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Science and Technology Parks: Global Outlook with a Focus on the Arab Region

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1. Introduction

1.1 Objectives

This report is concerned with defining the importance of Science and Technology Parks (STPs) as one of key success factors for the implementation and achievement of the Sustainable Development Goals (SDG's). This technical paper will assess STPs roles within local economies, highlighting their goals and objectives, comparing the different governance and management styles, defining the success factors and evaluation criteria, and showcasing best practices.

A variety of research references, good practice documents and the expert opinions were drawn upon in the preparation of the report.

1.2 Structure of the Report

In brief, the sections of this report cover the following:

- Section 1: Outlines the objectives and structure for this report.
- Section 2: Provides a general definition of Science and Technology Parks, an overview of their evolutionary development since their inception, and finally a historical background on STPs in the Arab region.
- Section 3: Details the goals and objectives of Science and Technology Parks in addition to their role in local economies. Moreover, it provides theoretical models and practical models that are relevant to the Arab region.
- Section 4: Details the governance and management criteria and models in relation to Science and Technology Parks in the Arab region
- Section 5: Details the services provided by Science and Technology Parks in general and that of the Arab region.
- Section 6: Details the accepted evaluation criteria used for Science and Technology Parks in addition to success factors and best practices.
- Section 7: Provides concluding remarks in relation to Science and Technology Parks in the Arab region.

2. Background of Science and Technology Parks

The establishment of Science and Technology Parks (STPs) was inspired by the idea of creating an optimal environment and ideal ecosystem for the establishment and growth of businesses, technologies, and innovations through providing a physical environment in proximity to other relevant institutions and delivering relevant support services within one convenient location. Such environment is found to support collaboration and idea sharing between startups, SMEs and science communities.

2.1 Definition: Science and Technology Parks

Today, there are thousands of institutions that use the title of a science and/or technology park, or a variant of this term. However, it is worth noting that there are slight differences between some of these terms.[1]

Despite the long history of STPs, neither a complete definition nor their roles have been formulated. The definition of "Science Park" currently adopted by the International Association of Science Parks and Areas of Innovation (IASP) is:

"Science Parks" are organizations 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. IASP's definition also goes on to say that the expression "science park" may be replaced in this definition by the expressions "technology park", "technopole" or "research park". [2]

Through examining different available definitions, the following generic themes are common in almost all of them:

- Supporting local or regional economic development
- Providing space and other support services
- Promoting innovation and competitiveness of clients
- Working with the knowledge base
- Facilitating investments of knowledge-based businesses
- Showcasing cluster developments
- Incubating start up activities
- Providing an environment that encourages networking and exchanging of ideas

2.2 Evolutionary Development of STPs

STPs have been evolving since their first establishment. The following further explains this evolutionary growth:[3]

▪ First generation STPs

STPs that started during and before the 1980s fit within the first generation. Their characteristics include:

- A well landscaped site with good quality buildings.

[1] (Nauwelaers, Kleibrink, & Stancova, 2014)
[2] (UNESCO, 2017)
[3] (Alvarez, 2013)

- An association with one or more Higher Education Institutions (HEIs), where STPs are linked to one or more universities.
- Active links with the associated HEIs to foster technology transfer in support of innovation through the tenants at the STP.

Second generation STPs

During the 1990s, many STPs began to realize that the smaller technology firms they were supporting were not growing as fast as expected. This was largely because the management teams of young technology start-ups were relatively inexperienced. Hence, STPs began to expand the support they offered their tenants to include access to finance, business trainings, mentoring and coaching programs, etc. These programs were either delivered internally by the STPs or through their external networks.

Simultaneously, STPs began to see themselves as an important pillar of the regional innovation ecosystem. On the basis of their experience of helping companies and the access to their own HEIs, these STPs started creating more complex networks to enable their tenants to access and utilize needed resources.

Second generation STPs can be characterized as having all the features of a first generation STP in addition to:

- Business support infrastructures for start-up and early stage technology businesses. Most frequently this takes the form of a business incubator together with its value-added services.
- Proactive networks in support of innovation. The networks are founded by the STP, yet are driven by the needs of their tenants; being universities, research and technology organizations, and technology businesses.

Most well managed STPs created in the first generation era have evolved to become second generation STPs.

Third generation STPs

The third generation of STPs was defined around 2006. They have all the features of second generation STPs, but would be physically constructed to create spaces and environments that are conducive to high levels of creativity and innovation. These collaboration spaces, available to the tenants, are also open to external companies and suppliers; hence creating a rich mix of possible networks.

2.3 STPs – Global Outlook

The history of STPs goes back to the 1950s, when the first STP was established at the Stanford University in the US. It has transformed the Silicon Valley from one of the poorest regions in the USA into a global center of technology, finance, education and research. Since the inception of Silicon Valley, the high-tech cluster phenomenon has seized the imagination of public policy makers. In the decade from the mid-1960s to the mid-1970s, Europe was introduced to STPs, where pioneering STPs included the Cambridge Science Park in Great Britain and the Sophia Antipolis Science Park in France. In the early 1970s, Japan established the first STP in Asia, where in the next decade STPs started to dynamically grow in Asian economies. In the first decade of 2000s, STP numbers accelerated doubling the historical cumulative number that had been created up to the year 2000. Interestingly, even the growth of the earliest STPs accelerated once the movement as a whole started to become significant.[4]

According to UNESCO, there are over 400 STPs worldwide and their numbers are still growing. At the top of the list comes the USA, which is reported to have more than 150 STPs. Japan comes next with 111 STPs. China began developing STPs in the mid-1980s and now has around 100. [5]

[4] (UNESCO, 2017)
[5] (UNESCO, 2017)

According to the European Commission, the trends that fueled the establishment and growth of STPs included:[6]

- The rapid growth of the ICT sector, starting with the small hardware companies using the new generations of microprocessors, followed by the explosion of software development activities, and then the internet and web technologies, mobile and wireless, computer games, digital media, etc. These companies needed high level skills and high-quality office environments. STPs were a perfect solution with the right working environment and access to technically qualified graduate communities.
- A similar trend emerged from biotechnology and other life-science businesses. From the 1990s onwards, the venture capital markets steadily grew and extended and had an appetite to invest in life sciences. Again, STPs were a logical solution for the early stage and growth of these companies.
- The realization by public policy makers that STPs tended to create more employment than other forms of commercial property development and that the jobs were of higher added value gave rise to the importance of public sector endorsement of STPs.

2.4 STPs – Arab Region

Businesses based on higher value-added products and services, especially with high-tech and innovation aspects, have been growing at an exponential rate. The Western and Asian economies, with their high technological capabilities, have been able to participate in this development. By contrast, the Arab region, which was once famed for its basic sciences, has not caught up with this trend and has fallen badly behind on measures of innovation and R&D, where they account for less than 1% of global R&D spending. Moreover, private companies barely spend on R&D, which accounts for another bigger loss. The below table (Table 1) provides an outlook on the strengths, weaknesses, opportunities and threats in the innovation policies and institutions in countries in the Arab Region. [7]

Table 1 - Arab region: Innovation SWOT Analysis

Algeria	○ **Strengths** • The Conseil National Economique et Social (CNES) has organized national conferences on the knowledge economy to raise awareness of key issues. • Existing fiscal policies aimed to create a knowledge-based economy and R&D activities. • Reforms in the information and communication technology (ICT) sector and the development of technology parks. • STI strategy which aims at encouraging research activities, enhancing international collaborations, attracting active participation of the scientific diaspora in national research programs. • Active involvement of universities in research projects for the private sector. • Funds to support spinoffs and commercialization. • Education and scientific research investment. • Average human resources capabilities. ○ **Weaknesses** • Weak participation in international research programs. • Lack of awareness in regards to the importance and role of STPs ○ **Opportunities** • Expected growth of the hydrocarbon sector. • Good funding opportunities. • Initiatives and investment to support the private sector. • Available young talents and skills.

[6] (Alvarez, 2013)
[7] (Hanafi & Arvanitis, 2013)

	○ **Challenges** • Brain Drain. • High unemployment rates among youth. • Regional instability. • State interference in the business environment. • No venture capital schemes despite some attempts in the past. • High administrative and bureaucratic burdens.
Bahrain	○ **Strengths** • Strong tertiary education. • Policy and partnerships in innovation between private and public R&D. ○ **Weaknesses** • Weak scientific production, although there was a small number of scientific breakthroughs during the past decade. • Weak indicators related to innovation efficiency in the high-tech sector. ○ **Opportunities** • Above average business environment. ○ **Challenges** • Political instability.
Egypt	○ **Strengths** • Strong institutional change in the policy toward research funding. • Regulations and incentives for scientific research and innovation. • Research and Development and Innovation agreement with the EU in 2007. • Research centers, technology centers, technology transfer officer and business incubators in multiple sectors. • 2030 strategy. • Funds are distributed to competitive projects, international collaborative projects, and recognition of the research activities. • Good expenditure on education. • Collaboration with international and regional countries in regards to STPs. • Strong regional collaborations in renewable energy, nanotechnology, biotechnology, agriculture, water resources and pharmaceuticals. • Establishment of Science and Technology Development Fund (STDF) with a special mandate. • Establishment of international universities that focus on innovation and development. ○ **Weaknesses** • R&D expenditure remains relatively low as a percentage of GDP. • Co-publications remain relatively low. • Weak economic and business sense and soft skills. • Marketing is not one of the primary activities for startups and entrepreneurs. ○ **Opportunities** • Conducive environment for attracting foreign investment. ○ **Challenges** • Brain Drain. • The general infrastructure for innovation is still a challenge • Political instability. • Rapid population growth has an enormous challenge on the education system. Although, Egypt has launched the education development plan.
Iraq	○ **Strengths** • Benefit from investment in all sectors, including government-designed projects • Gradual movement towards private sector participation and partnerships in economic development.

	• Iraqi officials are calling for western companies to do business in Iraq. • First intellectual property legislations where today Iraq has 5000 patents. ○ **Weaknesses** • Required reforms are underway, but progress is slow. • A stronger network within the business community is needed in order to expand opportunities. Trust in the Iraqi business environment must be established to increase the number of business transactions. ○ **Opportunities** • Large import market • Developing natural gas production and exports • Foreign investment is now permitted and protected under Iraqi law • Larger need for defense and security services and equipment ○ **Challenges** • Unstable political and security situation • Corruption and bureaucracy • Dependence on oil export revenues in light of falling oil prices
Jordan	○ **Strengths** • Major effort to transform the education system at the early childhood, basic, and secondary levels to produce graduates with the skills needed for the knowledge economy. • Regional center of ICT development to provide more attractive job opportunities for highly skilled young graduates. • National Council for Competitiveness and Innovation to improve the innovation climate. • Formulation of 2012–16 science, technology and industry strategy. • Strong existence of science and technology universities and community colleges. • Strong institutional change in policies toward research funding. • More funds distributed to competitive projects, international collaborative projects, and recognition of the research activities. • Strong emphasis in engineering and ICT. • Strong institutional infrastructure: Royal Scientific Society, El-Hassan Science Park, The Higher Council for Science and Technology, King Hussein Business Park, etc. • Multiple research centers in different sectors. • A decent level of R&D spending in the private sector. • Medium level relationship between universities and private sector. ○ **Weaknesses** • Most research centers have a very low budget. • Jordanian science journals are not internationally accredited and suffer from fundamental problems. ○ **Opportunities** • Relatively high number of university students in science majors. • Regional and international coalitions. ○ **Challenges** • Brain Drain. • Poor resources and industrial input. • Bureaucracy and poor cooperation among the local organizations and institutes. • Limited market size and undeveloped commercialization system.
Kuwait	○ **Strengths** • Strategy to support the university and research system. • Scientific Center of Kuwait serves as a center for environmental education of the Gulf region. • Friendly policy and partnerships in innovation between private and public R&D. • Clinical medicine is a research strength.

	○ **Weaknesses** • Weak R&D expenditure. ○ **Opportunities** • Good business environment. ○ **Challenges** • Bureaucracy. • Lack of cooperation with the Arab countries that have good human resources.
Lebanon	○ **Strengths** • Project to support innovative activities within the private sector. It includes an investment fund to provide a combination of cash and equity financing to foster innovative ideas and support start-ups and other firms in the early stages of growth. • Increasing growth of research production especially in agriculture and biology. • High levels and increasing number of co-publications. • Active pursuit of scientific research. • Strong medical research core of two large hospitals (Medical Center of AUB formerly known as AUH, and Hotel Dieu de France) which are both attached to two important universities (AUB and USJ). • AUB has deployed a strong effort in promoting its personnel's scientific production. • The average number of citations is the highest in the Arab region. • Berytech: The first technopole in Lebanon to provide a conducive environment for the creation and development of start-ups, hence participating in wealth and job creation and retaining hi-level skills in Lebanon. ○ **Weaknesses** • Low government investment in education. • Weaknesses in the overall ICT system. ○ **Opportunities** • Attempting to reverse the brain drain of medical doctors. ○ **Challenges** • Brain Drain. • Political instability.
Morocco	○ **Strengths** • Regulatory reforms in ICT and GSM systems in the late 1990s. • A number of technoparks and technological industrial zones that attracted FDI and advanced manufacturing operations. • Technology Business Incubators: such as Al Akhawayn University Incubator (Ifrane) and Casablanca Technology Park, Morocco Incubation and Spin-off Network (RMIE), Casa Pioneers (Casablanca), iNSANE! (Casablanca). • A series of national plans in several domains - agriculture, fisheries, industry, ICT, tourism, and education - inspired by a will to follow a knowledge-based development path. • ICT clusters aimed at creating innovative projects in four niches (Mobile services; Electro banking / management of digital copyrights/ security; Web design/ computer graphics / multimedia; Domestic developed software). • Political will to make the SNRI (National System of Research and Innovation) a lever for local and regional development. • High levels of co-authorship. • Strong patent application trends and numbers. ○ **Weaknesses** • Universities have a limited research record. • Very weak linkages among the different actors in the system. ○ **Opportunities**

	• Stratégie nationale pour le développement de la recherche scientifique à l'horizon 2025: It constitutes of a roadmap for developing multiannual and annual action plans to promote National System of Research and Innovation (SNRI). ○ **Challenges** • Bureaucracy and inadequate legal framework, human resources management and promotion system are still persistent.
Oman	○ **Strengths** • A combination of pro-employment policies, access to land ownership, facilitation of affordable consumer products, and freely available all-encompassing health and education services. • A research council as part of a policy to give high priority to research and innovation, including the initiation of open research grants. • Innovation policy and partnerships between private and public R&D. • Strong institutional setting with its driver being the Research Council. • Available entrepreneurship initiatives in favor of innovation. • Available strategies to promote research and innovation. ○ **Weaknesses** • Obstacles of the institutional setting including lack of understanding of innovation, fragmented innovation eco-system, minimal collaborations, and dependence on skilled foreign workforce. • Lack of commercial focus in government funded research and dedicated research centers • Private research - except in the oil and gas sector- is practically nonexistent. ○ **Opportunities** • Excellent infrastructure with fast developing projects, ports, and free zones. • Huge solar energy potential and renewable energy projects. • Huge demographic advantage. ○ **Challenges** • High unemployment rates. • Lack of SME technological capabilities to attract high-tech FDIs. • Lack of proper IP infrastructure and governing policies. • Poor productivity. • Lack of cooperation with the Arab countries that have good human resources.
Palestine	○ **Strengths** • Public sector is not taking a leading role in driving innovation in Palestine. The NGOs and Educational institutions are driving the sector. • Available programs that target students and fresh graduates: PICTI, Leaders, IYF, etc. • Many research centers are affiliated to universities. • Available ICT Centers of Excellences • Development of some incubators: Sadara ventures, Palestinian Investment Fund, Abraaj Capital, and Siraj. • Large number of highly qualified graduates. • Good network with European and American universities ○ **Weaknesses** • Weak linkages among the different actors in the system. • Lack of funding and exit strategies for entrepreneurs. • Lack of research culture and policies in universities. ○ **Opportunities** • Excellent ICT capabilities. • Return of local experts from the diaspora even for short period. ○ **Challenges** • Israeli occupation – political, economic and social nature.

	• Brain drain and lack of knowledge about the Palestinian diaspora.
Qatar	○ **Strengths** • Endeavored to enlarge its development model from one based solely on oil and natural gas to a model oriented toward the knowledge-based economy. • An education reform law in 2001 to break the mold of the rote memorization system. • The Education City by the Qatar Foundation for Education, Science, and Community Development, which aims at making Doha the center of educational excellence in the Middle East. • Key public institutions driving innovation: Qatar Foundation and the science and research organizations under it: (1) Qatar Science and Technology Park, (2) Qatar National Research Fund (3) Universities, and (4) R&D Directorate. • National Research Strategy identified pillars for R&D that span energy and environment, biomedical and healthcare, ICT, social science, arts and humanities. • The development of the centers of excellence: (1) Qatar Energy & Environment Research Institute (2) Qatar Computing Research Institute (3) Qatar Biomedical Research Institute. • Strong support of high level of research and innovation. • The allocation of around 2.8% of the budget to support scientific research. • Entrepreneurship initiatives in favor of innovation: (1) Technology Innovation and Entrepreneurship Program (under QSTP), (2) Digital Incubation Center (under ictQATAR), (3) The Qatar Mobility Innovations Center - the first regional independent innovations institution that focuses on using emerging mobility and wireless technologies, and (4) Gulf Organization for Research & Development. • Strategic sectors for deploying innovation in Qatar: Health and healthcare, Energy and Environment, Computer Sciences and IT, Social Sciences, Arts and Humanities. • A good R&D academic base. ○ **Weaknesses** • Limited human resource base. • Low diversification of domestic industry with dominance of Oil and Gas industry. • Limited scientific base. • Reliance on imported technology and human resources. • Gap between innovation inputs/outputs. ○ **Opportunities** • Oil and gas economy. ○ **Challenges** • Lack of qualified human resources. • Lack of cooperation with the Arab countries that have good human resources. • Parachuted universities' branches that do not contribute in a research which is necessarily relevant to Qatari society or to Arab societies.
KSA	○ **Strengths** • A strategy to move to a knowledge economy by 2022 • A host of education reforms. • Investing in the development of new universities, especially to boost science and technology. • Steep rise in scientific publications and patenting activities. • Friendly innovation policy and partnerships between private and public R&D. • Strong co-authoring activities. • King Abdulaziz City for Science and Technology (KACST) hosts the Saudi Arabian national science agency and its national laboratories. KACST is a science city with three components: research, innovation and service for the public and private sectors. • A model that is driven by local expertise, with the help of regional and international expatriates.

	• Unique "technology parks" that offer innovators and entrepreneurs mentoring support for product development and for deployment patents. • Technology Business Incubators (BADIR-ICT Technology Incubator, Badir for Advanced Manufacturing, BADIR for Biotechnology, Riyadh) ○ **Weaknesses** • The citation impact of most of the SA universities is below world average. ○ **Opportunities** • Oil and gas economy. • Emerging local and qualified human resources. • Good business environment. • Excellent ICT system. • Private sector funding for the R&D. ○ **Challenges** • Low Innovation Efficiency Index. • Lack of cooperation with the Arab countries that have good human resources.
Syria	○ **Strengths** • The international agricultural center ICARDA (HQ was based in Aleppo) plays an important role in structuring the research in this field in the region. • Good ICT access. • Several incubators for ICT, business and technology. ○ **Weaknesses** • Lack of incentives for faculty to conduct research. • Limited number of scientists and engineers who work in R&D. • Contribution to the production of original research and patents are inexistent. • The results of scientific researches are nonsignificant. ○ **Opportunities** • Self-sufficiency ○ **Challenges.** • Syrian political upheaval. • Very low FDI. • Brain Drain.
Tunisia	○ **Strengths** • A comprehensive knowledge economy strategy as part of its five-year plans to cope with high unemployment, especially among youth. • A series of technopoles throughout the country to renew and expand its economic base. • Tunisia research system is among the best structured in the Arab World with a system for research laboratories and research units. • Dedicated national budget for research. • National research evaluation system (called CNEARS). • Creation of a national program to support innovation co-funded by EU and Tunisia. • Structured system of interventions in support of innovation including investment in R&D, technology transfer and venture capital. • Strong biotechnological research. • Tunisia has quadrupled its publication in the past years. • Specific research centers for applied science in industry (textiles, mechanical and electrical engineering, packaging, agrofood, chemical industry, construction materials, wood and furniture, leather and shoes). • Reputable engineering schools. • Systematic policy to promote technoparks that function as incubators and technopoles such as El Ghazala technopole.

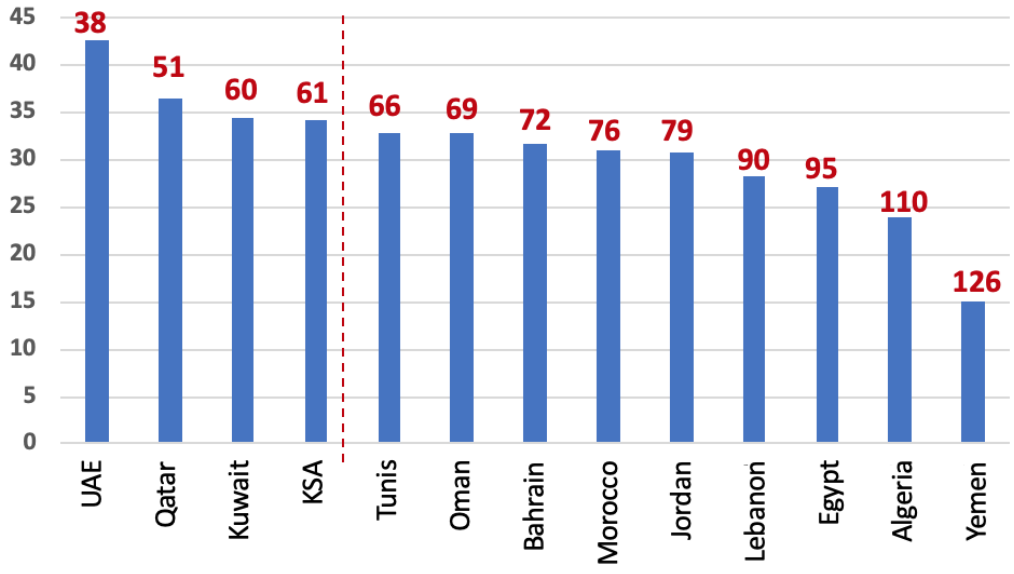
	• Industrial cluster in the sectors of textile and clothing industry in Ksar-Hellal, leather industry in El-Jem, carpets in Kairouan, construction bricks in Moknine, ceramics in Nabeul, mechanics, metal work, shoes in Sfax, etc. ○ **Weaknesses** • Technopoles might sometimes seem to be incompatible with local capabilities. ○ **Opportunities** • Democratic transition. • Flourishing industries; such as garment and ICT. ○ **Challenges** • Bureaucracy.
UAE	○ **Strengths** • Dubai based its development over two decades on a clear knowledge and innovation strategy. • A strategy of building a transport and logistics hub (centered on a world-class port) which spawned a successful tourism industry. • Core competencies in technology, media, and telecommunications. • A strategic plan for 2011-2013 and vision plan for 2020. • A strong growth of scientific publication, especially in agriculture and engineering. • Progress towards internationally recognized research, which might be the result of growing numbers of expatriates. • Strong infrastructure, including Masdar Institute of Science and Technology (MIST) in Abu Dhabi with a focus on alternative energy and green technology. • Grants to connect university researchers with the local industry. ○ **Weaknesses** • Research centers outside of universities play a primary role in science research. ○ **Opportunities** • Good outcome from tertiary education. ○ **Challenges** • Bureaucracy. • Lack of cooperation with the Arab countries that have good human resources.
Yemen	○ **Strengths** • Strategically important position. • Yemen contains strong oil and gas reserves. ○ **Weaknesses** • Lack of security • Falling oil reserves and production rates • Diminishing Water Resources • Inflation • Reduced Investment in the private sector • Bureaucracy and corruption • Informal economy; hence lost tax revenue and lost income and revenue for knowledge intensive industry • Rapid Population Growth rate and poverty • Low literacy rates and declining health care ○ **Opportunities** • Oil industry • Post war reforms ○ **Challenges** • Political instability and famine • Migration and brain drain

Furthermore, and according to the global innovation index of 2018, the Arab region scores and ranking are shown in the below table:[8]

Table 2 - Global Innovation Index - Arab countries

Country/Economy	Score (0–100)	Rank (out of 126)
United Arab Emirates	42.58	38
Qatar	36.56	51
Kuwait	34.43	60
Saudi Arabia	34.27	61
Tunisia	32.86	66
Oman	32.8	69
Bahrain	31.73	72
Morocco	31.09	76
Jordan	30.77	79
Lebanon	28.22	90
Egypt	27.16	95
Algeria	23.87	110
Yemen	15.04	126

Figure 1 - Global Innovation Index - Arab countries



Today, building a culture of technology, innovation and entrepreneurship remains to be on the top challenges facing Arab economies. Hence, STPs became a meaningful solution to these challenges, in addition to the fundamental need to enhance the innovative capabilities and technological progress of their countries; hence, in the long term, improve their people's standards of living.

Evidently, over the past few years, STPs have been sprouting up all over the Arab region. Recognizing that their natural resources, particularly oil, are being fast depleted, and looking to emulate the success

[8] (University of Cornell; INSEAD; WIPO, 2018)

stories of STPs in creating jobs and successful businesses, Arab countries started establishing local STPs. This concept is now a region-wide movement, but different reasons lie behind each country's decision to join the trend. For instance, to the oil-wealthy Gulf states, STPs are tools for diversifying the economy in preparation for the post-oil times. For other countries, such as Egypt and Jordan, STPs seem to be a resolution to poverty and unemployment. [9]

Today, there are around 50 operating STPs in the Arab region. Some have clear successes, in terms of their contribution to the innovative ecosystem or the number of jobs they have created. The following table (Table 2) highlights the main STPs in each country.[10]

[9] (World Bank, 2013)
[10] (University of Cornell; INSEAD; WIPO, 2018).

Table 3 – STPs, Business Incubators and Accelerators in the Arab region

Country	Type	Name of structure	Sector	Status	Size	Jobs
Algeria	Science park	Sidi Abdallah (including 4 technology parks)	ICT	Operational	1,870 hectares	
	Technology park	Technopark El Boustène	ICT, electronics, biotechnology (pharmaceutics)	Under development	45 hectares	
	Technology park	Technopark Ibnou-Sina	Biotech, pharma, healthcare, medicine, ICT, tourism, engineering	Under development	54 hectares	
	Technology park	Cyber Park	ICT, media, and communications	Under development	94 hectares	400 Objective: 2,400.
	Technology park	Park of Sidi Bennour		Under development		
	Business incubator	IncubMe	Multi sectors	Operational		
	Co-working space	Oran Workshop Room		Operational		
	Business incubator	ANTP		Operational		
Bahrain	Technology park	Bahrain Technology Park	ICT, health care, and medicine	Under development		
	Technology park	iTeknoCity	ICT, biotechnology			
	Business incubator	Bahrain Fintech Bay	Fintech	Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Business incubator	University Business Incubator Center				
	Business incubator	BBIC Bahrain Business Incubator Center		Operational		
	Business incubator	Riyadat Bahrain Women's Competence Development Centre		Operational		
	Business incubator	RUKN		Operational		
	Accelerator	CH9		Operational		
	Accelerator	Flat6Labs Bahrain		Operational		
	Accelerator	Brinc		Operational		
	Co working space	Co. Lab		Operational		
Egypt	Science park	City for Scientific Research and Technology Application	Biotech, IT, advanced engineering, nanotechnology (solar cells)	Operational	250 acres	30,000 (upon completion).
	Technology park	Egypt's Smart Village	ICT	Operational	300 acres	35,000 (2010) 100,000 (2014)
	Science park	Sinai Technology Valley	ICT, microelectronics, biotech, new materials, renewable energy	Under development	72 km2	
	Science park	Northern Coast Technology Valley	New technologies	Under development		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Contact- center	Cairo Contacts Centers Park	Call centers and outsourcing	Operational	31.08 hectares	40,000 direct and 60,00 indirect
	Business incubator	Technology Innovation & Entrepreneurship Center (TIEC)		Operational		
	Business incubator	Icecairo		Operational		
	Business incubator	AUC Venture Lab		Operational		
	Business incubator	Social Fund for Development		Operational		
	Business incubator	Information Technology Industry Development Agency (TIDA)		Operational		
	Virtual business incubator	IT General Division (FoCC IT), The Federation of the Egyptian Chambers of Commerce.		Operational		
	Virtual business incubator	CU-TICO		Operational		
	Co working space	CoworkInn		Operational		
	Co working space	The District		Operational		
	Co working space	Greek Campus		Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Co working space	Urban Station		Operational		
	Co working space	Seedspace Cairo		Operational		
	Accelerator	Flat6Labs Cairo		Operational		
Jordan	Technology park	The Hashemite University Technology Park	ICT	Operational	1.5 km2	
	Science park	El Hassan Science city	A platform including the Royal Scientific Society, The Higher Council for Science and Technology, iPARK incubator, and The Princess Sumaya University for Technology	Operational		
	Technology park	Cybercity	Special Free Economic Zone (real estate and industrial projects), ICT	Operational	4.5 km2	
	Business incubator	iPARK	Technology	Operational		
	Business incubator	QRCE	Technology	Operational		
	Business incubator	Jordan Innovation Centre		Operational		
	Business incubator	Jordan Forum for Business and Professional Women - Micro & Small Businesses Unit		Operational		
	Business incubator	BDC Business Development Center of Jordan		Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Business incubator	MENA Apps Jordan	Technology	Operational		
	Accelerator	Oasis500	Technology	Operational		
	Accelerator	CH9 MENA Hub	Technology	Operational		
	Accelerator	Arabreneur	Technology	Operational		
	Co working space	ZINC by Zain	Technology	Operational		
	Co working space	Big by Orange	Technology	Operational		
	Co working space	The Tank by Umniah	Technology	Operational		
	Co working space	VBC	Technology	Operational		
Kuwait	Technology park	Kuwait Technology Park	ICT	Operational		500 (since creation in 2001).
	Business incubator	Sirdab Lab	Technology	Operational		
	Accelerator	Savour	Food industry	Operational		
Lebanon	Technology park	Berytech	ICT, media and communications, healthcare, medicine, environment, agri-foods (food processing), energy.	Operational		45 jobs (215 expected in 2016).
	Business Incubator	BIAT	ICT, others.			

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Science park	Beirut Emerging Technology Zone	Electronics, ICT, biotechnology, media, and communications.	Under construction		
	Technology park	Edde Global Village (Jbeil)	ICT	Under construction		
	Technology park	Makse Park (Bekaa Valley)	ICT	Under construction		
	Business incubator	South BIC	Multi sectors	Operational		
	Accelerator	ALT City	ICT, Technology	Operational		
	Accelerator	UK Lebanon Tech Hub	ICT, Technology	Operational		
	Accelerator	Speed	ICT	Operational		
	Accelerator	Flat6Labs Beirut	ICT, Technology, Green Technology	Operational		
	Business incubator	Smart ESA	ICT	Operational		
Morocco	Technology park	Casablanca Technopark	ICT	Operational	29,400 m2	
	Technology park	Bouznika Technology Park	ICT		116 hectares	
	Technology park	Rabat Technopolis	ICT	Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Technopole	Oujda Technopole	Renewable energies	Partially operational	167 hectares	
	Technopole	Technopole de l'Aéroport Mohammed V				
	Agripole	Meknès Agropolis	Agrifood	Partially operational	130 hectares	11,000 (expected).
	Agripole	Oriental Agropolis, Berkane	Agrifood	Operational	102 hectares	5,000–7,000 (expected).
	Agripole	Agripole d'Agadir	Agrifood	Operational		400
	Agripole	Tadla Agropolis, Tadla azilal	Agrifood	Operational	244 hectares	
	Agripole	Gharb Agropolis, Kénitra	Agrifood	Operational		
	Agripole	Haouz Agropolis	Agrifood	Operational		
	Technopole	Tan Tan	Agrifood (sea products processing).	Operational (as cluster)		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Agripole	Haliopolis, Agadir	Agrifood (sea products processing).	Partially operational	150 hectares	
	Business incubator	Fez Innovation City	ICT	Partially operational		
	Business incubator	Marrakech Innovation City	ICT	Under construction		
	Business incubator	Rabat Innovation City		Planned		
	Business incubator	Casablanca Innovation City		Planned		
	Business incubator	Al Akhawayn University Incubator		Operational		
	Business incubator	Incubator of the International University of Rabat Incubator		Operational		
	Business incubator	Technopark Tanger		Operational		
	Business incubator	Morocco Climate Innovation Center		Operational		
	Business incubator	NUMA Casablanca		Operational		
	Business incubator	Casa Pioneers		Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Business incubator	iNSANE!		Operational		
	Business incubator	New Work Lab		Operational		
	Business incubator	Jokkolabs Casablanca		Operational		
	Business incubator	University Center for Analysis, Expertise, Transfer of Technology and Incubator (CUAETI)		Operational		
	Accelerator	Startup Your Life		Operational		
	Co working space	Sun Desk		Operational		
	Co working space	7AY Coworking		Operational		
	Co working space	Orange Coworking – Start On		Operational		
	Co working space	Seedspace Casablanca		Operational		
	Co working space	LaFactory		Operational		
KSA	Technology park	Prince Abdullah Bin Abdulaziz Science Park	ICT and oil	Operational	300,000 m2	
	Technology park	King Abdulaziz City for Science and Technology				

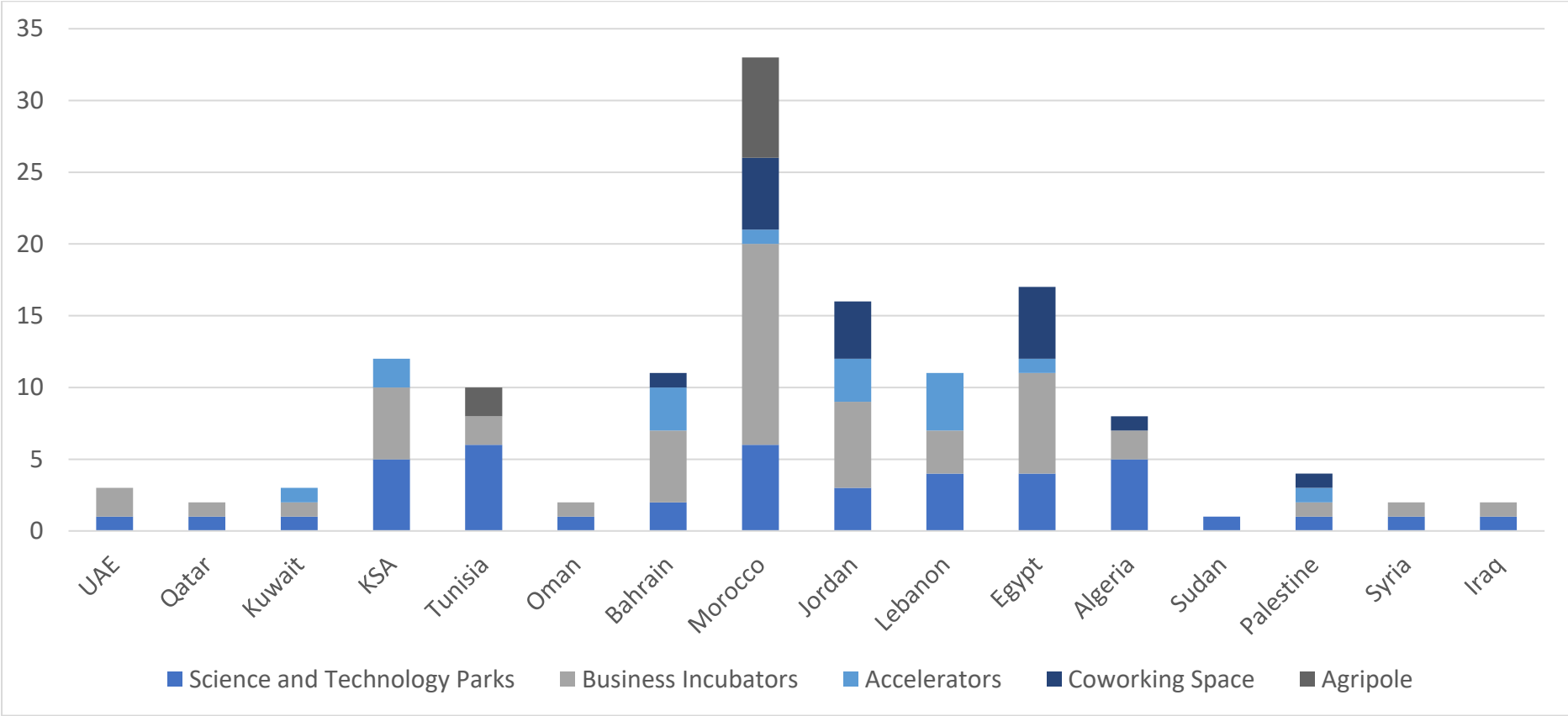
Country	Type	Name of structure	Sector	Status	Size	Jobs
	Techno-valley	Riyad Techno-valley				
	Techno-valley	Dahran Techno-valley				
	Science park	Jeddah BioCity Science Park	Biotechnology	Under construction		
	Business incubator	Badir	Technology, ICT and manufacturing	Operational		
	Business incubator	Makeen		Operational		
	Business incubator	WadiMakkah		Operational		
	Business incubator	KAUST		Operational		
	Accelerator	9/10^{ths}		Operational		
	Accelerator	Flat6Labs Jeddah		Operational		
	Business incubator	Afkar		Operational		
Qatar	Technology park	Qatar Science and Technology Park	Aircraft operations, environment, gas and petrochemicals, health care, ICT, water technologies	Operational		
	Business incubator	Qatar Business Incubation Center		Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
Oman	Technology park	Knowledge Oasis Muscat	ICT, tourism.	Operational	68 hectares	
	Business incubator	Ibhar Incubator		Operational		
Palestine	Technology park	Palestine Technopark				
	Accelerator	Glow	Technology	Operational		
	Business incubator	PICTI	Technology	Operational		
	Co working space	Gaza Sky Geeks	Technology	Operational		
	Business incubator	Business and Technology Incubator (BTI)	Technology	Operational		
	Business incubator	Pallinno	Technology	Operational		
Tunisia	Technology park	El Gazala Technopark	ICT	Operational	65 hectares	
	Technopole	Sidi Thabet	Biotechnology (pharmaceutics)		115 hectares	
	Technology park	Bizerte	Agrifood	Operational	150 hectares	
	Technology park	Sousse	Electronics, mechanics, and ICT	Operational	60 hectares	

Country	Type	Name of structure	Sector	Status	Size	Jobs
	Competitiveness Center	Monastir ElFejja	Textiles	Under development	100 hectares	
	Technopole	Sfax	Multimedia and communication	Operational	60 hectares	
	Technopole	Borj Cedria	Renewable energy, water, environment, and plant biotech.	Under development	90 hectares	
	Agripole	Medenine	Exploitation and commercialization of natural resources of Sahara.	Under development		
	Agripole	Jendouba	Exploitation and commercialization of natural resources of Sahara.	Under development		
	Competitiveness Center	Gafsa	Mining (phosphate)	Under development		
	Business incubator	Wikistartup		Operational		
	Business incubator	Impact		Operational		
Syria	Science and Technology Park	Syria Science and Technology Park				
	Business incubator	ICTI		Operational		

Country	Type	Name of structure	Sector	Status	Size	Jobs
Sudan	Science and Technology Park	Africa City of Technology	Energy, nanotechnology, industrial chemistry, food technology, biotechnology, and geotechnology	Operational		
UAE	Technology park	Dubai Technopark				
	Business incubator	In5		Operational		
	Business incubator	Silicon Oasis Founders		Operational		
Iraq	Business incubator	51Labs		Operational		
	Business incubator	RITS		Operational		

Figure 2 STPs, Business Incubators and Accelerators in the Arab region



3. Goals and Objectives of STPs

STPs often have different goals and objectives, especially as different stakeholders have different expectations of them. It is a challenge to construct a one-fit-all set of goals and objectives. For example, economic development would be a priority for policy makers, while profit generation and networks would be a priority for the tenants, research and technology development would be for academic institutions, and financial returns and fiscal outcomes would be of higher importance to private investors. Nevertheless, goals and objectives trends and best practices have been researched and outlined in the sections below.

3.1 Innovation Theory: Quadruple Helix

In order to highlight the goals and objectives of STPs, the 'triple helix' concept was utilized. The 'triple helix' involves the creative interplay between government, universities (and research institutes) and businesses. Subsequent authors have added 'market/society' as a fourth strand (or Quadruple helix). In general, STPs are a valuable mechanism for catalyzing the four parts of the helix to drive innovation. This makes perfect sense since the desired output of the triple helix activity is new and innovative products and services which generate jobs and wealth to the market and society.[11]

3.2 Derived Goals and Objectives

Deriving the goals from the Quadruple helix, STPs aim at: [12]

- Being a catalyst for local and regional economic development and a tool aimed at promoting industrial growth in terms of employment and production.
- Facilitating the creation and development of new technology-based companies.
- Promoting knowledge transfer from academia to business.

According to some authors, STPs are high-tech business clusters deliberately set up by government or university initiatives, such that they primarily facilitate business development with the final aim of promoting regional development.

According to multiple authors, breaking down the above goals, the objectives of STPs can be grouped into four interrelated categories:

Economic development:

- Improve the innovation ecosystem as a whole.
- Diversify the region's economic base.
- Expand local employment opportunities.
- Develop and nurture new business.
- Increase productivity through innovation.

Academic sector development:

- Build formal and operational links with centers of knowledge such as universities, higher education institutes and research organizations.
- Enhance university's technical training via collaborative research.
- Increase technology transfer to the private sector.
- Expand employment opportunities for university graduates.
- Commercialize and promote university-based research.

[11] (Stancova, Kleibrink, & Nauwelaers, 2014)
[12] (Vila & Pages, 2008)

- Utilize the outputs of R&D activities.

Income/profit generation for startups and SMEs:

- Encourage entrepreneurship in the region.
- Attract high skills and competent employees to the region.
- Provide higher-paying jobs locally.
- Expand employment opportunities for low-skilled workers.

Financial return on investment:

- Achieve financial sustainability.
- Maximize short term financial returns.
- Attract major equity partners.
- Maximize profits from land/facility sales/lease.

It is worth noting that it is essential that the STP balance all public economic development gains against a need to be sustainable over time.

3.3 Contributions to Local Economies (Markets and Societies)

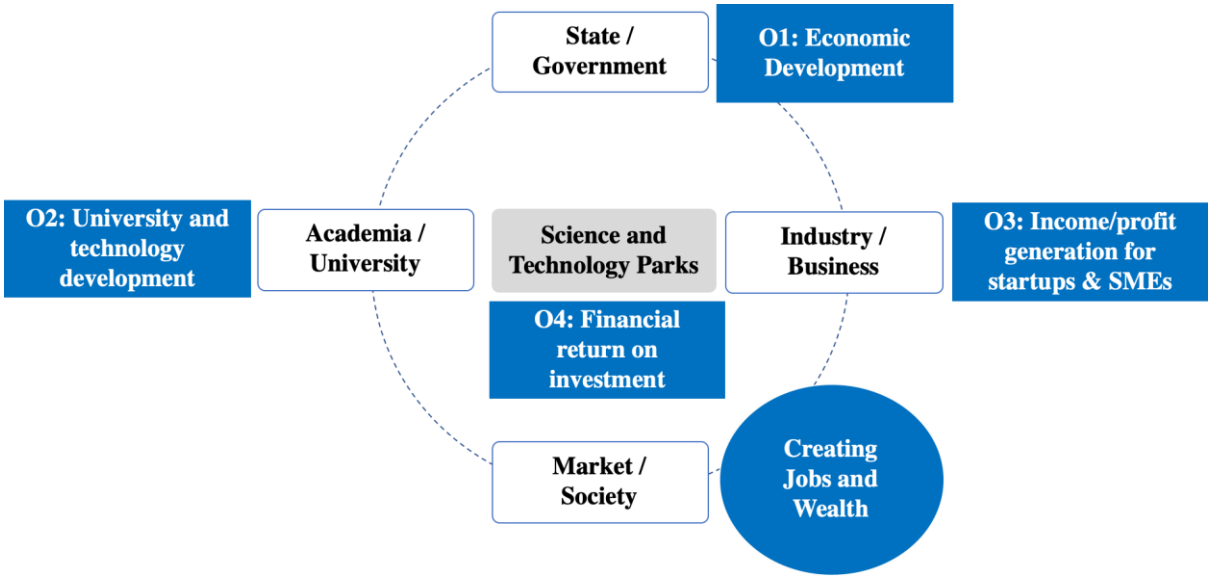
Governments view STPs as a way to improve regional and national economies. For example, and in response to overseas threats to its manufacturing industry in the 1990s, Singapore pumped $7 billion over 20 years into One North, a science park devoted to biotechnology, medical services, and advanced materials. Similarly, Barcelona retrofitted 115 blocks of the city's old Cotton District into a science park and Seoul planned Digital Media City, a 135-acre park to focus on entertainment and interactive technologies. Two new STPs in Chihuahua, Mexico, aimed to lure R&D work that might otherwise gravitate to Mexico City or Baja California.[13]

It is evident that STPs provide extreme value to local economies, market and societies because of the following three reasons:

- First, STPs aim to create jobs that are substantially of a high added value in addition to replacing jobs in declining traditional industries. STPs are proactive in the creation and development of new innovation-led businesses and stimulating the growth of other knowledge-based SMEs through both the deployment of their physical resources and from operating professional services. While employment outputs are undoubtedly the most important indicator of STP economic development contribution it is also very important that the employment being created is innovation-led or knowledge-based and offers prospects for high value job creation[14].
- Secondly, involving the region itself in new and fast-growing industries. Such is the case of ICT and biotechnology, which are meant to diversify the economies, attract investments, improve the economic status of the region. Hence, enhancing the standards of living of the region's population.[15]
- Thirdly, a region may want to use a science park as a strategy to create synergies between different players; hence allowing for new opportunities to arise and increasing the wealth of the region as a whole.

[13] (Brown, 2011)
[14] (Alvarez, 2013)
[15] (Vila & Pages, 2008)

Figure 3 - Objectives of Science and Technology Parks (Author)



3.4 Goals and Objectives: Selected STPs in Arab region

The below table (Table 4) illustrates the articulated goals and objectives of selected STPs in the Arab region and utilizes the above model to compare the various STPs to each other and to global STPs.

Table 4 - Goals and Objectives - Selected STPs in Arab Region

<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td>Bahrain Technology Park
Country: Bahrain</td><td>Objectives: Enhancing and developing the skills of Bahrainis, in addition to providing a fertile hub for industries to further develop their products.<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td></td></tr></table></td></tr>
<tr><td>Smart Villages
Country: Egypt</td><td>Objectives: To make an attractive business environment with modern high-tech facilities (that is fiber optic network, multi-source power supply, district cooling and heating redundant network plant), effective coaching and management services for national and foreign ventures.<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td>Yes</td></tr></table></td></tr>
</table>

<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td>City for Scientific Research and Technology Applications (SRTACity)
Previously known as: Mubarak City for Scientific Research and Technology, Alexandria
Country: Egypt</td><td>Vision: To develop technology-based economy serving different areas of human life.
Objectives:
Develop centers of scientific excellence to serve both economic and social developments of the Egyptian society.
Develop Central Laboratories Core Facilities to serve for consultations, training and solving problems of the industrial sector.
Inspire research proposals to achieve the investment plan (previously submitted to the ministry). Fields of interest are: Biotechnology, Information Technology, Advanced Technology and New Materials as well as Arid land cultivation.
Attract private sector with innovative ideas to implement their insights in the most suitable form: Technology Based Incubators (TBIs), or Spin-offs in the fields of biotechnology, informatics and materials science.
Cooperate with different national and international institutes and organizations in the various areas of technology.
<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td>Yes</td></tr></table></td></tr>
<tr><td>Sinai Technology Valley
Country: Egypt</td><td>Objectives:
Aim at bringing about a new constructional community relying basically on the modern hi-tech industry to keep up with the advanced comprehensive development.
To make Egypt a Technology producing and e porting country through establishing a broad productive base working in this field.
<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td>Yes</td></tr></table></td></tr>
</table>

<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td>El Hassan Science City
Country: Jordan</td><td>
Vision: To be the local and regional reference point and knowledge leader for science and technology using scientific and engineering research to power economic development and social progress.

Mission: To build and strengthen scientific and engineering research in the areas of greatest strategic value to Jordan’s long-term competitiveness and development.

Objectives:
• To conduct applied research and study
• To enhance scientific and technological cooperation with local, regional and international institutions
• To carry out joint contract research and other projects with national and international partners
• To conduct tests on materials, and finished and intermediate goods to offer relevant technical consultations
• To provide specialized technical consultations and services to the public and private sectors
<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>CyberCity
Country: Jordan</td><td>
Vision: CyberCity is a Qualified and Special Export Free Industrial Zone which aims to provide local and international investors with the required land, hangars, and buildings., infrastructure and services that will enhance their competitiveness in the region.

Mission: To be the leading Qualified Industrial and Special Export Free Zones in Jordan by offering better exemptions, incentives, services and facilities than competitors.
<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td></td></tr>
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<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td>Berytech Technological Pole

Country: Lebanon</td><td>Vision: We seek to be the leaders in supporting innovative companies to scale up, and in shaping the tech and innovation scene in the region using Lebanon as our launch pad.

Mission: We offer the right ecosystem for innovative entrepreneurs to create and develop their own startups and SMEs, through research, incubation, business support, networking, mentoring, funding, access to markets, company hosting, and acceleration.

<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td>Yes</td></tr></table></td></tr>
<tr><td>Knowledge Oasis Muscat (KOM)

Country: Oman</td><td>Objectives: KOM aims to enhance Oman’s position as the region’s leading center of business excellence, innovation and entrepreneurship. KOM provides its tenants with innovative real estate solutions and excellent service. Building and nurturing strong relationships with our tenants is at the heart of everything we do.

<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td>Yes</td></tr></table></td></tr>
<tr><td>Qatar Science and Technology Park Education City

Country: Qatar</td><td>Vision: To be an international hub for scientific and technology innovation, tech-based entrepreneurship and high-tech businesses.

Mission:

• Support tech-based entrepreneurship ventures in Qatar through incubation, funding, training, mentorship, and connection to the regional and global tech innovation ecosystem.

• Accelerate product innovation within the private sector through programs and grants that encourage new product development, innovation and collaboration with QF’s research institutes.

• Create an environment that fosters innovation and collaboration by attracting and supporting tenants focused on of tech-based products and services and the commercialization of scientific research.

<table><tr><td>Economic development</td><td>Yes</td></tr><tr><td>Academic sector development</td><td>Yes</td></tr><tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr><tr><td>Financial return on investment</td><td>Yes</td></tr></table></td></tr>
</table>

<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td>King Abdulaziz City for Science & Technology
Country: KSA</td><td>
Vision: To be a world-class organization in science and technology, fostering innovation and promoting a knowledge-based society in the Kingdom of Saudi Arabia.
Mission: The city works on the development and investment in the national system of science, technology and innovation, to promote the building of a knowledge-based society, which will serve the sustainable development of the Kingdom through the following functions and responsibilities:

Formulating policies and national plans for science, technology and innovation.
Coordinating national activities in science, technology and innovation.
Providing support to scientific research and technological development in the Kingdom.
Conducting applied scientific research and technological development.
Developing and strengthening cooperation and local, regional, and international partnerships for technology transfer and development.
Investing in technology development and its commercial processing.
Sponsorship, promoting and investing in intellectual property.
Providing advice and innovative solution.

<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td></td></tr>
</table>
</td></tr>
<tr><td>Riyadh Techno Valley
Country: KSA</td><td>
Vision: To be a leading university technology park that promotes the culture of innovation and competence for its associated knowledge-based institutions and business partners.
Mission: Providing a stimulating and attractive environment for R&D, which will contribute to achieving sustainability in development, as well as enhancing competitiveness of the national economy.

Transferring and developing technology to serve the national economy and achieve sustainable development.
Promoting the university’s cooperation with research and developing centers locally and internationally.
Creating a stimulating and attractive environment for local and global investment by establishing specialized firms in research and development.
Discovering, attracting and adopting innovators from within and outside the Kingdom.

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<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td></td><td>

Enhancing the utilization of knowledge and skills of all university students to achieve harmony between the output of education and the demands of industry.
Generating distinguished job opportunities in knowledge industry arenas.

<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>The Dhahran Techno Valley Company (DTVC)
Country: KSA</td><td>
Vision: Provide DTVC business lines with the guidance and resources needed to commercialize innovative technologies, create knowledge jobs and spur entrepreneurship.
Mission: To lead the commercialization of technologies by fostering the environment in which KFUPM and drivers of innovation work together to deliver economic opportunities of national and global value in the energy sector.
Objectives:

Actively manage the leading energy and related industries science park in Saudi Arabia
Deliver international-standard services to clients and National Champions
Foster collaboration between park tenants, KFUPM, Saudi Aramco and other drivers of innovation
Support technology related SMEs
Facilitate the launch of companies built around locally-developed technology

<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>Prince Abdullah Bin Abdulaziz Science Park (PASP)
Country: KSA</td><td>
Objectives:

Commercialization of research, both in terms of focusing the university’s endeavors towards commercially feasible areas of study as well as minimizing the transition period between technological innovation and its commercial deployment.
Presenting the university and the Kingdom to the international community as a significant player in high-end research and innovation.

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<table>
<tr><th>STP</th><th>Vision / Mission / Objectives</th></tr>
<tr><td></td><td>

Providing a strong point of presence for major international companies and enterprises thereby channeling world-class technology and practice into local and regional businesses.
Providing incubator programs to promote emerging small-businesses and enterprises with the much-required technical, financial and administrative support.
Utilizing the industrial presence for the benefit of students, researchers, and faculty members, thereby providing significant real-world exposure that will enhance their academic performance.
Generating employment opportunities for students during their course of study and upon graduation in these businesses.

<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table>
</td></tr>
<tr><td>Elgazala Technopark
Country: Tunisia</td><td>
Mission:

The establishment and operation of the technological center and its component areas.
Coordination in the operation, maintaining and maintenance of common spaces and equipment.
Support for cooperation and complementarity between research, training, production and development units.
The incubation and supervision of the holders of technological projects or services within the cluster as well as their assistance in the existence of their activities.
The draining of the national and foreign investment and the support of the partnership in the field of the specialties of the pole and the encouragement of the companies authorized to settle there.
Reinforcement of the technological watch in the fields related to the pole's specialties.

Objectives:

Socioeconomic (strengthen job creation in the ICT sector).
Tunisia excellency (Position Tunisia as a pillar in the ICT sector at the scale of the Mediterranean basin, promote the export of services and products based on the Tunisian gray matter).
Economic leverage (Develop and disseminate the use of ICT in the different economic sectors in Tunisia).

<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
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<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table></td></tr>
<tr><td>Sidi Thabet Biotechpole
Country: Tunisia</td><td>Objectives: The purpose for its establishment is to offer a new concept of partnership between research, innovation, training and production with technological connotation.<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table></td></tr>
<tr><td>Africa City of Technology
Country: Sudan</td><td>Vision: Transforming ideas into values ... and Innovation into development.
Mission:
Provide technical support and raise the spirit of leadership and innovation in targeted groups
Assist new projects in the start-up phase
Help inventors and researchers move the results of their research into the stage of commercial production and marketing
Perform Business Development and Marketing for technology Solutions.
Provide technical and advisory services for making a qualitative leap in production technologies and quality.
Transfer, localize and disseminate technologies for industries, agriculture, and ICT.
Develop new industrial materials and models of new products.
Provide sponsorship and incubation for individuals and groups performing Research, development and Knowledge-Based production.
To train national engineering technical administrative and cadres.
To organize global, regional and national Technology exhibitions.
Objectives: To localize modern technologies and its applications in the country and the region, developing human resources, promoting cooperation between public and private bodies nationally and internationally to achieve prosperity and welfare of the people.<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
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<table>
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<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td></td></tr>
</table></td></tr>
<tr><td>Dubai Techno Park (under construction)
Country: UAE</td><td>Objectives: The main purpose of this innovation center in Dubai is to provide for the local and foreign investors who are willing to invest in modern technology and infrastructure.<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table></td></tr>
<tr><td>Palestine Techno Park
Country: Palestine</td><td>Vision: To create a national infrastructure, business environment and culture that will enable knowledge-based enterprises to successfully operate locally, regionally and globally.
Mission: To be the location of choice to seed, grow and commercialize business opportunities by nurturing innovation-led programs across knowledge-based industries as well as developing synergies in the creative and technology clusters by nurturing leadership in collaborating with business, research partners, value chains stakeholders, and promoting innovative value propositions to end markets.
Objectives:
Establishing a must-have and essential infrastructure to enable growth and clustering in the technology sector by providing commercial offices services geared for innovation and technology companies.
Changing the brand and image of the technology sector to attract foreign direct investment and integrate with global value chains.
Supporting technology entrepreneurship programs, launching new technology start-ups, social enterprises and developing new products.
Conducting technology transfer activities that would work on the commercialization cycles of research and development whether at universities or industry and take them to markets.
Bridging the knowledge gap and the gap between private sector & academic in capacity building, technology and innovation.
<table>
<tr><td>Economic development</td><td>Yes</td></tr>
<tr><td>Academic sector development</td><td>Yes</td></tr>
<tr><td>Income/profit generation for startups and SMEs</td><td>Yes</td></tr>
<tr><td>Financial return on investment</td><td>Yes</td></tr>
</table></td></tr>
</table>

4. Governance and Management

Governance is defined as system of arrangements and multilateral agreements interdependence of the enterprise and its stakeholders. Governance models sets out answers to a number of interrelated questions. In determining the appropriate governance model, shareholders need to reach clarity on a number of dimensions.

4.1 Governance Dimensions

The following dimensions constitute the governance dimensions according to the model established by the World Technopolis Association: [16]

- **Legal status** – e.g. What is the legal structure of the STP? Will there be a separate science park company or will the park be a division of one of the partner organizations?
- **Ownership** – e.g. Who owns the land, sites, infrastructures and buildings that constitute the park? Who owns the assets in the early stages of the development? does ownership change over time?
- **Capital** – e.g. what is the capital, in the form of money or other assets, that is required during development and operations? Who provides that funding? Seed capital can be acquired from grants, loans, leasing etc., whereas, working capital can be generated against offered services or incentives at a science park.
- **Decision making and control** – e.g. Who makes strategic decisions? To what extent do each partner want to keep some level of control over the development of the park and how far are they prepared to relinquish this control? Will there be an external board with membership of wider partners and stakeholders or will the science park be run basically by the main sponsoring organization?
- **Management** – e.g. who makes operational decisions? What are the reporting arrangements? What is the level of autonomy? Management of a science park refers to the team of individuals that governs planning, development, administration, and operation of a science park. A successful management team has a clear vision and mission that helps in fulfillment of the objectives that aid in STP development and growth. Moreover, they are responsible for planning and formulating science park policies, undertaking risk analysis, drawing subsequent mitigation plans, and devising cost structure and revenue models. Finally, in order to achieve the full potential, STP needs to be developed and managed in an entrepreneurial way and this will be facilitated by having a fair amount of autonomy vested in the park management, allowing it to make strategic decisions that predominantly serve the interests of the STP.
- **Stakeholders** – e.g. who are the key stakeholders of the STP? A stakeholder is an entity or an individual that has an investment, share, or interest in the STP. Besides the management team of a science park, tenant companies, R&D organizations, regional and national development authorities, and private sector are key stakeholders in planning of a STPs.
- **Key performance measures** – e.g. What are the key performance measures for the STP? What is the balance between financial and wider economic development objectives and targets?
- **Technology Focus** - STPs face a number of crucial strategic choices, both at their planning stage and later on as they develop. One of them is to choose whether to have a strong technology focus or have a more generalist approach. The choice of being either specific or general mainly depends upon the economy sectors that are to be provisioned at the STP.
- **Target Group** - A target group is defined as a group of customers towards whom the STP decides to aim its services. This group may comprise startups, spin-offs, small and medium enterprises, privately or publicly owned R&D centers, business support agencies, venture capital companies,

[16] (Wasim, 2014)

etc. Clearly defining target groups at planning stage can help a science park to make appropriate arrangements for the target group.

- **Eco-settings** – e.g. Does the STP have eco-friendly policies? Does the management prioritize environment-friendly arrangements? Does it take proactive initiatives for improving the environment?

4.2 Governance Models

There are four major governance models for STPs. This section highlights the models along with their corresponding management systems[17]:

▪ Model I – University STPs

The basic functions of the university STP are:

- Creating a campus on a university or in its immediate vicinity.
- Providing space and infrastructure to enable research carried on by university staff and students along with the ability to create business start-ups and spin-offs.
- Creating an innovative environment for innovators and enabling them to transform themselves into entrepreneurs.

Moreover, The STP's relation to its stakeholders is characterized by:

- The STP is administratively a separate entity from the university yet it is incorporated into the administrative structure of it.
- The STP has its own management team. Yet, the team fulfills obligations within the university and benefits from public funds (grants awarded to universities for research) and university infrastructure.
- The level of independence of the parks management both in conducting research (selection and ways of financing research topics) and in commercial activities (acceptance of orders, sales projects) is essential.
- The STP's tenants are commercial in nature and are independent from the university.

Advantages of the University STP:

- Close contact with the university, which enables an easier access to assets within the university.
- Allows for a free flow of knowledge and personnel between the university and the STP.
- Allows for the use of administrative units of the university to support the STP.
- Allows for the benefits of having common and available infrastructure.
- Being connected to a well renowned university brand.

Disadvantages of the University STP:

- Limited independence in decision making.
- Inheriting bureaucratic procedures of universities.
- Difficulty in separating any financials between the STP and the university.

▪ Model II – University Independent STP

This STP model fulfills the scientific and research functions linked to businesses but is a distinct organization separated from the university, possessing its own headquarters and infrastructure, and is responsible for the results of operations and the entities belonging to it.

[17] (Lobejko & Sosnowska, 2015)

The shareholders of the STP are: the university or several universities, research institutions, innovative companies and organizations, regional development agencies, funding agencies, new venture capital funds as well as local government units. It is, therefore, a structure connecting both public and private companies. Together, they participate in financing investments, have joint responsibility for the STP activities and share the benefits.

The STP is managed together by a president and a management board and cooperates with the supervisory board elected by the shareholders.

The fact that the park is an independent entity, allows for expansion outside the academic zones, with the aim of exchanging ideas and facilitating collaboration.

Advantages of the University Independent STP:

- The STP is an independent organization administratively and financially from the university and its bureaucracies.
- It benefits from both a separate Board of Directors and a Scientific Council.
- Apart from the direct access to scientific activities, the STP allows for other commercial and business activities.
- There is always a drive to achieve positive financial results.
- It allows for a freer level of access to many types of tenants.

Disadvantages of the University Independent STP:

- Requires a significant initial capital investment.
- There is a risk that university personnel may not want to move their research outside the university and to the STP.
- The significant number of shareholders may challenge the financial results.
- The return on investment might be long.

▪ Model III – Corporate STP

The park is an independent organization established by a group of public and private founders focused on the potential possibility of a return of capital in the long term. The initial capital may constitute of financial investment or intangibles assets like patents, licenses, new technologies, etc.

The STP's board chosen by the founders and an appointed board of directors. The management team should be efficient with high qualifications combined with working experience in the scientific community.

Advantages of the Corporate STP:

- The initial capital and inflow of funds can be raised from multiple sources of financing.
- The brand of the park can be associated with a number of successful shareholders, which could be universities, private investors, etc.

Disadvantages of the Corporate STP:

- The size and complexity of the STP structure can be challenging.
- It could be potentially threatening that the number of scientific and technological projects is lower than the previous models.
- The STP's size may be difficult when considering infrastructure management.

▪ Model IV – Network STP

The network model assumes that the organization of a science and technology park is formed as a relatively free network system. The management of the park serves as an orchestrator managing and

coordinating the activities of independent scientific and business entities cooperating directly or through a network.

The STP needs to specify the basic objectives of the whole organization, functions of the entities participating in the STP, and the principles of cooperation between the entities. The terms also require the STP to have relationships with the community, the authorities, and a wider scientific domestic and foreign community.

Advantages of the Network STP:

- This STP uses tools offered by modern information economy, thus characterized by a high level of modernity.
- Participation of entities belonging to the network is voluntary and does not rule out an independent economic activity.
- Internal structures and strategy of the network model can be easily adapted to the needs in accordance with the will of participants of the STP.
- Management system can be based on the principle of consensus and participation in the decision-making process.

Disadvantages of the Network STP:

- The complexity of the connections and open access could hamper the formulation of common goals and putting them into effect.
- A complex system can be incompatible with others.
- The division of responsibilities between STP management and leadership may prove to be difficult.

4.3 Governance of STPs in Arab region

The following table further illustrates governance models and dimensions in selected STPs in the Arab region.

Table 5 - Governance in selected Arab STPs

	King Abdulaziz City for Science & Technology	Prince Abdullah Bin Abdulaziz Science Park	El Hassan Science City	Qatar Science and Technology Park	Berytech Technological Pole
Governance Model	Model III: Corporate STP Universities on site	Model I: University Science Park	Model II: University Independent STP	Model II: University Independent STP	Model I: University Science Park
Legal Status	Government institution. An independent scientific organization.	A non-profit company. For-profit subsidiaries. An independent management.	A non-profit-organization (NGO).	A non-profit organization.	A for-profit private company.
Ownership	Government owned.	Many partners: shares in proportion to contribution - cash or in kind.	Private.	Private.	Private.
Funding	Government funded	Multiple organizations and the government invested capital into the STP. Operations are funded by rent from tenants and consulting activities.	Multiple sources of income, including: Multiple projects with private and public sectors. Rent from tenants. Consulting projects. Grants.	Qatar Foundation. Rent from tenants.	Université Saint Joseph. Rent from tenants. Shareholders include: Bank Audi, Bank of Beirut, BankMed, Banque Bemo, Byblos Bank, Credit Lebanais, Indevco, LibanCell, Murex, Allianz SNA, Saturn Trust, Saradar Bank, GME, Arab Bank

	King Abdulaziz City for Science & Technology	Prince Abdullah Bin Abdulaziz Science Park	El Hassan Science City	Qatar Science and Technology Park	Berytech Technological Pole
Decision making and control	A board with membership of wider partners and stakeholders.	The main sponsoring organization (KFUPM)	The main sponsoring organization (RSS)	A board with membership of wider partners and stakeholders	A board with membership of wider partners and stakeholders
Stakeholders	Water & Energy Research Institute Materials Research Institute Information & Communication Research Institute Space & Aeronautics Research Institute Life Science & Environment Research Institute Nuclear Science Research Institute Saudi Patent Office A number of research centers	KFUPM The Saudi Government Chamber of Commerce Tenant firms and enterprises Investors and Private Start-up Companies Saudi mega companies, such as, Saudi Aramco, SABIC, etc.	RSS PSUT iPARK IRADA UN ESCWA WANA Institute MESIS	Resident companies Incubator and accelerators Education City	Saint Joseph University Tenants Startups
Key performance measures	KPIs exist and available to shareholders	KPIs exist and available to shareholders	KPIs exist and available to shareholders	KPIs exist and available to shareholders	KPIs exist and available to shareholders
Technology Focus	Energy, water, oil, gas and minerals, advanced	Petroleum, chemical industry, and IT.	Energy, water and environment	Energy, environment, health sciences, oil and	ICT

	King Abdulaziz City for Science & Technology	Prince Abdullah Bin Abdulaziz Science Park	El Hassan Science City	Qatar Science and Technology Park	Berytech Technological Pole
	materials, health and medicine, ICT, agriculture, building and construction, transportation and logistics, environment, nuclear science and applied physics, space and aeronautics, and defense and security.		Industrial Development Construction & Sustainable Buildings ICT for Development	gas, water, petrochemicals, information and communication technology	
Target Group	Technology start-ups Scientific researchers SMEs National research institutions	Researchers and scientists from the university and private industry Undergraduate students Start-up companies Established firms	Start-ups SMEs Universities Governmental institutions Incubators International organizations NGOs	Tech-focused start-ups SMEs Multinational corporates Research institutes Public sector agencies	Innovative business enterprises Lebanese start-ups Lebanese SMEs
Eco setting	N/A	N/A	Under planning	N/A	N/A

The following table illustrates governance models of other Arab STPs

Table 6 - Governance models of Arab STPs

STP	Governance Model
Smart Villages	Model III: Corporate STP
CyberCity	Model III: Corporate STP Adjacent university
Casablanca Technopark	Model III: Corporate STP
Knowledge Oasis Muscat (KOM)	Model III: Corporate STP Universities on site
Riyadh Techno Valley	Model I: University Science Park
The Dhahran Techno Valley Company (DTVC)	Model I: University Science Park
Elgazala Technopark	Model III: Corporate STP Multiple (three) associated universities
Africa City of Technology	Model III: Corporate STP
Palestine Techno Park	Model II: University independent STP

5. Service provision under the STPs

STPs support their tenants by providing physical infrastructure along with value-added services, business environment and networks. According to UNESCO, those services include [18]:

Physical infrastructure. Physical infrastructure is an essential element for STP tenants. Historically, 'science parks'' definition was limited to the real estate aspect, where universities would lease office space, real estate facilities, research labs to external businesses. Today, this is called 'industrial estates', while the term STP includes a much broad scope of services. This, however, does not undermine the importance of the basic infrastructure such as buildings, meeting rooms, utilities, laboratories, etc.

Location. Location is a significant factor in any STPs success. For example, proximity to transportation infrastructure (e.g. airports, highways, public transportation) is extremely important. Today, most high-tech STPs are situated within cities, yet a significant number is located outside cities. The latter would usually focus on agro-food and crop technologies.

Incentives. In order to attract knowledge-based companies to the STPs, many countries/regions offer a number of incentives to their tenants; these include financial incentives, tax exemptions, etc.

Research and development activities. STPs (a) facilitate the transfer of technology from academic and research centers to companies, and (b) facilitate the pull of appropriate R&D from the laboratory to the marketplace. The key factor in differentiating an STP from other commercial entities is the close ties to active research communities. If this element is missing from the range of services offered, it is clear that an institution does not have a scientific or technological character.

Business incubation. At least one incubator is normally located within the STP. In some cases, the STP is considered a big incubator with facilities and services to serve the follow-on stages. Incubation services include business planning, feasibility studies, defining economic results, risk mitigation, and commercialization of solutions developed.

Innovation implementation management: This includes services such as research and development, design, analysis, testing, certification, advice on achieving Technical Readiness Level and Manufacturing Readiness Level.

Access to sources of capital. Venture capitalists bring smart money; which includes technical skills, business experience and networks, in addition to cash, to the ventures they fund and environment they operate in. Many STPs offer access to finance services, including helping tenants access the needed funding or prepare the needed legal paperwork, etc.

Legal support. Legal support is critical to the STP tenants, this involves support in issues such as business registration, taxation, labor laws, intellectual property and legal conflicts.

Protection of intellectual property. The intellectual property created by academic center employees is owned by centers, and always have opportunities for commercialization. STPs may assist in this commercialization through difference routes: licensing, revenue sharing, spin offs, or through the formation of a venture company. In all circumstances, compensation is made to the original inventors.

Networking. STP is a combination of multiple types of tenants; those include R&D facilities, knowledge-based companies, universities, research centers, startups, SMEs. This creates an environment conducive to co-operation, sharing of ideas and creativity.

[18] (UNESCO, 2017):

5.1 Services of STPs in the Arab region

The following table highlights the services provided in selected STPs in the Arab region.

Table 7 - Services provided in selected Arab STPs

	Physical Infrastructure	Location	R&D	Incubation	Access to capital	Legal support	Intellectual Property	Incentives	Networking	Innovation Management
Smart Villages	x	x	x	x					x	x
Sinai Technology Valley	x	x	x					x		
El Hassan Science City	x	x	x	x		x	x		x	x
CyberCity	x		x					x		
Berytech Technological Pole	x	x	x	x	x				x	x
Casablanca Technopark	x	x		x					x	
Knowledge Oasis Muscat (KOM)	x	x	x	x					x	
Qatar Science and Technology Park Education	x	x	x	x	x			x	x	x
King Abdulaziz City for Science & Technology	x	x	x	x	x		x			x
Prince Abdullah Bin Abdulaziz Science Park	x	x	x	x	x				x	x
Elgazala Technopark	x			x	x				x	x
Africa City of Science	x	x	x	x						x
Palestine Techno Park	x	x	x	x						x

6. Evaluation Criteria

As countries, regions, and cities invest more to create STPs as a means to accelerate technological and economic transition, the task of measuring the contribution of STPs becomes more relevant and important. Performance measures or indicators are internal management tools reflecting key milestones and targets of a project. Once these indicators have been set, regular monitoring against targets will provide the management team and shareholders with information on progress and challenges.

In general, STPs should be evaluated to:

- Make them more accountable to the public and investors.
- Understand and improve the benefits they provide to universities, laboratories, and businesses.
- Reveal ways of increasing the efficiency of the science and commercialization efforts.

6.1 Evaluation Criteria

While each STP is different than the other, the following are amongst the most common indicators:

- Area of land developed and building space constructed
- Number of companies located at the park and the number of people they employ (detailed information may include the type of employment created, and the number of qualified scientists and engineers employed).
- Number of graduated companies and their employment numbers.
- Rental and services income per month, per year and over time.
- Type and range of logistic services provided (such as internet, meeting rooms, secretarial support, networking events, virtual addresses).
- Type and range of professional services provided either directly or indirectly. Such services include legal advisory, bookkeeping, access to capital, marketing, coaching, etc.
- Investment or grants for capital and operational purposes raised and spent.
- Investment projects attracted to the region by the STP or its partners.

6.2 Success Factors

As STPs focus turned from bricks to brains, developing clear success factors became important. Hence, STPs:[19] [20] [21]

- Cannot be stand-alone entities. They are connected to and involved in the implementation of national and regional economic development policies.
- Should have the right ownership and governance architecture, where all the right actors are on-board with a clear division of responsibilities and competences.
- Should have a professional and full-time management of the project.
- Should have a comprehensive and adaptable strategy relevant to the area they are operating, in. The strategic axes include: (i) location (ii) position in the technology pathway (iii) target companies (iv) technological/sectorial specialization (v) target markets (balance between the local, national and international visions) (vi) networking strategy (vii) management and organization.
- Should have a sustainable business model for the STPs.

[19] (Sanz, 2017)
[20] (Vila & Pages, 2008)
[21] (Sobkowicz, 2013)

- Should have accurate control over the activities of the tenants, without directly interfering in their work.
- Should have accurate designs of buildings and infrastructure.
- Should secure visibility and proactive position in international networks.
- Should participate in the academic research center's works.
- Should provide a list of supporting and value-added services.
- Should have incubators and innovation spaces.
- Should attract innovating and dynamic companies that bring along other firms.
- Should be connected with networks at all levels.

6.3 Best Practices

Since STPs vary dramatically (given their different goals, facilities, management structures), there are nonetheless some best practices, which include the presence of:[22]

- **Champions:** Committed champions who have matching visions and can provide sustained, high-level attention to ensure the growth and development of the STP.
- **Leadership:** Effective and professional management that can facilitate service provision in addition to networking among entrepreneurs, researchers, investors, and others within the ecosystem.
- **Funding:** Designated and sustained funding (public or private), combined with effective public policies to support companies that seek to convert ideas into innovations and innovations into commercialization.
- **Soft infrastructure:** This includes the inventory of human capital resulting from investments in education and training, public policies that encourage entrepreneurial culture, and the presence of networks among professionals.
- **Metrics:** Effective metrics to help management set clear goals and measure the effectiveness of the STP.

[22] (National Research Council, 2009)

7. Concluding remarks

There is great diversity in the Arab world, where groups of countries differ in their circumstances - some are rich in oil resources, while others are poor in such resources; and some are affected by political conflict while others are not. Moreover, they differ in their levels of engagement and growth of their knowledge and innovation base.

Even before the Arab uprisings, which resulted in slowing many aspects of development including science, technology and innovation, it is still evident that the innovation, science and technology potential has not been fully realized. In this regards, Arab countries could claim:

- A decent and growing number of higher educational institutions.
- A considerable investment in human resources.
- A reasonable ICT infrastructure.
- A strong and growing young generation that is technology savvy.
- A growing pool of entrepreneurs.
- Access to large regional markets.

Despite all of that, STPs growth and potential success remains limited due to the:

- Small level of university research leading to patent or commercialization.
- Almost a lack of research activity in the private sector.
- Limited linkages between the business communities and university research centers.
- Inadequate networking between local research institutions and their counterparts abroad.
- Small proportion of local products and services have novel technological content.
- Few enterprises are plugged into global value chains.
- Untapped youth potential within fields of science discovery, communication and advocacy.
- Brain drain of the educated and professional talents.
- Ineffective communication and relationships between the four stakeholders of the quadruple helix.

The Arab countries can be divided into four main groups in terms of innovation policies, institutions and STPs:[23]

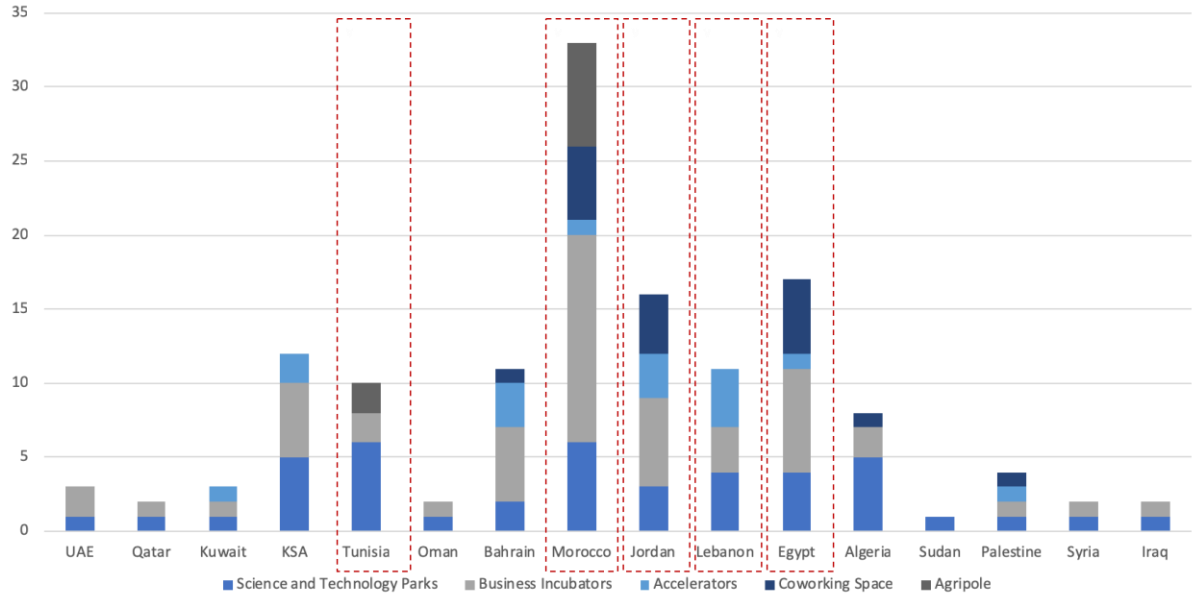
Group 1: Countries with dynamic and integrated STPs and innovation policies.

This group includes Tunisia, Jordan, Lebanon, Egypt and Morocco.

These countries have a dynamic research system and high records in published scientific research and relatively large numbers of researchers and innovative activities. These countries must complete their progress in sectoral or regional initiatives in the knowledge economy and move forward and accelerate reforms to ensure enhanced innovation and job creation.

[23] (ESCWA Technology Center , 2012)

Figure 4 - Group 1: Arab Countries

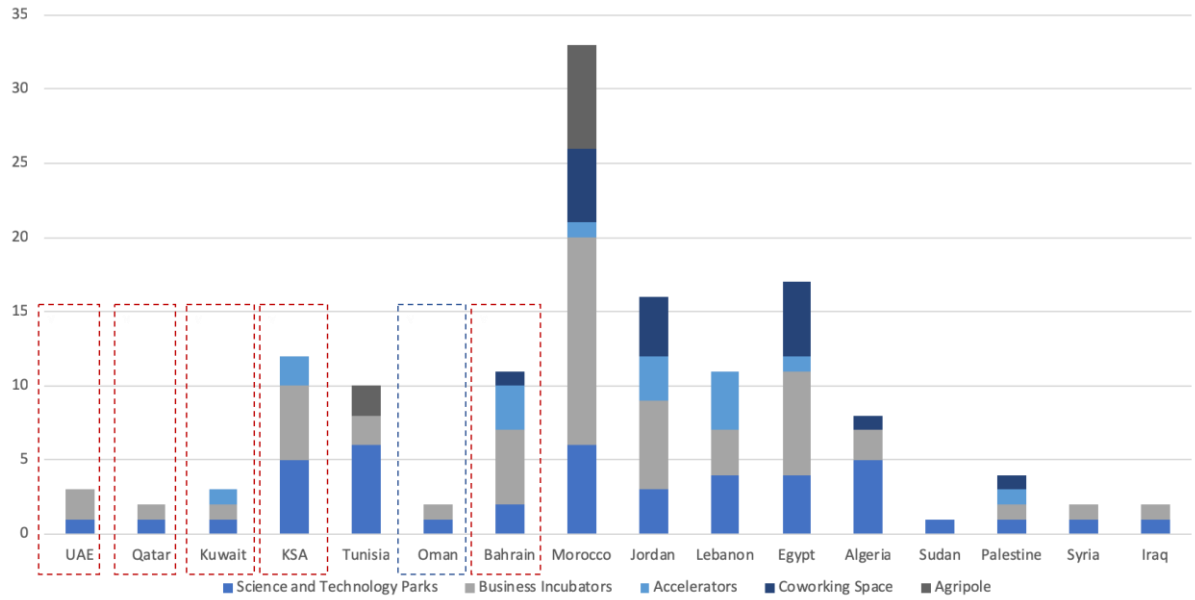


Group 2: countries with innovation policies and accelerating STPs to achieve economic diversification.

The group includes Saudi Arabia, UAE, Kuwait, Qatar and Bahrain. Oman can be added to the group.

These countries are very rich especially in oil. They must complete their economic diversification and increase the administrative capacity of their citizens so that they can replace many expatriates who have been brought in to fill key positions.

Figure 5 - Group 2: Arab Countries

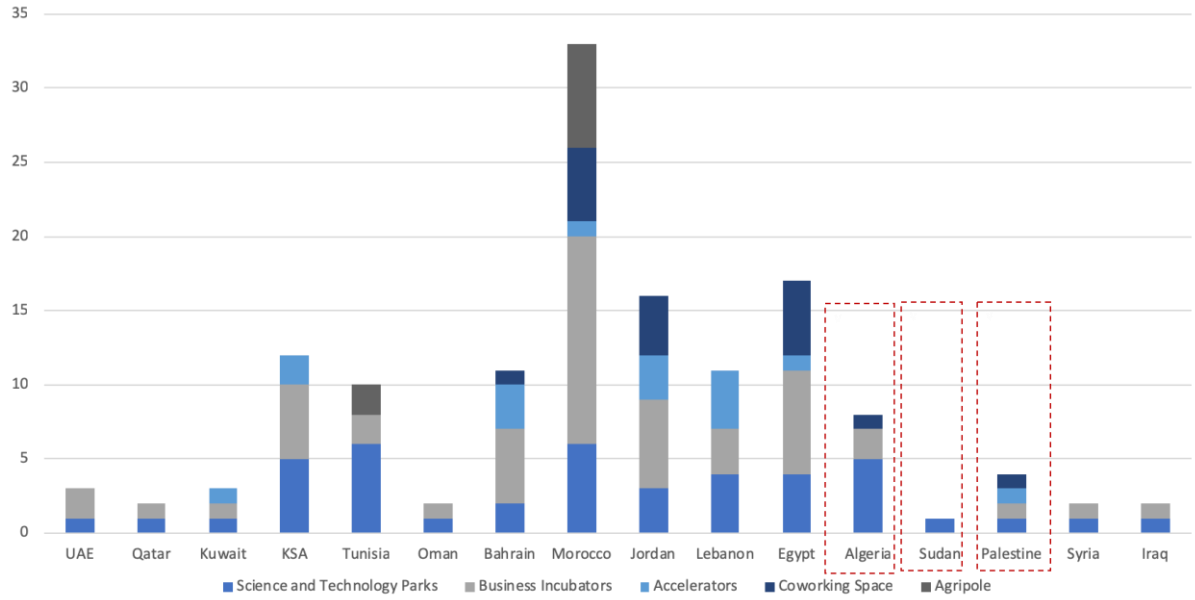


Group 3: countries with innovation policies and emerging STPs.

This group includes Sudan, Palestine and Algeria.

These countries should complete the establishment of STPs and exchange experiences with previous groups.

Figure 6 - Group 3: Arab Countries



Group 4. Others

It is very difficult to classify these countries. These are countries with limited policies, innovations and research. Some universities have been developed but their key performance indicators are low.

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