## **2.1 Information Technology Sector of Pakistan**

After 2000, Government of Pakistan has taken several initiative for the expansion of information and communication technology sector in the country. These include the deregulation of telecommunication, incentives for IT and IT-enabled services industry (Tax holiday on IT export earnings until 2016, 100% foreign ownership allowed, 100% repatriation of earnings allowed, 5% customs duty on import of IT related machinery and equipment and 33% annual depreciation of equipment allowed), establishment of more IT institutions, and development of science and technology parks particularly in software sector [17].

ICT sector has achieved remarkable growth, particularly after the introduction of internet and is one of the fastest growing industries in the world. Several countries (developed and developing) are giving significance to this sector for their economic development and for development of other sectors. Developing countries like India, Singapore, Philippines, and Malaysia have also seen substantial progress in IT, particularly in software industry. Software Industry of Pakistan have played important role in national economy in last decade [18].

Government and HEIs (Higher Education Institutions) have also played important role in success of software industry in Pakistan. Several public and private universities have introduced IT programs at undergraduate and postgraduate level, for producing much needed human resources for IT industry. On the other hand, government has also taken number of initiative to promote information technology sector in the country. These include financial incentives (tax exemption, foreign ownership of equity invested in IT, repatriation of profit, financial support and technical support for achieving quality certification and HR development) and infrastructure development (establishment of IT Parks with low rent).

## **2.2 Software Technology Parks in Pakistan**

In Pakistan, information technology sector particularly software industry remained on national policy agenda since 2000. The crucial steps taken by government includes: formulation of IT Policy 2000, establishment of IT Division, ICT R&D Fund, and development of Software Technology parks in major cities (Karachi, Lahore and Islamabad) for stimulating entrepreneurship, culture of innovation and bringing foreign investment in the country. Software Parks in Pakistan are somewhat similar to innovation center, information technology and software technology parks developed by Korea, Taiwan, China, and India. However, in Pakistan these parks were established in existing buildings with some additional facilities like high speed internet connectivity, satellite internet (VSAT) for backup international connectivity, and affordable rent for IT companies.

The STPs were launched by PSEB (Pakistan Software Export Board) to enhance exports of Pakistan's IT and IT-enabled Services [17]. PSEB is an apex Government body mandated to promote Pakistan's IT Industry in local and

international markets. PSEB facilitates the IT industry through a series of projects and programs in infrastructure development, human capital development, company capability development, international marketing, strategy and research, and the promotion of innovation and technologies [19].

The main objective of these STPs is to create a cluster of software companies, similar to the Silicon Valley and IT Parks of Bangalore. There are total ten buildings in three large cities of Pakistan which have been declared as STPs. Over 750,000 square feet of office space is provided to IT firms in these parks (Table 1). Lahore has five STPs with a total space of 276,986 square feet where as Karachi and Islamabad have two parks each with the office space of 190,000 and 253,000 square feet, respectively.

The federal and provincial governments are planning for the establishment of more STPs in the country. The federal government has allocated the land for STPs in Chak Shahzad (Islamabad) and near the international airports of Karachi and Lahore. In 2010 Punjab government has launched its first STP in Lahore and its total cost is nearly

US\$ 55 million and total covered area is about 475,000 square feet. The main objectives of STPs developed by Punjab government are to attract the foreign direct investment in the province and also encourage the local entrepreneurs to start new business in IT sector. Sindh government has also allocated land for its technology parks in Karachi largest industrial hub of the country. These parks will provide all necessary facilities to the start-ups companies and entrepreneurs of IT business [20].

Higher education institutions are also planning to establish science and technology parks within campus or close proximity to university. In this regard, NUST (National University of Science & Technology), has allocated land for first university based science and technology park in Pakistan. It has already created TIC (Technology Incubator Center) in Islamabad, where they are providing the business services, management services and other incubation facility to its incubatees. Higher Education Commission of Pakistan has also initiated programme for establishing more technology parks and technology and business incubation centers in major universities of Pakistan.

TABLE 1. SOFTWARE TECHNOLOGY PARKS IN PAKISTAN

Name/Location of STP	Size (Sq. ft.)	Year of Establishment	Number of Firms
Aiwan-e-Iqbal Complex, Egerton Road, Lahore	108,000	-	16
NetSol IT Village, Main Ghazi Road, Lahore	50,000	2004	03
Imran House, 39 Empress Road, Lahore	30,000	-	02
Bahria Complex, 103-A, Mall Road, Lahor	50,986	-	02
JGC-Descon Engineering, Lahore	38,000	-	01
Ceasar Towers, Main Sharah-e-Faisal Road, Karachi	100,000	-	22
C-1, Tariq Center, Main Tariq Road, Karachi.	90,000	-	04
Awami Markaz, G-5, Islamabad	80,000	1997	36
Evacuee Trust Complex, F-5, Islamabad	173,000	-	29
Rose IT Park, Rawalpindi	30,000	-	01
Source: Pakistan Software Export Board, <a href="http://www.pseb.org.pk">http://www.pseb.org.pk</a> [Accessed on 10 August 2008] [17]			

### 3. RESEARCH METHODOLOGY

For this research the primary data was collected through survey of firms located at two software technology parks of Islamabad. The selection of STIP (Software Technology Parks of Islamabad) was based on two reasons: first, these STPIs are comparatively older and larger than others parks located in Karachi, Lahore and other cities; second, these STPIs have higher number of working firms than other cities. According to PSEB, there were total 65 firms located in two software technology parks (Awami Markaz and Evacuee Trust Complex) of Islamabad. While only 26 and 24 software companies were in STPs of Karachi and Lahore.

The designed questionnaire sought information about type of businesses (local private, local public, foreign or Joint venture); primary business markets for firms (Domestic focused, Export focused or both); after starting business at STPs, what was growth trend of firm in terms of sales, employment and profitability in first five years. Questions regarding other benefits of being located at STP were also assessed through survey questionnaire.

The survey questionnaire was administered to firms located in both STPIs. At the time of survey, there were 24 companies present at first STP and 4 at second STP. In total, only 21 firms (75%) agreed to participate in this study and only sixteen firms (76%) sent back their response. Similar response rate is found in studies such as Surrey

Research Park UK [16] with 21 firms in its sample, and Technology Parks of Malaysia [14] with 22 firms in its sample.

### 4. RESULTS AND DISCUSSION

#### 4.1 Characteristics of Software Technology Based Firms

Questionnaire survey was carried out at software technology parks of Islamabad, and total sixteen firms have responded to questionnaire (14 from first STPI and 2 from second STPI) out of 21, which were agreed to participate in this study. Table 2 shows the various characteristics of firms which are located at these STPIs. In this study, number employees is used as an indicator to measure size of firms. Firms with employees less than 50 are categorized as small, with 50-100 as medium and more than 100 as large firms. Results show that majority of firms were small in size representing nearly 67%, while only 26% of firms with employees more than 100 were large firms. They were four firms in this category and three of them were either foreign based or joint venture. Bulk of firms doing business at parks were of age more than 4 years (80% firms), 50% of firms started new businesses and 12% of firms launched their branch offices at these parks.

The firms working for international market were mainly designing and developing software products. It is worth

TABLE 2. CHARACTERISTICS OF FIRMS LOCATED AT SOFTWARE TECHNOLOGY PARKS OF ISLAMABAD

Employment	7% (1-10 Employees)	40% (11-25 Employees)	20% (26-50 Employees)	7% (51-100 Employees)	26% (>100 Employees)
Years of Location	13% (<1 year)	6% (1-3 years)	25% (4-6 years)	56% (>6 years)	
Ownership of Firms	50% (Local Private)	6% (Local Private State-Owned)	25% (Joint Ventures)	19% (Foreign Based)	
Status of Firms	50% (Start-up firms)	38% (Existing Firms)	12% (Company's Branch)		
Market Orientation	20% (Domestic Market)	47% (Export Oriented)	33% (Both-Export & Domestic)		

Source: Mangrio, W.B., "Role of Science and Technology Parks in Establishing University-Industry in Pakistan: Case Study of Software Technology Parks of Islamabad", MS Thesis, Mehran University of Engineering and Technology Jamshoro, Pakistan, 2009 [28].

noting that at the time of survey nearly 80% (13 firms) were focused on international as well as domestic markets. However, when these firms were established only four of them were involved in export market.

The main objective for the establishment of these STPs was to create clusters of software firms for encouraging new businesses in Information Technology sector in the country. A cluster is defined as a group of associated ventures located in one geographical region or centered at a science park [21]. It has been proved that clusters of firms attract new firms to the region or at the Park [22]. In this study, it was also observed that the software parks of Islamabad has remained partially successful in attracting new firms as 50% out of total 16 firms were startup firms. Amongst them five firms were local private and three firms were foreign based.

#### 4.2 Advantages of Software Technology Parks

It is generally believed that firms by locating at close proximity can facilitate them to have access to a greater number of potential business partners, suppliers, customers and technical expertise [18]. In addition, these

parks can also facilitate firms in acquiring knowledge from various sources such as universities, government laboratories, research institutes and other firms in the same or other businesses. During survey, firms rated the option "interaction with other firms located at park" with highest priority (Table 3). It is obvious that in view of these firms, interaction with other firms is the most important source of knowledge for them as compared to any other factor. They view this most important for their market survival, as it can offer the resource retention, forming partnerships, acquiring services or trainings and data services through collaborations.

These two software technology parks of Islamabad are in close vicinity to each other and they are located in prestigious area of the capital city. In this zone, not only the concerned organization such as PSEB and MoIT are situated but secretariat of other federal ministries and their organizations, parliament house and five stars hotels are also located in this area. In response of an option "location of software technology parks", firms rated it as second highest important factor. A number of studies have also reported that, for firms, image benefit or prestigious address is one of the most unique attractions of science parks [23-24].

TABLE 3. ADVANTAGE OF SOFTWARE TECHNOLOGY PARKS AS RATED BY FIRMS

Advantage	Number of Firms	Mean Weightage Awarded
Interaction with other firms located at park	15	3.53
Software Technology Park's location	16	3.50
Access to recruitment of appropriate staff	16	3.19
Quality of infrastructure	16	3.13
Access to basic support services	16	3.00
Incentives offered by government	16	2.56
Advanced business services	15	2.53
Financial incentives	15	2.47
Proximity to university	14	2.21
Presence of research center for potential cooperation	14	2.00

Source: Mangrio, W.B., "Role of Science and Technology Parks in Establishing University-Industry in Pakistan: Case Study of Software Technology Parks of Islamabad", MS Thesis, Mehran University of Engineering and Technology Jamshoro, Pakistan, 2009 [28]

The firms also gave a relatively higher rating to an option "access to recruitment of appropriate staff" as an advantage of being located at a software technology park. As result, firms can recruit manpower from universities or from employees of other companies. Technology parks provide opportunities to recruit middle or senior level staff from other tenants which are also doing same type of business.

Facilities provided in the STPs of Islamabad include high-speed fiber connectivity, backup international connectivity via VSAT, and other modern facilities while maintaining the rent at an affordable level. Firms, located at the STPs consider provision of these and other infrastructure facilities as an important factor which give them a competitive edge over those out of Parks. Therefore, quality of infrastructure option has also been given a higher rating by firms.

The collaboration between business enterprises and universities is not only beneficial for concerned academic institutes and individual companies, but it is also important for development of knowledge-intensive businesses in the country. In Pakistan, industry does not believe that collaboration with universities and public sector R&D organizations can be beneficial for them [25]. Therefore, interaction with university faculty and researchers is not considered important by entrepreneurs of these firms. On the other hand, the technology or science parks of other regions of the world are either developed within university campuses or are located adjacent to universities for promotion of university-industry interactions, commercialization of research findings and creation of new businesses. The software firms of STPIs had given very low rating to "proximity to university" and "Presence of research center for potential cooperation". It indicates that government did not consider location of parks close to university as strategy to promote the culture of innovation by encouraging university-industry interaction.

### 4.3 Growth Performance of Firms After Locating at Software Technology Parks

It is assumed that locating at science and technology parks enhances the firms' performance. Ferguson and Olofsson [23] and Westhead and Storey [24] reported that firms located at science parks have a considerably higher rate of survival and a greater rate of development than firms located out of science parks. In order to test the assumption that locating at STPs enhances the performance, information was gathered regarding growth trends of firms after they started their businesses at Software Technology Parks. Sales and profitability were used as indicators of firm growth. Firms were asked to choose one of the three options (increase, no change or decrease) for all indicators. They were asked to provide this information for the first five years of their presence at Parks. The chi-square test was used for data analysis. The reason behind this test is the data is of ordinal data.

Majority of the firms reported that their employment has increased after they located at the STPs during first five years; particularly in the first, second and fifth year. Statistical analysis of the data showed significant increase for all the years except for the 4th year (Table 4), confirming that there are greater chances for firms to experience increased employment after locating at these STPs. The similar type of increased in sales was observed, statistical analysis showed statistically significant increase in sales growth for all the years except for the second year.

On the other hand, the data showed relatively less profound effect on profitability of the firms as compared to employment and sales. Statistical analysis showed significant difference only for the first and third years (Table 4). Monck, et. al. [26] observed different trends among profitability and other measures of firm performance in their study on high-tech firms. They stated that it is

TABLE 4. STATISTICAL ANALYSIS OF PERFORMANCE GROWTH TREND (EMPLOYMENT, SALES AND PROFITABILITY)

Indicator		1st Year	2nd Year	3rd Year	4th Year	5th Year
Employment	N	14	11	11	11	10
	Chi-Square	4.571	11.636	7.818	5.091	6.400
	Df	1	2	2	2	1
	p-value	0.033*	0.003*	0.020*	0.078	0.011*
Sales	N	12	9	8	9	9
	Chi-Square	6.000	2.667	4.500	5.444	5.444
	Df	2	2	1	1	1
	p-value	0.050*	0.264	0.034*	0.020*	0.020*
Profitability	N	11	8	8	9	9
	Chi-Square	7.818	1.000	6.250	2.778	2.667
	Df	2	2	2	1	2
	p-value	0.020*	0.607	0.044*	0.096	0.264

\*Significant at the 5% level (p-value, 0.05)

Source: Mangrio, W.B., "Role of Science and Technology Parks in Establishing University-Industry in Pakistan: Case Study of Software Technology Parks of Islamabad", MS Thesis, Mehran University of Engineering and Technology Jamshoro, Pakistan, 2009 [28].

surprising that data on this performance measure of technology based firms is extremely dissimilar from that of sales and employment. They explained that the small number of firms in science and technology parks generating profits in their early years of life may be attributed to the fact that many firms actually start at the park without any product to sell. It may be noted that in the present study majority of the firms reported increase in profitability, although this increase was statistically insignificant for most of the years. Monck, et. al. [26] found that performance in terms of employment, sales turnover and profitability also depends upon the age of firm.

This better growth performance of firms after locating at the park may be due to the cluster benefits. According to Khomiakova [17], clusters not only create competition among the firms but also attract more suppliers and customers in comparison with a single firm, which help firms to grow and perform better. Other possible reasons for better growth performance of firms may be the benefits of enhanced image (by starting their business at STPs) or better quality infrastructure available at the STPs.

## 5. CONCLUSION

The science and technology parks in Pakistan are similar to the parks found in other Asian countries such as China, India, Korea and Taiwan. These parks were established to foster new businesses and attract the foreign investment in information and communication technology sector. The results showed that the establishment of STPs could be helpful in the creation of new businesses as half of the firms located at the STPs were startup companies. Therefore, these STPs, to some extent have achieved the objective set by Pakistan Software Export Board while establishing these Parks.

The results showed substantial growth in the performance of firms in terms of employment, sales and profitability after locating at the STPs. However, no final conclusion, regarding the role of STPs in enhancing firm growth, can be drawn from these results as these results are only for firms which are located at STPs. The other important finding of this study is the technology parks established in Pakistan are different

from other Asian counterparts (China, India, Korea and Taiwan) in terms of area. The area of science and technology parks of China and India were established on average more than 20 acres, while in the case of Pakistan existing parks are small in area. However, future planned science and technology parks by universities and other provincial and local governments might cover more area. In this regard, Punjab government has recently established technology park (Arfa Kareem Software Technology Park) which is the largest park in the country in terms of its space.

This study found that parks are very small in area and established in existing building. To create new jobs and new businesses, government need to develop large parks not only in information technology sector but also in other sector such as biotechnology and with close proximity to universities and R&D organization.

This research effort was based on quantitative approach (survey), whereas personal interviews with the industry management should be part of any further study to gain more insights on science and technology parks and its role for creation of new business in IT sector. Another limitation of this study was that, it collected data only from those firms which are located at STPs, further study should be conducted to compare the growth performance between firms working within STPs and firms operating outside the STPs.

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