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THE ROLE OF TECHNOLOGICAL INCUBATORS IN FOSTERING ENTREPRENEURIAL GROWTH: THE CASE OF EGYPTIAN UNIVERSITIES AND RESEARCH CENTRES

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Abstract. Incubators enable firms to grow technologically by providing them access to leading technologies and technical support. This paper undertakes an analysis of the way technological incubators can be utilized to enhance how Egyptian universities and research centres competitively drive entrepreneurship projects. The paper delves deeper into dimensions of cost reduction, improved quality, speed and flexibility in performance, creativity, and innovation. Using primary data on assembled information from a survey of entrepreneurs being trained under the INTILAC program and secondary information from business and academic publications, the paper tests how resources, strategies, operating techniques, and incubator management methods influence the capabilities of entrepreneurial ventures. The research results have proven that there is a strong positive statistically significant relation at the level of (0.01) between the dimension (objectives of the incubator and its administration) and the competitive advantage dimensions from entrepreneurship projects in the technological incubators of the Academy of Scientific Research. The research then proceeded with an overview of the SWOT analysis of the internal and external factors that affect business incubator performance. The study, therefore, seeks to establish a way by which technology-based incubators can develop an enabling environment not only for incubating innovative startups but also for fostering the region's economic growth. Results showed the indubitably significant role of those incubators in transforming the outputs of scientific research and innovations into a viable, economically feasible, and technologically competitive business that supports the development of Egypt's knowledge-based economy.

Keywords: Technology incubators; Competitive Advantage; Entrepreneurship; Egyptian Universities

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JEL Classifications: M1, M2, O1, O3

1. Introduction

Entrepreneurship is crucial for ensuring economic security by influencing employment, income, self-realization, and financial literacy, ultimately enhancing personal competitiveness within the economic system (Oblaukhova, 2023; Aghion, 2016). Incubators facilitate the launch of new businesses by giving entrepreneurs the resources and environment they require during the ideation phase. They function as hubs for entrepreneurial activity, transforming business concepts into ready-to-use operational procedures, goods, or services (Kaur et al., 2024).

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Business incubation is widely recognized as a crucial mechanism for supporting entrepreneurs in establishing new ventures and is considered an integral part of modern entrepreneurial ecosystems (Szabó, 2006; Hausberg & Korreck, 2018). These incubators not only drive job creation and regional economic development by providing various facilities (Abetti, 2004), but they also play a significant role in the innovation system (Aerts et al., 2007). The effectiveness of business incubators hinges on their ability to attract high-quality ventures and to foster the development of new firms with significant growth potential, often originating from R&D activities within universities and research institutions (Alsos et al., 2011). Incubators already play a crucial role in facilitating the development of entrepreneurial capabilities within universities. Intrapreneurship refers to applying entrepreneurial skills and techniques within an existing organization, usually to devise and drive new business initiatives (Shekhar et al., 2023).

In addition, incubators contribute to the technological advancement of startups by facilitating access to cutting-edge technologies and technical support. This aspect is particularly crucial for technology-based startups whose competitive advantage often depends on their ability to innovate quickly (Leitão et al., 2022). Business incubation programs help create successful business opportunities, help achieve a good rate of return on investment, develop poor geographical areas, and improve the image and reputation of local communities, not to mention helping them reduce production costs and high rate of return on investment (Ali & Nazmi, 2023). In this context, the term "technology incubator" describes a system that facilitates the transfer of technology, helping in the growth of small businesses through innovation and supporting economic development methods (Allen & Mccluskey, 1991). Universities worldwide have shifted their focus and goals in response to the requirement to remain economically viable and grow their value-generating activities (Wright, 2012), which also significantly impacts entrepreneurial ecosystems (Rubio & Cubero, 2015). These advances have strengthened the emphasis on academic entrepreneurship, defined as entrepreneurial activities conducted within academic environments by employees (Klofsten et al., 2021).

University technology incubators are crucial in fostering entrepreneurship and innovation within academia. The university business incubator (UBI) is defined as an incubator set up by the university to provide office space, equipment, mentoring services, and other administrative support to assist in the formation of new ventures (Wonglimpiyarat, 2016). These incubators serve as hubs for entrepreneurial ecosystems, providing support for young business startups through tangible and intangible resources (Rifai et al., 2023). These incubators provide startups with not only a physical workspace but also access to essential resources, including mentorship, networking opportunities, and often important funding sources. Knowledge, human capital, material capital, and entrepreneurial capital can all have an impact on a startup's performance (Audretsch & Keilbach, 2004). Access to various networks, resources, and expertise can also impact startup performance (Battistella et al., 2018). The role of these incubators extends beyond simply providing support to significantly enhancing the competitive advantage of entrepreneurship projects. They act as catalysts that turn innovative ideas into viable business ventures equipped to thrive in competitive markets (Nawawi & Mulyadi, 2022).

Most countries in the world have long-term public incubator programs aimed at promoting economic and social development. In Africa, they have recently begun to expand the activity of incubators based on science, technology and innovation (Lalkaka, 2002; Chandra, 2009; Dalmarco et al., 2018). In Egypt, business incubators have become a key part of the entrepreneurial ecosystem, supporting the growth and development of startups and fostering innovation. These incubators provide essential resources such as funding, mentorship, office space, and technical support, and they are often closely linked with universities, government initiatives, and private-sector partnerships. As a component of their innovation and entrepreneurship policies, many countries use technology business incubator programs to promote economic development. (Ács & Naudé, 2013).

One of the most important incubation programs in Egypt is the INTILAC Program affiliated with the Academy of Scientific Research and Technology. The INTILAC Program is considered the largest umbrella for establishing

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and managing technological incubators in the entrepreneurship and innovation system. The program has established 43 technological incubators and aims to transform ideas, innovations and research outputs into emerging technological companies capable of economic and technological competition and their products. With a competitive ability to achieve the goal of the knowledge economy and to implement this program, the Academy cooperates with all parties in the country, including universities, institutes and research centres, in addition to cooperation with several ministries such as investment, industry and trade, in addition to the private sector and civil society institutions. Despite the potential importance of incubation in enhancing technological entrepreneurship and, consequently, the country's competitiveness, limited research has been conducted to determine the ability of Egyptian incubators to meet these high expectations.

Technology incubators enhance competitive advantage by fostering innovation, entrepreneurship, and collaboration between academia and industry, leading to economic growth, job creation, and societal benefits (M et al., 2022). A startup's competitive advantage is crucial for its success, stemming from unique attributes that outperform competitors (Sokhan & Popovskyi, 2023). Business incubators significantly enhance the competitive advantage of startups by establishing a supportive ecosystem that promotes growth and innovation. By providing essential resources such as office space, technology, and administrative services, incubators reduce overhead costs, allowing startups to focus on strategic growth activities (McAdam & McAdam, 2008). Organizations must continuously innovate and adapt to external environmental demands and internal capabilities for sustained competitive advantage. Creativity and innovation are essential pillars for maintaining this edge. The primary dimensions of competitive advantage include quality, which entails providing defect-free products at minimal cost and flexibility (Diab, 2013), which involves rapidly adapting to changes in product design and customer requirements and innovation, which empowers organizations to swiftly address environmental challenges and seize new market opportunities more effectively than their non-innovative counterparts. Additionally, cost efficiency plays a critical role in achieving competitive advantage by minimizing production costs to meet the demands of a broader customer base (Jerab & Mabrouk, 2023).

The aim of this paper is to present a study that handles and elaborates on the positive relationships between the dimensions of technological business incubators and the dimensions of competitive advantage for entrepreneurship projects that the "technological incubators of the Academy of Scientific Research and Technology" in Egypt incubated. This considers focusing on how the resources, the strategy, the techniques of operation, the objective, and the method of management of the incubators affect the improvement of entrepreneurial project capabilities of cost reduction, quality improvement, speed, and flexibility improvement along with creativity enhancement and innovation development and identifies the reality of business incubators by assessing the indicators of the internal environmental analysis and the external environment to identify the factors that have an effect on the success of business incubators at Egyptian universities and research centres.

2. Methodology

This study employs a structured methodology to explore the relationship between technology business incubators and their role in enhancing competitive advantage. The research framework is designed to focus on both independent and dependent variables. The independent variables of business incubators comprise dimensions such as resources, strategy, operational techniques, and management goals, while the dependent variable of competitive advantage comprises dimensions such as cost reduction, quality improvement, speed and flexibility, and creativity and innovation. Data collection for this research depends on primary data collected through a survey administered to entrepreneurs in incubators affiliated with the Academy of Scientific Research, which includes 43 incubators under the INTILAC program, encompassing 1,794 entrepreneurs.

The survey was designed to capture quantitative insights into the incubation processes and their outcomes, with a random sample of entrepreneurs in the technology incubators affiliated with the Academy of Scientific Research

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totalling 340, and a response rate of 93.2%, resulting in 317 valid questionnaires. At the same time, the secondary data were sourced from published and unpublished studies, annual reports of technology incubators, and relevant academic and commercial publications. A SWOT analysis was administered to the managers of business incubators to assess the challenges and opportunities of incubators related to the Academy of Scientific Research and Technology in Egyptian universities and research institutes.

Descriptive statistics were applied to analyze the following dimensions of the study: Incubator Strategy, Incubator resources, Operational Techniques, Goals and Management of the Incubator, Cost Reduction, Quality Improvement, Speed and Flexibility, Creativity, and Innovation. A five-point Likert scale was utilized to measure each item of the survey, ranging from "Strongly Agree" (5), "Agree" (4), "Neutral" (3), "Disagree" (2), to "Strongly Disagree" (1). Based on the number of response, the range from (1-1.80) represents complete disagreement with a completely low level of agreement, range from (1.81-2.60) represents disagree with a low level of agreement, range from (2.61.-3.40) represents neutral with a moderate level of agreement, range from (3.41-4.20) represents agree with a high level of agreement and the range from (4.21-5) represents completely agree with a completely high level of agreement.

3. Results

3.1. Descriptive analysis

As shown in Table 1, the analysis of responses in respect of the incubator resources has detected moderate consensus regarding most statements, which, finally, is traced in the average mean score of 2.94, with a standard deviation of 0.23. The highest average mean value (3.19) was observed for the statement "The incubator's management encourages private sector institutions, companies, and banks to invest in developing scientific research," which sheds light that the role of the incubator is directed positively and there is support from the incubator for the private sector to invest in research. In contrast, the lowest score was observed for "The incubator provides an environment that supports innovation and commercialization" with an average mean of 2.51, supposedly indicating some dissatisfaction with the support environment in the incubator.

Most of the responses were in the 'Neutral' range (2.61-3.40), with an average level of agreement regarding the dimensions surveyed. The effectiveness of the incubator resources has shown a moderate level of consensus, with an average mean score of 2.94 and a standard deviation of 0.23 across all the statements. The highest average mean score of 3.19 was measured regarding this statement: "Incubator's management encourages private sector institutions, companies, and banks to invest in developing scientific research." Conversely, the lowest average score of 2.51 was recorded regarding this statement measured regarding the support rendered by the incubator to innovation and commercialization, suggesting a critical area for improvement. Most of the responses fell into the 'Neutral' category (2.61-3.40); hence, the general attitude toward the incubators would lean more toward ambivalence rather than standing firmly against the potential of incubators to become more supportive structures stimulating innovation and attracting more substantial private sector engagement.

Table 1. Mean, the degree of agreement, and standard deviation of the incubator strategy and incubator resources dimensions

Incubator strategy dimension	Mean	Standard deviation	Degree of agreement	Incubator resources dimension	Mean	Standard deviation	Degree of agreement
The incubator has a clear strategic vision about the necessity of investing in the human element.	2.63	1.216	52.6%	The incubator allocates a portion of its revenues to support technological ideas and training programs.	2.77	1.123	55.4%
The incubator constantly seeks to diagnose and adopt investment opportunities.	2.79	1.518	55.8%	The incubator continuously prepares exhibitions to sell products and provide services.	2.86	1.463	57.2%

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Incubator strategy dimension	Mean	Standard deviation	Degree of agreement	Incubator resources dimension	Mean	Standard deviation	Degree of agreement
The incubator hosts projects in one field or projects in various fields.	2.97	1.401	59.4%	The incubator provides an environment that supports innovation and commercialization.	2.51	1.279	50.2%
The incubator organized several meetings with companies and mentors.	2.58	1.199	51.6%	The incubator management system is effective and supportive.	2.91	1.386	58.2%
The incubator has one or more alliances with industrial institutions in the incubator's field of work.	3.06	1.280	61.2%	The incubator's management team possesses effective leadership skills.	3.18	1.170	63.6%
The incubator maintains a close relationship with universities to encourage students and project members to develop new products.	3.18	1.513	63.6%	The incubator helped you effectively with regard to business deal processes (promotion, negotiation, contracting, etc.).	3.12	1.430	62.4%
The incubator evaluates the results achieved from human investment.	3.31	1.324	66.2%	The incubator facilitates cooperation and networking with other entrepreneurs.	2.97	1.363	59.4
The incubator targets technology companies for investment.	2.98	1.275	59.6%	The incubator's management encourages private sector institutions, companies and banks to invest in developing scientific research.	3.19	1.349	63.8%

Source: Authors

Table 2 shows the mean, relative importance, and standard deviation of responses on the operational technique's dimensions; the average mean was 2.87 and average standard deviation (1.40). Notably, the item "The incubator provides updated databases to facilitate patent registration procedures for their innovative projects" registered the lowest mean, indicating lower perceived effectiveness. On the other hand, the statement "It provides the necessary incubator to support the ideas and projects of talented people" recorded both the highest and lowest standard deviation, suggesting it is viewed positively albeit with varied experiences. Entrepreneurs' responses regarding the objectives and management of the incubator dimension resulted in an average mean 2.62 and a standard deviation 1.60, the item with the lowest mean was "The incubator management provides databases with advanced programs for business implementation," which suggested lesser effectiveness. The highest mean was 2.96 noted for "The incubator management system including mentors, managers, alliances, and company representatives cooperate in a consistent and integrated manner," indicating higher satisfaction.

Table 2. Mean, relative importance, and standard deviation of the operational techniques and goals and management of the incubator dimensions

Operational Techniques dimension	Mean	Standard Deviation	the degree of agreement	Goals and Management of the Incubator dimension	Mean	Standard Deviation	the degree of agreement
The incubator evaluates the team members and ensures that they are integrated.	3.08	1.304	61.6%	The incubator has a clear and specific goal that guides and decides its development direction.	2.28	1.603	45.6%
During the selection stage, the incubator is keen to evaluate the timetables for running projects and give comments and advice.	3.05	1.400	61%	The incubator management provides databases with advanced programs for business implementation.	2.25	1.438	45%

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The incubator provides services in the field of establishing projects.	2.29	1.360	45.8%	The incubator management provides learning opportunities by sending external missions.	2.36	1.570	47.2%
The incubator provides updated databases to facilitate patent registration procedures for their innovative projects.	2.14	1.479	42.8%	The incubator's management uses advanced technologies to deliver its creative and innovative explorations.	2.61	1.510	52.2%
It provides the necessary incubator to support the ideas and projects of talented people.	3.48	1.239	69.6%	The incubator management has strong capabilities to integrate external technological resources with internal resources.	2.81	1.769	56.2%
The incubator has an efficient technological system to complete and manage activities with high efficiency.	3.47	1.298	69.4%	The incubator has clear policies that allow you to have appropriate expectations for the future.	2.77	1.647	55.4%
One of the criteria for evaluating projects is the ability to achieve rapid growth.	2.83	1.481	56.6%	The incubator management system, including mentors, managers, alliances and company representatives, cooperate in a consistent and integrated manner.	2.96	1.692	59.2%
During the selection stage, the selection team is keen to evaluate the available capital.	2.65	1.635	53%	The incubator creates job opportunities and commercializes new technology.	2.90	1.608	58%

Source: Authors

Table 3 indicates that responses to queries regarding the cost reduction dimension in technological incubators averaged a mean of 2.67. The statement, " There is a commitment from the incubator to reduce the costs of providing services by providing benefits to customers," received the most positive response from entrepreneurs; it has a mean of 2.79 and a standard deviation of 1.572. The statement, " The cost in entrepreneurs' projects is low compared to competing projects," received the least positive response, with a mean of 2.43 and a standard deviation of 1.285. Simultaneously, the average mean of the responses related to the quality improvement dimension was 2.98. This statement, "The incubator provides feedback from the client about quality," received the strongest endorsement (mean of 3.35, standard deviation 1.155). On the other hand, with a mean of 2.75 and a standard deviation of 0.987, the statement that got the lowest rating was, "The incubator seeks to improve and develop the quality of services to suit the desires and needs of customers." These results show that entrepreneurs are only somewhat satisfied with the incubators' attempts to reduce costs and increase quality.

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Table 3. Mean, relative importance, and standard deviation of the Cost Reduction and Quality Improvement dimensions

Cost Reduction dimension	Mean	Standard Deviation	Degree of agreement	Quality Improvement dimension	Mean	Standard Deviation	Degree of agreement
The cost of entrepreneurs' projects is low compared to competing projects.	2.43	1.285	48.6%	The incubator seeks to improve and develop the quality of services to suit the desires and needs of customers.	2.75	0.987	55%
The incubator seeks to perform all functions and activities at a lower cost and with high efficiency.	2.74	1.434	54.8%	The incubator constantly evaluates the quality of its services and develops them compared to competing services.	2.76	1.223	55.2%
The incubator seeks to reduce fixed and variable operating costs.	2.45	1.463	49%	The incubator is interested in distinguishing its services from those of its competitors on an ongoing basis.	3.03	1.088	60.6%
The incubator is interested in making better use of the available capabilities in order to reduce costs.	2.67	1.194	53.4%	The services provided by the incubator are subject to continuous improvement.	3.02	0.887	60.4%
The incubator is committed to reducing the costs of providing services by providing benefits to customers.	2.79	1.572	55.8%	The incubator provides feedback about quality from the client.	3.35	1.155	60.4%

Source: Authors

Table 4 showed that the responses regarding the dimension of speed and flexibility were moderate, with an overall average mean of 2.96. The most agreeing response within this dimension came from entrepreneurs regarding the statement, "The incubator adheres to the specified deadlines to provide services to customers as quickly as required," which scored the highest mean of 3.21 and a standard deviation of 1.195. Conversely, the least positive feedback was for the statement, "The speed of service delivery is appropriate for customers," which recorded a mean of 2.72 and a standard deviation of 1.168. Similarly, responses related to the dimension of creativity and innovation averaged a mean of 2.98. The peak response in this category was for "The incubator works to develop and provide new and innovative services," with a mean of 3.31 and a standard deviation of 1.275. The lowest scored statement was, "The incubator is interested in constantly developing creative individuals in their field of work," with a mean of 2.82 and a standard deviation of 1.140. These results underscore a moderate level of entrepreneur satisfaction with both dimensions, highlighting areas where further enhancements could bolster incubator effectiveness.

Table 4. Mean, Degree of Agreement, and Standard Deviation of The Speed and Flexibility, Creativity, and Innovation Dimensions

Speed and Flexibility dimension	Mean	Standard Deviation	Degree of agreement	Creativity and Innovation dimension	Mean	Standard Deviation	Degree of agreement
The incubator can meet ever-increasing demands.	3.08	1.027	61.6%	The incubator is interested in new ideas and works to develop them.	2.97	1.124	59.4%
The incubator develops service delivery systems in order to respond to customer requests quickly.	3.05	1.092	61%	The incubator encourages research and development efforts.	2.88	0.808	57.6%
The incubator has the ability to reschedule internal operations to improve the speed of providing services to clients.	2.76	1.017	55.2%	The incubator is interested in constantly developing creative individuals in their field of work.	2.82	1.140	56.4%

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The speed of service delivery is appropriate for customers.	2.72	1.168	54.4%	The incubator has financial and human capabilities and capabilities that distinguish it from competitors.	2.93	1.157	58.6%
The incubator adheres to the specified deadlines to provide services to customers as quickly as required.	3.21	1.195	64.2%	The incubator works to develop and provide new and innovative services.	3.31	1.275	66.2%

Source: Authors

The Pearson correlation coefficient test was used to determine the correlation coefficients between the dimensions of technological business incubators and the dimensions of competitive advantage for entrepreneurial projects. The analysis showed that there is a positive, statistically significant relationship at the level (0.01) between the dimension (incubator resources) and the dimensions of competitive advantage (cost reduction, quality improvement, Speed and flexibility, creativity and innovation) with correlation coefficient values (0.543, 0.571, 0.548, 0.529), respectively. There is a statistically significant positive relationship at the level of (0.01) between the dimension (incubator strategy) and the dimensions of competitive advantage (cost reduction, quality improvement, speed and flexibility, creativity and innovation) with correlation coefficient values (0.589, 0.526, 0.524, 0.517), respectively.

There is also a statistically significant positive relationship at the level of (0.01) between the dimension (operating techniques) and the dimensions of competitive advantage (cost reduction, quality improvement, speed and flexibility, creativity and innovation) with correlation coefficient values (0.735, 0.738, 0.669, 0.674), respectively, and there is a relationship Positive, statistically significant at the level (0.01) between the dimension (objectives of the incubator and management) and the dimensions of competitive advantage (cost reduction, quality improvement, speed and flexibility, creativity and innovation) with correlation coefficient values (0.792, 0.741, 0.630, 0.647), respectively.

The results indicate that technological incubators associated with the Academy of Scientific Research actively support investment by private sector entities, companies, and banks in scientific research. Entrepreneurs confirm that these incubators facilitate the evaluation of outcomes derived from human investment and ensure the availability of essential facilities like halls, labs, and equipment. They also collaborate with production lines of various companies and factories to assist the projects and ideas of entrepreneurs. Furthermore, from the perspective of the entrepreneurs, the incubators' goals and management aim to establish a cohesive and comprehensive network among mentors, managers, strategic alliances, and company representatives. These incubators affiliated with the Academy of Scientific Research prioritize cost reduction in service provision by offering benefits to clients and gathering customer feedback on quality. They also maintain loyalty to timelines for delivering services rapidly. Additionally, the incubators attempt to innovate and supply new services.

3.2. SWOT analysis

The SWOT analysis of incubators in universities and research centres highlights a strong structure that supports innovation transformation, technical needs, and risk reduction, coupled with effective utilization of resources and transparent policies. Despite these strengths, the incubators face significant challenges, including insufficient government funding, limited marketing reach, and bureaucracy that hinder operational effectiveness and strategic planning. Opportunities arise from Egypt's rich resources and the presence of global companies, enhanced by donor support and technological advances. However, threats such as budget deficits, inadequate intellectual property protections, cultural barriers, and the potential brain drain to more favourable economic environments pose substantial risks to the sustainability and effectiveness of these incubators.

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Strengths:

- Organizational Structure: Incubators have a defined structure aligned with university and research centre goals, fostering community service and environmental development.
- Support for Innovation: Provides crucial assistance in transforming innovative ideas into marketable products.
- Technical Support Facilities: Offers workshops and labs to support the technical needs of incubated projects.
- Transparent Policies: Implements innovative and transparent policies for project acceptance.
- Risk Reduction: Minimizes obstacles and risks associated with starting businesses.
- Resource Utilization: Capitalizes on the university's capabilities and its creative and innovative talents.
- Project Evaluation: Conducts comprehensive evaluations of incubated and graduated projects.
- Reporting and Feedback: Provides periodic reports to help diagnose strengths and weaknesses.
- Entrepreneurial Training: Trains entrepreneurs to link their projects with various financing and investment programs.

Weaknesses:

- Insufficient Funding: Lack of adequate government funding to enhance product development and marketing.
- Limited Marketing Reach: Marketing strategies of incubators are confined to local levels, not extending to national or international scopes.
- Cultural Dissemination Gaps: In some universities, there is an absence of mechanisms to spread the culture of business incubation.
- Bureaucracy: Prevailing bureaucratic and non-dynamic approaches within incubator management.
- Strategic Planning Deficiencies: Shortcomings in strategic plans aimed at achieving financial sustainability.
- Hiring Standards: Limited adherence to clear global standards in recruiting talent.
- Operational Weaknesses: Weak operational procedures related to the stages of incubation.
- Continuity and Awareness Issues: Lack of continuous updates and awareness of the specialized courses offered by the incubator.

Opportunities:

- Natural and Human Resources: Egypt's rich and diverse resources provide a solid foundation for potential growth.
- Presence of Global Companies: The existence of leading global companies offers partnership and learning opportunities.
- Donor Support: Significant backing from donor agencies and international cooperation programs that support innovation.
- Technological and Digital Advances: Initiatives like the establishment of technological cities and a digital city enhance infrastructure for business incubation.
- Government and International Partnerships: Increasing trends towards creating collaborative ventures among government, universities, and industry.

Threats:

- Budget Deficits: Increasing deficits that impact funding availability for innovative projects.
- Intellectual Property Rights: A lack of procedures and awareness for protecting intellectual property.
- Unemployment: High unemployment rates could dampen the entrepreneurial spirit.
- Government Bureaucracy: Bureaucratic hurdles that complicate business processes and project registration.
- Lack of Competitive Analysis: Insufficient market analysis and business strategy development tailored to evolving markets.

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- Cultural Barriers: Low societal acceptance of entrepreneurship and self-employment.
- Taxation and Economic Challenges: High taxation and economic hurdles that discourage startup culture.
- Brain Drain: Flight of startups and entrepreneurs to more favourable economic environments, particularly the Gulf countries.

4. Discussion

The study showed the presence of positive, statistically significant relationships at the level of (0.01) between the dimensions of technological business incubators in Egyptian universities, which include the incubator's resources, strategy, operating techniques, goals, and management, and the dimensions of the competitive advantage of the incubated entrepreneurial projects. These dimensions include cost reduction, quality improvement, speed and flexibility in performance, and creativity and innovation. These results were reached through analysis of data collected from business incubators affiliated with the Academy of Scientific Research, which indicates that these incubators play an important role in enhancing the competitive advantage of the entrepreneurial projects they incubate.

Based on insights from a recent questionnaire and SWOT analysis, a series of strategies have been recommended to enhance the efficacy of Egyptian business incubators. These include increasing government support for universities and research centres in transforming scientific research into practical applications. There is also a call for developing distinct national policies that foster creativity and innovation. Establishing a committee of experts to refine project selection criteria is suggested to improve the quality and effectiveness of these incubators. Raising awareness about the importance of intellectual property rights is crucial for nurturing an economy based on knowledge and innovation. Additionally, there is a push for academics to translate their research into viable investment projects and for their active participation on the editorial boards of journals, focusing on research with tangible economic benefits. It's advised that research agendas should align more closely with labour market demands and promote the application of findings in practical settings.

Other recommendations also include using performance appraisals and constructing sound information systems that can monitor the project. It signals the creation of expanded units in universities to support specialized units to foster rare but innovative projects, programs for media activation that can demonstrate the benefits of partnerships, and policies that can facilitate the export capacity of pioneering projects. More crucial are propelling closer cooperation between the Academy and industry as well as stirring support by business leaders for innovative projects, not to mention revisiting the legislation framework that can support the creation of startups, said to be a necessary adjunct to bring the ecosystem closer to Egypt. Finally, linking relationships between the incubators and the business through the sector in terms of scientific organizations.

Conclusion

"Exploring the Role of Technology Incubators within Egyptian Universities and Research Centers Confirms Their Pivotal Impacts in Promoting the Growth of Entrepreneurship and Innovation." The incubators are the main catalyst for transforming creative ideas into competitive, feasible business projects. They can thus integrate pooled resources that would include mentorship, office space, and technology tools to strategic support from the Academy of Scientific Research and Technology, universities, and the government. Incubators significantly decrease startup costs and barriers so that entrepreneurs can instead focus on strategic growth and innovation. The results from the survey and SWOT analysis in the document, therefore, expose that the incubators do not only support startups by offering necessary resources but also through their integration into an ecosystem that supports sustainable economic development. Such an environment is valuable in enhancing innovation and offering the competitive edge that the startups urge in the global market. In conclusion, this study of Egyptian business incubation provides evidence that these have been, and continue to be, an integral source of support for the

country's broader economic development strategy via technological innovation. Incubators facilitate the commercialization of new technologies and contribute significantly to the economic and social landscape as they support the growth of knowledge-based enterprises.

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