Knowledge Sharing in Technology Business Incubators

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Abstract

Given the economic growth challenges facing countries all around the world, the importance of the initiative of technology business incubators in developing the economic growth of countries has been recognized. Technology business incubators are included in many of the processes that support economic growth, such as job creation and developing innovative technologies. This research paper examined how the knowledge sharing aspects impact technology business incubator performance in Saudi Arabia. The findings provide key factors affecting knowledge-sharing process towards technology incubator performance.
Keywords: Technology incubator, Business incubator, Knowledge sharing, Saudi Arabia

1. Introduction

The main purpose of technology business incubation is to support innovation through joint cooperation between competences and resources. As noted by Yee [1], "The technology incubator is an entity where knowledge is transformed into innovative products and services [1]." The combination of knowledge-sharing and incubator management helps these incubators to produce successful projects. In [2] the authors found that business incubator functions had a positive impact on the country economy [2]. A review of the literature shows the impact of business incubators was examined for different categories: job creation [3], incubatee development [4] and incubatee graduation percentages [5]. The incubators reviewed were of diverse types, including university-linked incubators, non-profit incubators and for-profit incubators [5]. A company's knowledge base is the essential factor of the growth of the company and its competition with other companies [6]. One of the principal challenges is creating projects using what incubators produce or incorporating incubators in new projects. To ensure the success of new projects, many sources are required [7]. Good performance and the sustainability of the projects are critical factors. Because of the growth of a knowledge-based economy, technology and innovation are considered important components of

performance [8]. The business economy can be enhanced by business organizations rely on their ability to innovate. Therefore, a lack of ability from completing projects successfully limits their business development and ability to improve their profits [9]. Innovation can contribute to rises in productivity, a high level of competition and wealth generation [10]. There are two areas in the literature that focus on business incubation: industry based and academic based. Incubation is treated as an agency, emphasizing the relationship between knowledge and innovation. While studying the incubation's evaluation, a certain division in the incubation's process has got academic researcher's attention [11-13]. Many technology incubators are linked with study organizations such as universities, tech-parks or corporate/industries with research and development (R&D) resources in the public and private sectors. As a result, technology incubators contribute to supporting entrepreneurs, tech-based organizations and other affiliates of universities and big organizations by providing appropriate materials for survival, wealth-generation and job foundation.

In the Kingdom of Saudi Arabia (KSA), incubators are considered an essential part of the technological development of the country by encouraging business innovation. The main goal of Saudi incubators is to help Saudi society become more knowledge based, leading to the development of a knowledge-based economy [65] through designed programs providing good opportunities to help in such situation. Although incubators in Saudi (KSA) are not in incubation world for a long time, they have a positive impact on the development of technology incubators. However, research states that technology incubators in developing countries are unable to meet expectations. They also did not help the local economy to grow, the apply the technology, the design of new enterprises, or increases in the establishment of new jobs [14]. A review of related studies shows that technology incubation in KSA is in its progress levels [15]. In Riyadh and Jeddah there are two private-sector firms that operate as technology incubators by providing fee-based services to aspiring entrepreneurs. Saudi technology incubators are not autonomous institutions because they work under universities, therefore the funding and services provided in these incubators are limited [16]. The aim of Saudi technology incubators is to support entrepreneurs, thus contributing to the economic growth of KSA. Private firms and academic institutions manage the technology incubators and parks in Saudi Arabia. The purpose of this research is to solve the gap in the current research by studying technology incubators in Saudi Arabia.

There is a lack of existing knowledge about the process of business incubation [17]. Consequently, the effect of business incubation and the influence incubators have on startups are not confirmed or clear [18]. The goal of business incubators is to help new companies become established and successful. It has been proven that knowledge plays a fundamental role in successful startups. The knowledge that defining by many academic researchers is significant for a new projects' performance [19].This research examines how the performance of Saudi technology business incubators is affected by applying knowledge-sharing practices.

2. Literature Review

2.1. Incubators

There are different categories for incubators depending on the service they provide, the type of customers they have and their organizational structure [20]. Academic scholars have introduced the incubators in a high adaptable way, therefore with each goal improving the local economy, they provide some features, such as providing jobs for youths, enhancing the affluence of local areas and addressing the mechanisms of transferring technology or research detected at organizations or universities. The biggest concern of incubators is the growth of innovative technologies, producing goods and offering services to people/customers. Different types of incubators include business, technology and mixed/general. Business incubators are designed to advance and motivate general businesses for specific economic purpose such as industrial restructuring and the generation of income as well as the beneficial consumption of offered resources [21]. The main purpose of setting up the mixed/general-use

incubators is to encourage continuous industrial and economic development in the area that the organization belongs to through overall business growth [22]. While these incubators are knowledge-intensive companies, they may also work with low-technology companies from the services and light manufacturing industries. The goal of technology incubators is to support the technology growth levels of firms and new businesses that have been endorsed by business incubators [4]. However, technology innovators are classified by their main objective. This objective is twofold: completing their particular role in enhancing technology-based firms and to assisting those technologies that are under development. Technology incubators are typically present near study and growth institutes such as universities and science technology parks. The main type of incubators discussed in the literature are business incubators and technology incubators, with technology incubators generally considered as a sort of business incubator [23]. The first technology incubator established in Saudi Arabia was BADIR-ICT (Badir), which was opened in January 2008 [14]. The Badir incubator operates as a section of the National Badir Technology Incubator Initiative of Saudi Arabia's national studies organization at the King Abdul Aziz City for Science and Technology although began to admit its primary projects. The government of the KSA have budgeted 8.6 billion US dollars for studies and improvement as part of a 20-year National Science and Technology Plan [24]. Up to now, numerous projects that work specifically as business and technology incubators have been developed include the King Abdullah Bin Abdul Aziz Science Park (KASP), Technology Zones (SOIETZ), the Saudi Organization for Industrial Estates, the King Saud University Science Park (KSSP), the Information Technology and Communication Complex (ITCC) and the King Abdul Aziz City for Science and Technology (KACST) in addition to several technology incubators, particularly technology parks that are presently in the planning stages.

2.2. Knowledge-Sharing Process

Knowledge is very important factor that contributes to maintaining the learning skills, problem-solving skills and essential experiences of organizations, and to identify new useful situations [25]. Knowledge-sharing in incubators can help an organization to develop competitive benefits, like the improvement of intelligence capital, by inspiring the exchange and creation of knowledge inside itself. While knowledge is the primarily a competitive advantage, helping organizations to achieve continuous innovation, it is a strong factor in the advancement of any organization and it is considered a significant indicator in the efficient performance of technology incubators. Knowledge-donating and knowledge-collecting are the two methods of knowledge-sharing that can be useful for a technology incubator [26]. Knowledge-sharing is vital activity in all businesses that are based on knowledge management. All knowledge-sharing that happens between staff in an organization should be considered as either knowledge-donating and knowledge-collecting. While knowledge-sharing is in important part of knowledge management, knowledge management is a larger term that includes a wide range of subjects [27]. When knowledge-sharing is performed using a consistent knowledge management approach, it can help organizations achieve their strategy of enhancing their performance and capabilities effectively [28].

3. Theoretical Background and Research Model

This research aims to improve a conceptual model based on overall theoretical considerations from relevant research and current empirical evidence pertinent to the experience under investigation. Thus, this section is a review of both related frequently used models and reflected theories regarding the modified model in this research. Knowledge-sharing is the major theoretical basis of these existing models. Research conducted in organizational settings which could present a theoretical foundation for the study is cited because of the literature presented on research carried in technology incubators is controlled. Figure 1 displays the research model and Table 1 presents the factors description.

Knowledge-donating and knowledge-collecting are the two knowledge-sharing processes [26, 29]. These terms illustrate the process where knowledge is exchanged, transmitted and created between staff. The literature review shows the influences of knowledge-sharing are categorized into two groups: individual influences and organizational influences [30, 31].In knowledge-sharing individual extent, the majority of related literature studied the individual influences of self-efficacy [29, 32], enjoyment in sharing knowledge [29], and interpersonal trust [33-36]. Also, looking at organizational knowledge-sharing, the majority of related literature discussed the motivational influences that consist of management support [37-40], information technology infrastructure [41, 42], and inducements and rewards [35, 37, 43]. In order to consider the impact of individual (self-efficacy and enjoyment), organizational (top management support, organization rewards) and technology factors (the use of IT) on the knowledge-sharing practices regarding an organization's innovation capability, Lin developed a model [29]. The results show that organizations can enhance their innovation performance through developing a knowledge-sharing culture. Choi and Lee [30] developed a model to examine the relationship between knowledge practices and enablers (such as organizational content and technological content) on organizational creativity and performance [30]. The outcome of this model shows that the effective use of some approaches, such as organizational creativity and knowledge enablers, can have economic benefits for organizations. Moreover, the relationship between knowledge-sharing, innovation and organizational performance was investigated by Wang and Wang [44]. Their findings show that financial and operational performance are affected by innovation speed and knowledge-sharing.

There is no single explained criterion that can assess the performance of technology or business incubators [45]. However, a number of studies have examined diverse indicators in order to define incubator performance [46]. For instance, Rothaermel and Thurs examined university-based incubators by looking at the revenues produced, performance of tenants, total funds upraised, project capital finance obtained and whether firms succeeded, failed or remained in the incubator [47]. Mian's [48] finds there are four kinds of performance results for university technology business incubators [48]: (a) the program's sustainability and development, (b) tenant firm's survival and increase, (c) contributions to the sponsoring university's mission, and (d) community-related impacts according [48, 49]. The researcher used Mian's [48] assessments of incubator performance in the content of the recent study. The developed model is presented in the Figure 1.

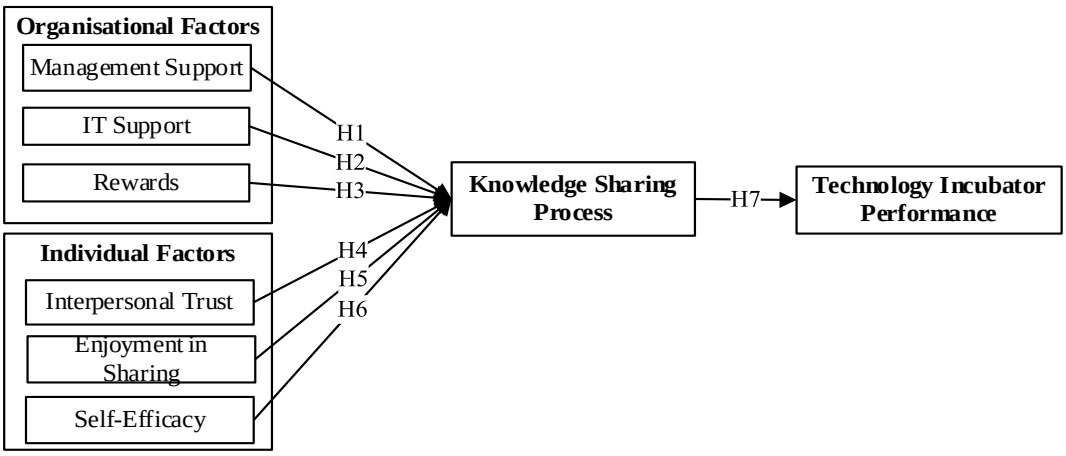

Figure 1: Research Model

Table 1: Factor's Description

Factor	Description	Source
Knowledge-sharing process	Knowledge-donating refers to "the process of individuals communicating their personal intellectual capital to others" while knowledge collecting is defined as the "process of consulting colleagues to encourage them to share their intellectual capital."	[29, 50]
Knowledge-sharing individual factors	Self-efficacy refers to as the "judgments of individuals regarding their capabilities to organize and execute courses of action required to achieve specific levels of performance." Trust: refers to "co-workers having a good level of faith in each other in terms of intentions and behaviors." Enjoyment in sharing knowledge is identified as "Knowledge workers who derive enjoyment from helping others may be more favorable oriented toward knowledge sharing and more inclined to share knowledge – in terms of both donation and collecting."	[29, 51, 52] [32, 53]
Knowledge-sharing organizational factors	Management support is identified as "The degree to which the top management support the organisational climate of knowledge-sharing by providing sufficient resources and influencing the employee willingness to share knowledge." IT support is identified as "level to which facilitating knowledge-sharing through information technology use." Reward is identified as "the degree to which a reward system to share any new and creative ideas and effectiveness knowledge-sharing."	[54]
Technology business incubator performance	Performance outcomes: • Sustainability and program growth (such as, space, growth of budget ,services, facilities, staff and tenants) • The survival of tenant company and growth (such as, growth in sales, growth in employment) • Contributions to sponsoring university's mission Community-related impacts (such as sales, revenues, taxes, experience and graduate employment)	[48, 49]

3.1. Hypotheses Development

Motivational Factors for Knowledge-Sharing – Organizational Dimensions

Management support: The vision of organizations is related to the involvement of leadership that is implicated in efficient usage of knowledge [55]. Management support is significant in enhancing the culture of knowledge-sharing [38, 39]. According to Wong, leaders are role models for demonstrating knowledge-sharing behavior in organizations [37]. Moreover, leadership has an influence on the behavior of knowledge-sharing. For instance, managers need to support and monitor staff contribution in knowledge-sharing actions [40, 42]. Hence, hypothesis 1 (H1) posits that:

H1: Management support positively impacts the knowledge-sharing process (donation and collection) in Saudi technology incubators.

Information technology (IT) support: In knowledge-sharing practice, information technology support is a major influence on the knowledge flows that accelerate the process of sharing knowledge [41]. There are two main components of IT infrastructure that are used to improve knowledge-sharing practices: hardware and software [42] and increase knowledge-sharing features like the range and timeliness [56]. For that reason, implementing technology in the organization's functions is very important, especially in knowledge-sharing. Therefore, it is encouraged that organizations provide sufficient IT training for staff [55]. Therefore, hypothesis 2 (H2) posits that:

H2: Information technology positively impacts on knowledge-sharing practices (donation and collection) in Saudi technology incubators.

Rewards: It is recommended that staff who are involved knowledge-sharing practices be encouraged by having a reward system as motivation [37]. Team performance could be more efficient if individuals contributed to the process of knowledge-sharing, which may also increase individual rewards expected [43]. Having a reward system can encourage staff to be involved in the process of knowledge-sharing [57]. Some values have an instant influence on motivation regarding knowledge-sharing between colleagues [43, 58]. Accordingly, hypothesis 3 (H3) posits that:

H3: Rewards positively impact knowledge-sharing practices (donating and collecting) in Saudi technology incubators

Motivational Factors for Knowledge-Sharing – Individual Dimensions

Interpersonal trust: The literature shows that staff can be more effective and collaborative in providing valuable knowledge if there is a trust between them [33]. A lack of trust can affect individuals in negative way by making them unmotivated to share any kind of knowledge [34, 35]. Consequently, individuals' inclination to donate or collect knowledge is enhanced by interpersonal trust [36]. Hence, hypothesis 4 (h4) posits that:

H4: Interpersonal trust positively impacts knowledge-sharing practices (donation and collection) in Saudi technology incubators.

Enjoyment in sharing knowledge: Research findings show that the joy that gained from when staff help each other leads to these staff being more interested in providing knowledge [32, 53].Therefore, staff can be more effective in knowledge-sharing processes in both donating and collecting [29]. Therefore, hypothesis 4 (H5) posits that:

H5: Enjoyment in knowledge-sharing positively impacts knowledge-sharing practices (donation and collection) in Saudi technology incubators.

Self-efficacy: Self-efficacy is how a person judges his or her ability to arrange and perform daily life activities effectively [29]. The tendency of individuals to take actions (problem's difficulty, perseverance, task effort and expressed concern) effect on the individual's sense of self-efficacy [59, 60].Lin stated that an organization's performance is enhanced by the contributions of knowledge-sharing, if staff's willingness to donate and collect knowledge is boosted [29]. Hence, hypothesis 6 (H6) posits that:

H6: Self-efficacy positively impacts knowledge-sharing practices (donating and collecting) in Saudi technology incubators.

Knowledge-Sharing Practices

An organization's performance can be improved by organizational cerebral capital and the indefinable resources that are created by efficient knowledge practices [61]. For instance, two kinds of knowledge are tacit knowledge and explicit knowledge. The whole organization benefits when staff transfer knowledge from tacit into explicit [62]. This means that better knowledge management of an organizations' assets leads to a greater chance to boost its performance in the market [62, 63]. Hence, hypothesis 7 (H7) posits that:

H7: Incubatees' willingness to share knowledge (donating and collecting) positively impacts technology incubators' performance in Saudi technology incubators.

4. Approach

This study applied the survey method to collect numerical data from participants in technology incubators in Saudi Arabia. The sample consists of employees at university incubators, including the King Abdullah Bin Abdul Aziz Science Park (KASP), the King Saud University Science Park (KSSP) and the King Abdul Aziz City for Science and Technology (KACST) as well as BADIR-ICT, the Saudi Organization for Industrial Estates and Technology Zones (SOIETZ), and the Information Technology and Communication Complex (ITCC) technology incubators. The survey was originally developed in English. A translated Arabic version has been included in the survey. Participants were required to fill in a questionnaire that contained closed ended questions that require responses on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) is used. The research model is tested using the Partial Least Squares-Structural Equation Modelling (PLS-SEM) statistical technique using SmartPLS version 3 [64], which is considered to be suitable for this study. PLS allows the researchers to concurrently evaluate structural path coefficients and measurement model parameters. In this research model, all constructs were modeled as reflective indicators because they are viewed as effects of latent variables.

5. Data Analysis

Survey was sent to 150 participants and 130 people participated in the survey. After removing incomplete responses, a total of 110 responses have been used for data analysis. Data collection lasted from November 2016 to January 2017. Descriptive analysis shows that 70% of the participants were male and 30% were female. 60% were in the age of 26-35 years, 30% participants are 36-45 years and 10% are older than 45 years. 55% of the respondents hold a master's degree; followed by 35% with a bachelor's degree and 10% with a doctoral degree. 50% of participants have more than 5 years of work experience, followed by 30% with between 3-5 years. 20% of the participants have work experience of 1-3 years.

5.1. Reliability and Validity Assessment

In order to test the reliability and validity of all factors, the measurement model is evaluated by composite reliability and discriminant validity. Convergent and discriminant validity are calculated using items loadings that were at least 0.70 and the square root of the average variance extracted (AVE) from its factor indicators, which was at least 0.70 and was greater than that factor correlation with other factors. Items loading are shown in Figure 2. Table 2 shows the average variance extracted (AVE), Cronbach's reliability, composite reliability and the AVE of all constructs values exceed the recommended value of 0.70.

Table 2: Reliability, Correlation, and Discriminant Validity of Constructs

	AVE	C-alpha	CR	ES	ITS	ITrst	KSP	MS	Rwd	SE	TIP
ES	0.63	0.74	0.84	**0.79**							
ITS	0.75	0.85	0.9	0.68	**0.86**						
ITrst	0.63	0.73	0.84	0.61	0.59	**0.79**					
KSP	0.61	0.86	0.89	0.75	0.67	0.58	**0.78**				
MS	0.69	0.8	0.87	0.72	0.64	0.54	0.67	**0.83**			
Rwd	0.75	0.85	0.9	0.48	0.62	0.35	0.55	0.45	**0.86**		
SE	0.63	0.74	0.84	0.72	0.65	0.6	0.72	0.69	0.5	**0.79**	
TIP	0.71	0.87	0.91	0.84	0.68	0.6	0.82	0.7	0.51	0.77	**0.84**

Notes: 1. AVE: Average variance extracted, CR: Composite reliability, C Alpha: Cronbach's alpha
2. ES: Enjoyment in sharing, ITS: IT support, ITrst: Interpersonal trust, KSP: Knowledge-sharing process, MS: Management support, Rwd: Rewards, SE: Self-efficacy, TIP: Technology incubator performance
3. Diagonal elements are the square root of AVE.

5.2. Structural Model Testing

In order to test the proposed hypotheses, the structural model was tested by analyzing the significance of the paths between factors using t-test calculated with the bootstrapping technique at a 5 percent significance level [66]. The coefficients of the causal relationships between factors are determined by the significance of the path coefficients and the (R^2) variance of the dependent construct. Table 3 shows the path co-efficient mean, standard deviation and t-statistics and p-value for each of the proposed hypotheses. The recommended t-values are $t > 1.96$ at $p < 0.05$, $t > 2.576$ at $p < 0.01$, $t > 3.29$ at $p < 0.001$ for two-tailed tests. As shown in the Table 2, the results confirm the relationship in significance for all hypotheses at $p<0.05$. Figure 2 shows the path testing.

Table 3: Hypotheses Testing

	Path	Path coefficient mean	StDev	T statistics	P value	Supported?
H1	Management support -> KSP	0.30	0.06	4.93	0.00**	Yes
H2	IT support -> KSP	0.12	0.06	1.84	0.04*	Yes
H3	Rewards -> KSP	0.09	0.04	1.99	0.02*	Yes
H4	ITrust -> KSP	0.82	0.02	52.55	0.00**	Yes
H5	Enjoyment in Sharing -> KSP	0.11	0.05	1.98	0.04*	Yes
H6	Self-efficacy -> KSP	0.14	0.05	2.69	0.01*	Yes
H7	KSP -> Tech. incubator performance	0.23	0.05	4.47	0.00**	Yes

Notes:
- StDev: Standard deviation, KSP: Knowledge-sharing process,
- *Significant at 0.05 level, **Significant at 0.01 level

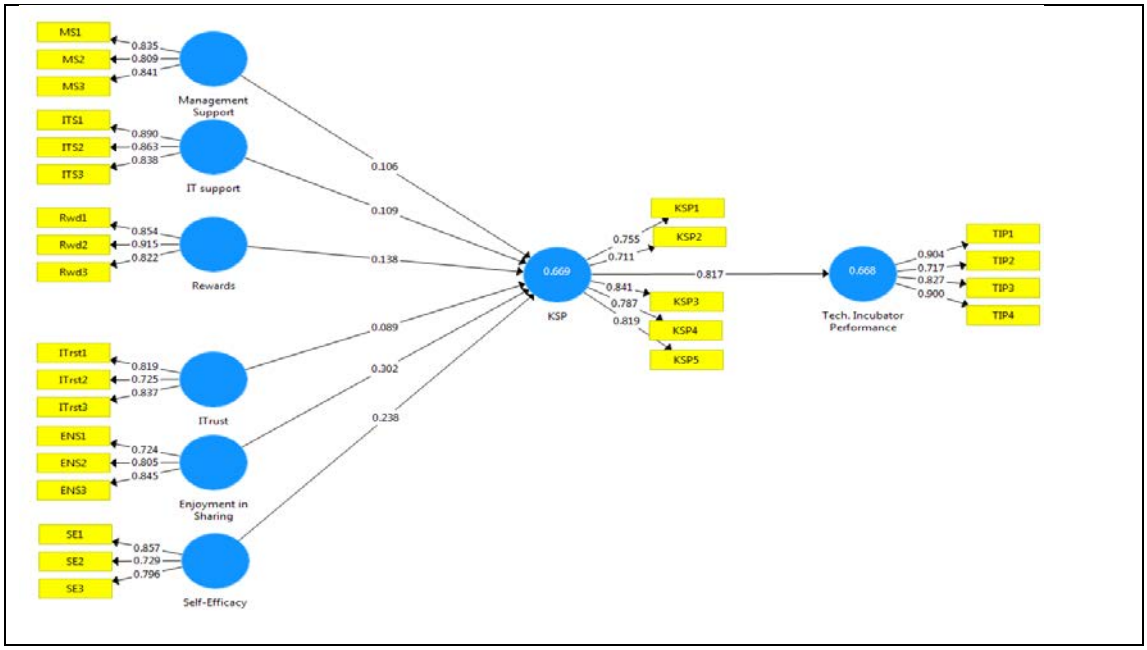

Figure 2. Path Testing

As shown in Figure 2, the results confirm the relationship is significance for all hypotheses at $p < 0.05$. $R^2 = 0.66$ indicates 66 percent variance in the knowledge-sharing process. Also, for the technology incubator performance $R^2 = 0.66$ indicates 66 percent variance in actual technology incubator performance in Saudi Arabia.

6. Discussion and Conclusion

According to the path testing as shown in Figure 2, the order of significance among the knowledge-sharing organizational factors that have a significant effect on knowledge-sharing process is “rewards,” followed by “IT support” and “management support.” This indicates that giving incentives to employees helps to encourage knowledge-sharing processes. This could be attributed to the fact all the participants in the survey were Muslims. As per Islamic belief, rewards are encouraged by religion, which is consistent with Prophet Mohammed’s recommendation. Additionally, participants’ knowledge-sharing information is influenced by the degree of top management and IT support. This is consistent with Wong [37]. The organization promotes a knowledge sharing culture that focuses on participation.

In addition to this, the order of significance among the knowledge-sharing individual factors that have a significant effect on the knowledge-sharing process is “enjoyment is sharing,” followed by “self-efficacy” and “interpersonal trust.” This shows that employees enjoy helping each and others and having a good level of faith in each other regarding their capabilities to organize and execute the courses of action required to achieve specific levels of performance. Finally, knowledge-sharing processes (donation and collection) enhance technology incubator performance such as tenant firms' survival and growth, contributions to sponsoring universities' missions and community-related impacts (such as sales, revenues, taxes, experience and graduate employment).

In conclusion, this study has fulfilled its main aim to examine technology business incubator performance by studying the incubation process, such as the knowledge-sharing process, which is important in the developmental process of new ventures. Concerning implications from a theoretical and practical perspective, this study contributes to the literature by presenting a proposed knowledge-sharing factors model in the incubator context. Practically, therefore, in an effort to encourage employees to adopt knowledge-sharing processes, Saudi technology incubators should implement supportive knowledge-sharing processes within the organization. As a result, the incubators’ stakeholders will gain advantages from knowledge-

sharing that will improve the organization's goals achievement. The Saudi incubators are designed for technology innovations, which are mainly established to serve as knowledge-based programs to produce opportunities that lead to transforming the country into a knowledge-based society and consequently developing a knowledge-based economy [65]. Finally, this study has limitations. This research model did not cover all aspects of the knowledge-sharing process. Thus, this is an area for future research to consider.

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