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A New Era for Sustainable Technology Based Development

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ABSTRACT

Science Parks have become a crucial technology growth propellant over the past 40 years, creating operative alliances between universities and Industrial Clusters. Their incubator programs play a crucial role by promoting start-up innovation-based enterprises, which are a significant economical asset. The Prince Abdullah Bin Abdul-Aziz Science Park (PASP) merged with KFUPM, addresses the prominent issue of university and industrial collaboration. The paper discusses the functional, administrative and management aspects of PASP, with focus on its potential for a positive impact on the regional economy through supporting technological innovation and growth.

1 INTRODUCTION

The twenty-first century has been witness to numerous fundamental changes that have overtaken and revolutionized the educational, industrial and economic sectors. This has been most evident over the last decade with the advent of the Information Age and its subsequent impact on these sectors. This influence is characterized by the ongoing global transition from industrial economies to knowledge-based economies. In this new model, modern economy is dictated by intellectual capital, and assets are substantially defined by knowledge and capability. A single intelligent idea, if effectively capitalized upon, can alter the economic scenario. What is primarily required but unfortunately often absent, is the ability to transform such new ideas and knowledge into business products and services most rapidly and efficiently.

It is basically to fill this void - this required channel that facilitates technology transfer from research centers and Universities into manufacturing and marketing departments - that the idea and need for Science Parks has arisen. This paper outlines the setting up of such a facility – the Prince Abdullah Bin Abdul-Aziz Science Park (PASP), in direct association with King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia. The working and administrative structure of the facility is outlined along with its relationship with the university. The following section describes the concept of science parks in general, their different structures, and working mechanisms. Section 3 introduces PASP, the vital reasons for its establishment, and defines its proposed working model. The management and fiscal structure are elaborated and discussed. Section 4 concludes this paper.

2 TRANSFORMING TECHNOLOGY INTO BUSINESS – SCIENCE PARKS

The establishment and development of Science Parks has been a concentrated area of focus with emphasis on the integration of business, technology and innovation. The earliest of such establishments, the Bohanson Research Park in California, was founded in 1948. Following its success, between 1950 and 1971, 128 research parks were founded [1,2]. Of these, the first university-related park was the Stanford Research Park, founded in 1951, in affiliation with Stanford University [3]. Since then different names, classifications, and models have evolved, depending on specific structures and working models. Some of these models failed, while others are no longer identified as research/science parks because of changes in tenant admission criteria [2]. Nevertheless all these establishments share the common objective of being a focus of knowledge and wealth creation through enhanced innovation and its effective commercial utilization.

A Science Park as per the International Association of Science Parks (IASP) is generically defined as [5]:

An organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the 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 institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.

This definition has often varied, in terms of individual organizational structures, financial models and participant stakeholders, depending on respective regional economic and administrative scenarios. A singularly important factor for such classification is the involvement of universities and academia in these endeavors. Initially, Science Parks referred to state-sponsored, high technology, knowledge-intensive industrial clusters, bringing together both established and start-up firms for promoting technology exchange and innovation. These

industrial complexes did not share a functional or formal link with universities. This trend has understandably changed, given that universities are the primary points for knowledge creation and innovation. According to statistics reported in November 2000, thirty two percent of science and technology parks were located inside a university campus or adjacent to it [8]. This figure is stated to increase with the establishment of recent parks, which invariably lay emphasis on technology transfer and exchange between universities and industrial establishments.

With this view, the objectives and scope of Science Parks can be stated as follows [6, 7]:

- *Develop formal and operational links to promote strong collaboration between large and small-scale businesses and centers of knowledge creation such as universities and public research institutes.*
- *Provide for technology exchange between universities and industrial research enterprises.*
- *Encourage and support the start-up, incubation and development of innovation-led, high-growth, knowledge-based industries.*

The first two objectives lay emphasis on the development of science parks as centers of mobilization for business-oriented research and development. This industrial clustering with its strong links to the university plays a clear role in supporting technological development and its transition into feasible commercial products. Hence it has a very tangible and visible effect on regional economy and growth.

The third objective stresses on the need for establishment of a dedicated program within the science park providing a comprehensive fiscal framework for start-up enterprises and entrepreneurs. These Incubators can be defined as:

A comprehensive growth facility that generates and sustains the dynamic process of business enterprise development through provision of infrastructural, logistical and financial support for young start-up firms and small and medium-sized enterprises willing to build commercially viable products and services over innovative technologies

The significant impact of such programs can be seen from Finland's experience [8], which has the highest incubator density per capita in the European Union. Over the past decade, these incubators have seeded and fostered the development of over 2000 companies with an average output of 200 companies per year. Of these over eighty percent have survived and flourished in the market thus contributing significantly to the Finnish economical capital.

Other well-managed incubator programs such as the Hong Kong Science and Technology Corporation [9] and France's incubator program [10] also endorse these encouraging figures.

In the United States, the University of Texas at Austin provides one of the most successful models for an integrated system for technology development and its transformation into a commercial product or service. The Austin Technology Incubator, IC2, is a direct result of the University-Industry-Government cooperative endeavors. The park working with various industry consortiums has transformed the city of Austin from a government education and agriculture based economy before 1980s, into the fourth highest ranked high-tech city in the world as ranked by the Boston Consulting Group Inc [4].

The growth and evolution of Science Parks is a continuous process, wherein the research facilities and interest are broadened, while sectoral alliances with other universities are signed thus spawning 'Centers of Expertise' [8]. Furthermore, science parks can extend beyond national boundaries by entering into mutual agreements with other regional and well-established parks. This truly defines the global outreach that tenant companies and start-up enterprises can utilize.

3 SYNERGY BETWEEN INDUSTRY AND UNIVERSITY – PASP

The Prince Abdullah Bin Abdul-Aziz Science Park was inaugurated in 2002 under the patronage of H.R.H Crown Prince Abdullah Bin Abdul-Aziz. Strongly affiliated with the King Fahd University of Petroleum & Minerals (KFUPM) the Science Park is an ambitious initiative underscoring the development of a common platform for technological research and innovation between academia and industry. It enjoys an excellent on-campus location, spread over a sprawling 75-acre site and within close proximity to the various engineering and science colleges, as well as the University's 'Research Institute'.

The driving initiative behind the establishment of PASP was to have a self-sustaining functional entity that would merge the two erstwhile distinct roles of university and industry in the development and implementation of new technologies. This ambition is substantiated by the PASP vision:

"To make a significant contribution to the wealth & welfare of the Kingdom of Saudi Arabia through the development of knowledge-based companies that will also strengthen the achievement of the mission of KFUPM to be a leading institution in the creation and dissemination of knowledge in its chosen fields of study."

3.1 PASP and KFUPM

With forty years since its establishment, King Fahd University of Petroleum & Minerals commenced on its fifth decade with a strong and pressing initiative – PASP - to create a regional focus point for joint research and development between its scientific community and the Industry. The demographical and industrial settings of KFUPM made it an ideal choice for the development of such an entity. The university is situated adjacent to Saudi Aramco [11], the world's largest and richest oil exploration and development company. With Petroleum and Petrochemical technology being one of the significant research strengths of the university, PASP is anticipated to grow into a globally recognized hydrocarbon R&D facility. Also KFUPM offers courses and programs in a wide number of disciplines with a high student population at undergraduate, graduate and doctorate levels, all of which would provide a significant talent pool for park tenants to utilize.

The absence of major non-petroleum-based industries in the region, and its moderate rate of development were also major motivation points for the establishment of PASP within KFUPM.

3.2 Strategic Directions

Over the relatively short span of the past six decades, Saudi Arabia has undergone a tremendous transformation, shifting its economical foundations from being primarily oil-based to a more broader, diversified industrial structure. With an approximate investment of over $900 Billion to ameliorate its social and fiscal status; the Kingdom now exhibits a largely wide-based industrial sector, providing self-sufficiency for a large portion of the country's domestic needs. At present, there are over 3,000 industrial plants and facilities in the Kingdom with a total investment of over $61.9 Billion. The one-time fishing villages on the coasts of the Red Sea (Yanbu) and the Arabian Gulf (Jubail) have been transformed into bustling centers of industry, producing and exporting everything from petrochemicals to electronics to over 70 countries over the globe. As one of the fastest developing countries in the world, with an average annual economic growth of around 5.5%, Saudi Arabia is the most dynamic economic power in the Arab world and ranks 20^{th} globally in its size.

The PASP endeavor is established as a major vehicle for the acceleration of the Saudi economy and its diversification. This is achieved through the development of a functional and structural park model appropriate in both scale and scope to the regional strengths and constraints. Based

upon these models, the following areas of strategic thrust are identified that would best enhance regional technological innovation and development:

- *Research and technology collaboration between the University and Industry through the establishment of the latter's R&D units within the park premises as tenant firms.*
- *Nurturing start-up companies and enterprises through the provision of comprehensive research and development facilities available within the university.*
- *Channeling new global technologies and practices into the Kingdom by creating a substantial regional point of presence for industrial research and innovation.*

The Science Park, still very much in its infancy, will focus on two specific areas reflecting KFUPM's main research interests – the Petroleum-based sector and the high-end Information Technology sector. The first phase of the park is expected to be ready by 2004. Property will be leased to local, regional and international companies who have a market presence in the Kingdom, and international companies will be attracted to take up tenant positions in the park.

It is anticipated that the close interaction between the park's tenant companies and the university will result in mutually beneficial joint endeavors, providing a wide platform for intellectual exchange of technologies and ideas. One important outcome would be the identification of key technology areas, especially those that are most commercially viable, and the mobilization of research to focus on these. Another substantial benefit from such a convergence of efforts would be the rapid transition of technological innovations from the laboratory into the marketplace and their effective commercial deployment. This would be best achieved through formal 'Technology Transfer' channels whereby proprietary university patents and research would be accessible to firms with viable business initiatives for commercial development.

Beyond technology, a wider channel of interaction will be established through exchange of personnel, especially the inclusion of senior industry management and technical staff on university advisory boards and adjunct appointments of industry experts for faculty positions.

Very often a significant fraction of economic acceleration is attributed to the capital gains that a successful entrepreneurial business can create. It is this realization that accentuated the need for an incubator program to be established as one of the core components of PASP. Such a program will promote nascent enterprises and entrepreneurial efforts in commercially feasible ventures, by allowing access to the university's research, development and administrative support facilities.

The last of the strategic directions emphasizes the need to create a regional point of presence for high-end technological research and development. The convergence of international R&D firms on the science park would be an immense vantage point for local and regional industries, providing insight into the latest technological practices and innovations.

3.3 Stakeholders

The primary stakeholders in the development, sustenance and growth of PASP are:

- King Fahd University of Petroleum & Minerals.
- Tenant firms, including both established research firms and private start-up companies from the incubator program.
- Investors, banking establishments and Venture Capitalists.

Each of these groups of stakeholders plays a vital role in the development and growth of the science park. Correspondingly, each of them has individual interests and potential benefits to be achieved from the park. These are listed below:

Benefits to KFUPM

- Close links and collaborative efforts between the science park's businesses and tenants and the university's faculty, researchers and students.
- A strong international reputation in academic and business circles as a significant player in high-end research and innovation.
- Attract and retain from among the best in faculty and research.
- The presence of International major companies and enterprises will keep the university abreast of the latest technological trends and developments. Undergraduate and graduate programs could be modified and enhanced to reflect these changes.
- Significant student absorption into these business enterprises, both during their course of study and upon graduation.

Benefits to tenant firms and enterprises

Tenants are local, regional and international companies who presently have a market presence in the Kingdom. Emphasis will be laid on companies involved in the Petroleum-based sector as well as high-end Information Technology, which are the two main significant strengths of the University.

- Tenant companies can have a significant point of presence in the region especially from an R&D perspective.
- Negotiated contracts could be reached for access to the research infrastructure at KFUPM such as laboratories, library resources, supercomputing facilities at the Research Institute, faculty consultation, etc.
- Developing companies would benefit from the mentoring, investment and marketing support established larger companies could provide.
- Private start-up companies would have access to the incubator program at PASP, which would provide a stable growth catalyst. This is in addition to other research and development facilities as available to other tenants.
- Availability of a skilled work-force pool from graduate and undergraduate students.
- Assistance in identifying university programs and resources that best relate to the company's research program.
- Adjunct faculty participation for key company employees.
- Opportunity for commercially deployment of university's proprietary patents and innovations. The terms and contract for this would be negotiated through PASP's Technology Transfer Office.
- Access to the university's advanced educational and training programs for company employees.

Benefits to Investors

The various avenues and channels for funding of PASP, and its incubator program in particular are presented in detail in the following section. The three main funding sources are private investors, banking establishments and venture capitalists.

- Venture Capital companies can get involved in developing infrastructure for PASP and can go beyond it by managing the park as a commercially profitable enterprise.
- With the establishment of a thorough screening system for startup companies, investors and banks would be presented with potentially low-risk, high-return opportunities.

3.4 Funding & Finance

The basic purpose of PASP as mentioned earlier is the enhancement of research and innovation, with core focus on the generation of business and profit from technology. The wide advantages and benefits of this aspect make PASP a particularly attractive investment opportunity for the private sector. The financial model of PASP is solely based on funding sourced from private entities such as investors, industries, banking establishments and venture capitalists. The government is to have no financial involvement either through KFUPM, or otherwise. As Science Parks worldwide have proven to be quite successful not only in business support, but also as commercial real estate operations, this invariably unique fiscal policy is a measure of the industry's interest and initiative in the project. Under this model, the university would be a privileged decision member responsible for establishing standards and leasing to tenants while maintenance and construction would be the responsibility of a private sector enterprise.

Under the proposed financial system, the University will provide the land-area for the science park, entering into a lease agreement with a private enterprise for construction and development. This enterprise may receive its returns from a percentage of the land and building rentals. Further funds are be sourced from individual tenant firms, in some cases through their 'Saudi Offset' programs. Under the terms of such programs, foreign companies entering the Kingdom commit to a certain investment in the country. This investment will be directed into the development of PASP.

Financial support for incubator programs will be drawn from banks and venture capitalists. As all entrepreneurial incubator projects will be carefully pre-screened for commercial viability and hence will present a low to moderate-risk, high-return investment opportunity, such a funding model is very much feasible.

3.5 Management & Governance

The effective management and governance of the science park is based on the collaboration between three major parties: the university, industry, and the government. The prerogatives of each of these entities as per their relation to the science park are as follows:

- Regulations and incentives from the government
- Knowledge and resources from the university
- Financing and money from the industry

The park is managed as a commercial enterprise in which the above three entities would have a share. The university will provide the land-area for the science park, leasing the same to a private enterprise for construction and development. The park's management would be overseen by a board of directors, the members of which will drawn from the government, university and the industry. The Rector of the university will chair this administrative panel. Throughout the management structure there is a conscious effort to distinguish between the university and park management. With this perspective, the university and government representation in the Board of Directors will be responsible for setting down standards, rules and tenant conditions.

The private sector represented on the Board of Directors will be drawn from both the tenant firms as well as from those involved in the parks development and growth.

A management team headed by a park manager would play the intermediary role between the tenants and the administration and would report to the Board of Directors. This team would exercise sufficient power and control to allow for flexibility and easy adaptation to change. The park will also have a standing committee whose chairman will also serve on the Board of Directors.

3.6 Park Tenants

PASP has two equally important tenant programs – the clustering of large and small enterprises in inter-networked collaboration with the university and, the nurturing of start-up firms and innovative enterprises through its incubator project.

Local, regional and international companies that presently have a market presence in the Kingdom will be encouraged to take up tenant positions in the park. These firms will be expected to have active research and development programs in the park, i.e., they will extend beyond mere retail outlets for the company. The conditions of the tenant contract will be outlined and agreed upon prior to any physical placement within the park.

The incubator program is the second significant focus area of the science park. Its purpose is to support the creation and growth of start-up enterprises through a fiscal framework, providing the required resources and infrastructure. The incubator tenants will have access to KFUPM's research, development and logistic facilities, with emphasis on development of market skills. PASP will also advise and assist in critical issues such as legal concerns, sourcing funds, marketing, and product launch.

Though the overall incubation process for a proposed product/service development will be addressed in stages as enumerated below, an appointed board of industry professionals and personnel will constantly monitor its progress.

- **Pre-Incubation**: As a pre-screening stage, the proposals submitted from individual entrepreneurs and start-up firms undergo a preliminary assessment, where the potential business plan is reviewed.
- **Evaluation**: The proposal and its objectives are then evaluated against regional, and PASP interests by a panel of experts drawn from the industry and university. The panel evaluates the interrelationship between the targeted market, the final product and the effect on regional economy. The issues addressed are the innovation behind the product, its success factors, potential for job creation, effect on regional commerce, and the resources required during its incubation. Timelines and product development stages are agreed upon, along with the university resources and infrastructure facilities to which the concerned firm will have access.
- **Incubation**: Once the individual, or start-up firm reaches this stage, it is housed in the incubator building. Their progress is monitored according to the terms of the outline agreed upon with the evaluation panel. The final phase of incubation is often the market launch of the final product.
- **Exit**: Once the product has been finalized, tested and introduced into the market, PASP assists the firm in attaining funding and seed capital from venture capitalists and banking establishments. The firm leaves the incubator to establish itself either in the main market, or within PASP itself.

4 CONCLUSION

The Prince Abdullah Bin Abdul-Aziz science park is a strong statement of KFUPM's determination to maintain its high standards in research, technological development and academic excellence. It is an initiative to couple the university's resources and talent with the technological capabilities of the industrial sector, thereby creating a highly collaborative environment with vast potential for joint technological research and development. Besides this mutual relationship between the university and established companies, the science park will promote local and regional private startup enterprises and entrepreneurs through its incubation program. A committee comprised of representatives from the university, government and industry will jointly manage the science park. Funding will be primarily from private investors, with the university providing the land-area.

With the establishment of this science park, KFUPM moves forward into its fiftieth year with a far-reaching initiative that will be a dynamic catalyst for technological development and collaboration between the university and the industrial sector.

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