

The Role of Technology Incubators in Fostering Interorganizational Networks

A Case Study of MaRS

Gan Jing

EMBA Education Center, National School of Development, Peking University, Haidian District, Beijing 100080, China.
ganjing@nsd.pku.edu.cn

Correspondence should be addressed to Gan Jing: ganjing@nsd.pku.edu.cn

Article Info

Journal of Enterprise and Business Intelligence (<https://anapub.co.ke/journals/jebi/jebi.html>)

Doi: <https://doi.org/10.53759/5181/JEBI202505005>

Received 10 September 2024; Revised from 25 October 2024; Accepted 28 November 2024.

Available online 05 January 2025.

©2025 Published by AnaPub Publications.

This is an open access article under the CC BY-NC-ND license. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Abstract – Business Incubators (BI) emerged in the early 1980s as a result of previous experiences with different services aimed at developing businesses. Their main objective is to support the process of creating new ventures. They offer cost-effective workspace along with shared amenities, counseling, training, data, and connections to external networks for entrepreneurial collaborations. In this research, we employed a case study design to theorize on the network’s nature and strategies of incubated firms at MaRS Innovation Centre in Canada. This research was carried out over two years (2021–2023) in the form of 29 interviews with the representatives of the MaRS tenants, including senior executives (20) and managers (7). The interviews that explored business development, R&D strategies and networking at MaRS were audio-taped, transcribed, and analyzed using conventional qualitative data analysis procedures. Tenants were grouped according to business type and incubator functions, while networks were further coded based on functions and partners. The analysis revealed three types of networks such as advisory, spin-off, and strategic, with different degrees of engagement of support organizations, large enterprises, and SMEs. Enablers incorporated the community setting, MaRS business services, close access to advisers, clients, and partners, and MaRS identification, while barriers consisted of distinct business orientations, restricted resources, numerous tenants at MaRS, and approaches to recruitment. MaRS had a strong collaborative culture and offered a wide range of services that greatly supported network development and usage among the tenants.

Keywords – Business Incubators, Interactive Community Setting, MaRS Innovation Centre, MaRS Administration Services, High-End Quality of MaRS, Interorganizational Networks.

I. INTRODUCTION

In contemporary times, innovation has emerged as the primary driver of long-term economic growth and is progressively linked with improvements in efficiency and competitiveness. According to Hekkert et al. [1], innovation originates from the agent’s need for change. Wang, Dou, and Zhou [2] suggest that producers are typically the initiators of economic change, while consumers, if necessary, are “educated” to desire new or different things from what they are accustomed to consuming. According to Chen, Chiang, and Storey [3], innovation can be differentiated from invention in that invention refers to the act of discovering an opportunity, while innovation refers to the act of capitalizing on a profitable opportunity. According to Caloghirou, Kastelli, and Tsakanikas [4], innovation involves allocating new abilities to current resources inside the organization, resulting in the creation of wealth. Educational institutions play a substantial role in the advancement of new technologies by facilitating the transfer of knowledge. This transfer is essential for economic development and progress, whether in industrialized or developing countries.

Alvarez and Barney [5] assert that prosperous entrepreneur’s endeavor to generate value and make contributions. However, they are not satisfied with enhancing existing circumstances; instead, they strive to generate value and attain novel and distinct gratifications. This is accomplished by creating a fresh and more efficient innovation through the amalgamation of preexisting resources. Hence, it is imperative to engage in systematic innovation and actively pursue purposeful and coordinated improvements. Providing targeted assistance to specific companies has been proven to significantly increase the likelihood of Business Incubators (BI) staying in business. Furthermore, Li et al. [6] suggests that the initial financial support given by the government is repaid through taxes, along with other positive effects such as promoting entrepreneurship and fostering cultural transformation. The rate of growth has been exceptionally swift, and what the world currently requires is not merely additional incubators, but enhanced ones. Enumerating the quantities of incubators is a perilous undertaking,

given the significant discrepancies in definitions across different countries. Furthermore, the situation is always changing while the flow of information is irregular. As of 2001, out of the total 3,500 worldwide, over 1,100 are expected to be in both North America and Europe [7]. Asia contains around 700, while the remaining are located in South America, Africa, and other countries. The bulk of individuals in Europe are located in Germany, France, and the UK. [8] Curiously, incubators in developed countries have a wide range of goals, whilst those in developing nations primarily concentrate on technology.

Business Incubators (BI), particularly those focused on technology, play a vital role in enhancing competitiveness in the national economy. They are essential elements of the innovation process [9]. The environment promotes the interchange of new knowledge, which is based on technological expertise gained via ongoing learning [10]. The success of incubation ventures is ascribed to the competencies and proactive efforts of both the incubated enterprises and the incubators [11]. Throughout the process of innovation, a firm that is being incubated has the capacity to acquire and assimilate knowledge, as well as cultivate the necessary technical and behavioral skills needed for the innovation process. In addition, incubators employ highly skilled advisers on their team to guarantee the success of incubated firms throughout the incubation phase [12]. The correlation between the firm being incubated and the incubator displays significant potential for producing favorable results due to the high level and excellence of their interactions.

Our research mainly stems from the understanding that technology-based incubators, including MaRS Innovation Centre, fosters interorganizational networks to meet the strategic needs of incubated organizations. Therefore, this study aims at identifying the characteristics of network formation, the enablers and barriers to network formation with a view of providing understanding on the delivery of incubator services and impact of collaborative structures for the development of firms. Concerning the implications of the findings, they have to do with the discussion of the kinds of effect that incubators can have such as enhancing innovation, enhancing business models and supporting the positive sustainable development of technology-based organizations. The aim of this study is to enhance the understanding of networking behaviors of hi-tech companies and the links to incubator ecosystem using a qualitative research method. The examples highlighted in this study reveal how different forms of networks can be established. An assessment is also done on all the actions of the parties involved on the enablers and barriers. The paper used a case study design with the aim of developing theory on the characteristics of networks as well as how the incubated firms can engage and gain access to them. The primary research questions that propelled this study were as follows:

- How do the endeavors of technology-based incubators enable interorganizational systems to correspond to the requirements of firms?
- How do incubated administrations perceive and understand the systems they are involved in?
- What factors facilitate or impede the development of advantageous networks?

The subsequent sections of the article have been arranged in the following manner: Section II describes the conceptual framework, which includes incubators and networks. Section III presents the methodology employed when composing this research. The findings of this research have been discussed in Section IV and V to further shed light on the type of networks, network enablers, and network barriers. Lastly, Section VI concludes the research and recommends future research directions.

II. CONCEPTUAL FRAMEWORK

Incubators

Ayatse, Kwahar, and Iyortsuun [13] define an 'incubator' as an administration that facilitates the birth and growth of new enterprises. This term is commonly used to encompass many types of organizations that support the establishment of startups. Cancino et al. [14] assert that previous studies on incubators have primarily focused on measuring their outcomes. They argue that identifying best practices necessitates a comprehensive approach that considers the incubators' goals and evaluates the interpretation of dissimilar incubators in relation to their specific incubation models. Although the field of Business Intelligence (BI) has been around for a while and has been extensively studied, there is still no universally agreed-upon definition for BIs as shown in **Table 1**. Neteler et al. [15] define a BI as a shared office space facility that aims to give its incubatees with a value-added and strategic intrusion mechanism for business and monitoring help [16]. This highlights the similarities identified among definitions provided by business incubations, extensive studies, and academic research see **Table 1**. Overall, Business Incubators (BIs) are efforts that focus on property and offer a combination of services to its tenants, including business support services, networking, and infrastructure opportunities [17].

These definitions also imply some effects of Basic Incomes (BIs). Tavoletti [23] define BIs as a tool for encouraging economic advancement, while Bøllingtoft and Ulhøi [24] suggests that BIs assist enterprises with exceptional potential in generating employment and wealth. Mukherjee [25] extends its scope by proposing Business Incubators (BIs) as instruments to rejuvenate communities and enhance the economic strength of nations. The underlying premise here is that providing assistance to enterprises at its first stages, shielded from the competitive nature of the market, will enhance their likelihood of achieving success and ensuring their long-term viability. Regarding Technology Incubators [26], the impact is particularly noticeable since Business Incubators (BIs) serve as a crucial connection between technology-focused entrepreneurs and the process of bringing their service or product to market.

Networks

A network refers to a collection of connections involving different individuals or organizations [27]. Each of these can furnish a centered corporation with vital resources. Acquiring network resources is crucial for entrepreneurial enterprises [28]. According to Bititci et al. [29], company competencies encompass the capacity to create, sustain, and leverage connections with diverse external partners. Storbacka and Nenonen [30] argue that relationships play a crucial role in understanding customers' demands, enabling the firm to offer marketable services or products. The researchers discovered that the network capability of university spinoffs had a positive impact on their success. In their study, Pietrobelli and Rabellotti [31] discovered that having a strong networking capability helps enterprises in creating knowledge-intensive goods and enables them to recognize and take advantage of performance opportunities in global markets.

Table 1. Various Definitions of Business Incubation (BI)

References	Definitions
[18]	BI is a process that helps start-up and fledgling companies grow quickly and successfully by offering entrepreneurs a range of specialized services and resources.
[19]	BI is a distinctive and adaptable blend of company development procedures, infrastructure, and personnel, specifically designed to foster and expand new and small firms by providing support during their first stages of growth and transformation.
[20]	A BI is an organization that facilitates and synchronizes the process of development of successful firms by providing them with a one-stop-shop solution that includes business support services, incubation, and opportunities for networking and clustering.
[21]	BI is a broad term that incorporates several procedures of company development, structures, and people who are involved in the development of small emerging firms at their infancy. Moreover, it is also defined as an economic instrument with the main aim of facilitating the establishment of new businesses within a nation.
[22]	BI aids in the establishment of new businesses and the entrepreneurial process by offering assistance to the new enterprise at its most critical and fragile phase. Incubators aim to stimulate job growth and economic progress by establishing a supportive framework that fills knowledge gaps and connects skilled individuals, resources, and funding to assist new business endeavors.

According to Pettersen et al. [32], incubated firms consider networking and clustering to have the least impact on the development of their businesses. This is because businesses have different commercial objectives and hence realized low advantages in collaborating with local administrations. Galston [33] contended that although networks play a crucial role in high-tech incubators, there is less understanding of the underlying mechanisms that drive these models. The researchers evaluate the interactions or connections between various administrations within or affiliated with a technology-based incubator, with the aim of gaining a deeper comprehension of how these interactions may impact the growth and longevity of tenant enterprises. The research specifically highlights the connections between the networking tactics of incubated enterprises and the incubator's approach to promoting networking.

III. METHODOLOGY

The utilization of the MaRS Innovation Centre in Toronto, Canada as a case study provides an ideal location for completing this investigation. MaRS is an organization based in Toronto, Canada and specifically in the downtown area. It is situated in the 'Toronto Discovery District' with several research institutes, one of which is the University of Toronto. Originally launched in 2005 as an attempt to link the spheres of government, business, and science, the incubator has evolved and provides services for over 60 tenants [34]. The services offered by the MaRS Centre can be described as comprehensive which is typical of the technological incubators. These services consist of management consulting on corporate management, accountancy, selling and promotional services, financial and human resource management among others. They also provide legal and Intellectual Property (IP) support and customer support and other operational services.

The MaRS Centre is among the most recognizable representatives of vast network-oriented technological incubators linked with renowned academic universities. Several public and commercial entities have contributed towards the development of MaRS through partnerships, which have shaped its strategy and architecture. Some of its partners include Ogilvy Renault LLP, the Royal Bank of Canada, and the original members of MaRS. Some of these prominent companies contributed to the support of the incubator by occupying the status of 'anchor tenants' and providing various services to the enterprises in the process of their incubation. Another factor that boosted the credibility of the incubator was affiliation with several reputable universities and research institutions. It was seen as a 'success story' in policy journals and official documents, including the Government of Ontario report in 2021. The timeline for this study was two years which was from the year 2021 to 2023. In the first year of the study, Both, structured and unstructured and also general interviews were conducted on the occupants of the MaRS Innovation Centre. Interviews were done with representatives from 29 MaRS renters who voluntarily consented to participate. The interviews were performed in person and over the telephone.

Out of the informants, 20 interviewees had top executive roles, whereas seven interviewees held managerial or professional positions within their firms refer to **Table 2**. The interviews encompassed inquiries regarding the tenants' business advancement and research and development plans, as well as more detailed inquiries about their knowledges at MaRS. The latter investigated the reasons for choosing MaRS as a location, examined the characteristics of the incubator that either facilitated or impeded the tenants' progress, and analyzed the expenses and advantages linked to the tenants' research and development activities in relation to MaRS.

Table 2. Role of Interviewees

Roles within the organization	Large organizations	Supporters	Research or non-profit organizations	Small and medium-sized enterprises	Total
Professional or managerial	0	5	1	3	7
Senior executive	2	6	3	9	20
Total	2	11	4	12	29

In addition, inquiries were made regarding the tenants' official and informal connections both outside and within the incubator in order to understand the origin, qualities, and advantages of their current models. The interviews were documented and converted into written form. The data was organized, coded, and analyzed using conventional qualitative data analysis approaches [35]. The tenants were first classified based on the type of their enterprises and their respective functions inside the incubator. Subsequently, the networks of the tenants were discovered and categorized based on their respective collaborators and functions, as outlined in **Table 3**. During the investigation of the tenants' models, careful consideration was given to any elements that facilitated or impeded their creation.

IV. RESULTS

Type of Network

The primary results of this research relate to the characteristics of different models. While previous works frequently addressed networking in a general manner, it is crucial to distinguish between several categories of models. Three distinct categories of models were found within the incubator: strategic, spin-off, and advisory refer to **Table 3**.

Table 3. Detailed Breakdown of Findings of SME Networks, Organized According to Types of Collaboration

Organization	Collaborator	Type of network
Ambit Biosciences	Accounting/Auditing firms	Advisory
Octopz		
AXS	Government agencies	
NeurAxon Inc.	Venture capital firms	
ConstabPharma	Legal counsel	
Arctic DX Inc.	Large enterprises	Spin-off
BioQuest Innovations	University of Toronto	
Sigma Analysis and Management Ltd.		
Clera Inc.		
Global Health McLaughlin-Rotman Centre		
Ambit Biosciences	Practicalities	Strategic
Arctic Dx Inc.	Government	
Vasogen		
Sigma Analysis & Management Ltd.		
BioQuest Innovations		
AXS	Research Institutes, Universities (colleges, & Hospitals)	
CBERC	Investors, venture capital organizations	
ConstabPharma	Small, medium, and large enterprises	
ONSETT		
Skymeter Corporation		

OCBN	
NeurAxon Inc.	
Kanata Chemical Innovations	Professional association
McLaughlin-Rotman Centre	Technological transfer office

The identification of these kinds was based on the goals and tactics mentioned by the respondents for their networking efforts. This was done by drawing upon various network typologies found in the literature [36]-[39]. The support groups primarily engaged in advice frameworks and sporadically participated in strategic frameworks as an external investor. The major corporations engaged in planned frameworks to establish alliances in study and advancement, venture capital, clinical trials, distribution/supply, and government relations. The small and medium-sized enterprises (SMEs) were entailed in three types of networks, namely Advisory networks, Spin-off networks, and Strategic networks.

Network Enablers

The MaRS Centre defines itself as a 'convergence center', where science, capital, and innovation are brought together [40]. In order to cultivate a culture that values innovation, collaboration, and entrepreneurship, the organization has deliberately brought together a diverse range of entities to encourage discussions, networking, investment, and the development of new ideas [41]. Indeed, 62% of the respondents stated that they arrived at the incubator with the intention of engaging in collaborative efforts. About 4 catalysts encompass the cooperative community plan, the services provided by the MaRS Organization, the close immediacy to partners, clients, and advisers, and the branding opportunities. Initially, the findings indicate that 11 groups located in the incubation facility claimed that the architectural design of the building facilitated their ability to engage with others and establish meaningful links. For instance, the arrangement of tenants across the building facilitated chance encounters and, thus, heightened the frequency of contacts. The convenient placement of the communal equipment (such as a photocopier) and facilities (such as a coffee shop) enabled regular occasions for the occupants to participate in casual conversations.

Table 4. Detailed Breakdown of Findings on Network Enablers

Catalyst	Description	Examples of Benefits	Organizations Reporting Benefits
Interactive Community Setting	Incubator design that promotes frequent informal interactions among tenants.	Frequent informal discussions leading to sharing of business interests and establishment of relationships.	ConstabPharma, AXS Animation, NeurAxon, others.
	Shared equipment and amenities that facilitate spontaneous conversations.	Coordination of formal projects and new partnerships.	11 organizations
	Circulation of tenants across the building that increases interaction opportunities.	Informal contacts evolving into formal collaborations.	
MaRS Administration Services	Delivery and organization of programs, workshops, events, and conferences.	Establishing or improving networks through participation in events.	18 tenants (6 supporters, 1 large enterprise, 11 SMEs)
	Provision of communication solutions such as newsletters, press releases, and promotion of success stories.	Enhanced networking activities.	3 informants
	Referral services to advisors, clients, partners, and projects.	Access to new technology and professional services, establishing diverse networks.	13 informants, including Merck & Co, Inc., Kanata Chemical Technologies, Octopz Inc.
Proximity to Partners, Clients, and Advisers, Clients	Close proximity to academic institutions, hospitals, government offices, and commercial partners. Frequent collaboration with University of Toronto and affiliated hospitals.	Easier coordination of meetings and improved collaboration efficiency.	17 tenants
Branding		Greater appreciation among investors and clients.	NeurAxon Inc., Skymeter Corporation,

Association with MaRS enhancing tenant organizations' visibility and prestige.	Promotion of brand and legitimacy.	Clera Inc., AXS Animation 5 representatives from SMEs

Based on the feedback from the participants, these impromptu discussions facilitated mutual assistance among the renters and the sharing of shared business objectives. The interviewee explicitly acknowledged these casual meetings as the cause for the formation of relationships. Two tenants' representatives also mentioned the enhanced convenience of arranging official projects and fostering new partnerships. During interactions in communal areas or when utilizing shared amenities, residents frequently engaged in the exchange of information and encountered unfamiliar fellow occupants. Renters engaged in collaboration with both fellow renters and external groups, either formally or informally. Some of our sources confirmed that the social environment of incubators can provide networking possibilities that can lead to business prospects. Interviewees from ConstabPharma and AXS Animation reported that certain informal connections they made in the incubator developed into official partnerships. When questioned about the changeover, they asserted that regular interactions during social events and meetings, as well as shared interests, resulted in official partnerships. Another interviewee from NeurAxon proposed that casual discussions within the community could potentially foster collaborative prospects.

Another significant factor that promotes collaboration is the range of facilities offered by the MaRS administration. The services offered encompass the administration and execution of programs, workshops, events, and conferences, as well as the provision of communication solutions. Additionally, the service includes the reference of advisers, projects, partners, and clients. The majority of these facilities were provided in areas that the tenants were less acquainted with and overseen by professionals like marketing advisors, the entrepreneurs-in-residence, and incubator partners. Specifically, a total of 18 tenants (consisting of six advocates, one major corporation, and 11 small and medium-sized enterprises) reported experiencing positive outcomes from utilizing the services to create or enhance their networks see **Table 4**.

Additionally, four support groups, namely Royal Bank, BioDiscovery Toronto, BioScience Managers, and the Biotechnology Initiative, independently arrange and participate in networking events within the incubator. These organizations also benefit from the assistance provided by the MaRS administration. Eleven renters said that their participation in conferences, events, workshops, and activities at MaRS has facilitated the development of both casual and formal contacts. This is unsurprising given that the administration organizes 13 regular event series, along with various programs, workshops, events, and conferences that are available during the year see **Table 4**. Three informants asserted that the organization's communication techniques, including the dissemination of newsletters, issuance of press releases, promotion of achievement stories on the internet and blogs, and upkeep of an updated tenant list online, greatly facilitated their networking endeavors see **Table 4**.

Thirteen individuals provided information stating that their organizations derived advantages from the referral services offered by the Administration. Merck & Co, Inc. was granted extensive access to the innovative technologies being developed and marketed within and around the incubator by the administration [42]. The majority of SMEs sought assistance from both internal and external experts in sectors like investment banking, consulting, law, and other financial areas. Individual SMEs built and maintained various networks with both external and internal contacts to meet their specific resource and service needs. For instance, Kanata Chemical Technologies and Octopz Inc. mostly serve clients located outside of Canada. Conversely, certain organizations opted to engage external contractors located in different locations. They came to the realization that being physically present at MaRS did not immediately contribute to their research and development efforts, as stated by a representative from one of the firms.

Furthermore, 17 tenants explicitly recognized the need of being close to partners, clients, and advisers as a crucial element for effective networking. According to the respondents, the convenient location of this place facilitated the organizations in bringing their agents for meetings and enhanced the effectiveness of their associations. For example, MaRS is located near government offices, universities, hospitals, and other commercial partners. The University of Toronto and its allied hospitals were collaborators that were stated most frequently. MaRS not only benefits from its advantageous geographic location, but also enhances the visibility and reputation of SMEs. 5 representatives from these firms stated that their association with MaRS has enhanced their credibility and brand, as the incubator's reputation extends to the tenant organizations. Consequently, the firms gained increased exposure among clients and investors due to their affiliation with a renowned company like MaRS. Four organizations, 3 start-ups (Skymeter Corporation and AXS Animation, NeurAxon Inc.), and 1 university spin-off (Clera Inc.), have experienced various advantages such as increased recognition, reputation, and visibility. MaRS may be characterized as a prestigious technological incubator that provides various services within a prime location in Toronto. It also benefits from a positive reputation among potential partners and sponsors. Interviewees have reported varying degrees of benefit from the services and possibilities provided by this incubator. However, it is evident that this recently established incubator has made deliberate efforts to maintain an inclusive, encouraging, and cooperative environment.

Network Barriers

The individuals we surveyed have highlighted some obstacles when it comes to constructing and overseeing networks refer to **Table 5**. The main challenges included divergent corporate interests among tenants, resource limitations that hindered

certain groups from locating at MaRS (such as expensive rent and limited space), and the extensive number of tenants to engage with. Subsequently, the following obstacles, along with others, will be examined in greater depth. Three tenants encountered conflicts of interest within their models, which hindered their ability to collaborate. Their disputes centered on their shared ambitions for collaboration and their responsibilities to safeguard their IP. They had challenges in establishing associations and negotiating license agreements with fellow tenants in the incubator due to a lack of shared objectives.

Table 5. Detailed Breakdown of Barriers to Networking in MaRS

Barrier	Description	Examples of Impact	Organizations Reporting Impact
Different Business Interests	Conflicts of interest revolving around IP protection and misaligned business objectives.	Difficulties in negotiating collaborations and licensing terms.	3 tenants
	Competition among firms with overlapping business interests.	Limited resources, clients, and partners, leading to frustration.	2 tenants
	Strategic misalignment between tenant objectives and investment goals.	Not very useful for building relationships with most tenants.	2 informants
Resource Constraints	Limited space and costly rent impacting some organizations' ability to locate at MaRS.	Consideration of relocating due to high costs and space disadvantages.	Representatives from 8 organizations
	Space limitations hampering larger collaborations.	Demand for MaRS expansion underway to accommodate more businesses and R&D labs.	4 interviewees
Large Number of Tenants	Difficulties in building networks with a large and diverse tenant base.	Insufficient support for establishing new formal relationships, particularly for SMEs.	3 respondents
Recruitment Strategies	Broadly cast networks creating challenges in advising and assisting tenants.	Uncertainty regarding the feasibility of creating mutually beneficial networks with every tenant.	2 interviewees
High-End Quality of MaRS	High costs and space limitations being disadvantageous for some firms, especially early-stage companies.	Early-stage companies considering relocating from the incubator due to affordability concerns.	8 out of 29 organizations no longer tenants in 2011

Two tenants identified the presence of competition between enterprises with similar organizational interests as a concern. Their concerns arose from the existence of incubator or firms' services providing identical or comparable services, while the availability of clients, partners, and resources was limited. Two informants said that their economic goals did not align with those of the majority of incubator tenants, even though there was no conflict of interest with regard to intellectual property and overlapping interests. According to one private equity firm, they prefer to invest in life science start-ups that are further along in their improvement. Because of this, the majority of the incubator's tenants didn't match their investment goals. Consequently, the corporation did not see much benefit in forming relationships and working together with most of the renters. These difficulties indicate a lack of strategy alignment among the tenant organizations, most often on a local scale.

In addition, two respondents conscientiously voiced their apprehensions over the incubator's enrollment techniques and tenant administration. One informant, while analyzing the incubator's extensive models, highlighted the firm's doubts about the feasibility of creating models with 'everyone' within the incubator and the advantages of developing such networks. The abundance and diversity of tenants within the incubator provide challenges for support groups in providing guidance and aid to tenants. Several renters have reported receiving insufficient support in establishing new relationships, even after their arrival at the incubator. Three respondents stated that there were just a few possibilities provided by MaRS in which they established new, official relationships. This is mostly detrimental for SMEs, as they could derive significant advantages from advisory and strategic networks. Several sources noted that the exceptional quality of MaRS, as previously outlined, could potentially provide difficulties to their companies, ultimately impacting their networking strategy.

The advantages of a favorable location and close proximity to several firms were not always seen as compensating for the expenses borne by SMEs when choosing to establish themselves at MaRS. Multiple tenants voiced their dissatisfaction regarding expenses and restrictions on available space. Representatives from eight organizations expressed that it was expensive for them to continue operating within MaRS. Indeed, certain firms were contemplating moving from the incubator during the interviews due to that particular reason. Not surprisingly, these worries regarding affordability were more urgent for the enterprises in their initial stages. In 2011, a total of 8 out of the 29 groups that took part in the research were no longer occupying space at MaRS. Four interviewees stated that the lack of available space for growth hindered their ability to form larger partnerships with other companies or research and development partners. This might be interpreted as proof of the

high demand for the ongoing expansion of MaRS. The new building will increase the accessible space for research and businesses and development laboratories by more than two times.

V. DISCUSSION

This study investigates the correlation between networks facilitated by incubators and the networking tactics employed by tenants in Business Incubators (BIs). The framework establishes a structure for comprehending these networks by categorizing them based on the type of resources (immaterial and tangible) and the relations they have with external and internal entities. A tenant survey was conducted by Van Weele et al. [43] and revealed that incubator firms establish a greater number of networks to gain access to intangible resources compared to tangible resources. The study also identified disparities in networking activities between highly inventive and moderately to less innovative organizations. The findings demonstrated that MaRS had a direct and indirect impact on tenants' networking techniques as they sought out new connections and appropriate resources. Having network connection is essential for a successful incubation process, and many incubators make great efforts to develop a strong local presence. Incubation programs sometimes prioritize specific industries as their competitive focus, commonly include information technology, Internet services, software, and biotech. Certain university incubators prioritize specific technologies, influenced by the magnitude of the infrastructure investment or the prestige of particular academic departments.

The reference workshops, services, seminars, and events organized by the administrations facilitated tenants in establishing new connections and engaging in joint projects. Nevertheless, the incubator was unable to adequately cater to the networking requirements of each tenant based on their specific industry and business strategies. Business incubation necessitates the use of suitable selection criteria and departure procedures, which are essential managerial characteristics inside business incubators. Sector-specific incubators benefit from greater economies of scale due to their specialized and customized solutions. Cavallo, Ghezzi, and Balocco [44] offer a more intricate portrayal of networks within a technology-based incubator, scrutinizing certain interactions or connections discovered within and linked to MaRS. The typology created in this investigation expands on prior research by concentrating on strategic inter-firm alliances in the biotechnology sector, spin-off and advisory networks, and the various subdomains within the biotechnology industry.

There is a scarcity of research on how knowledge management affects the networks of organizations. Additionally, there is a lack of clear guidance on the definition of effective knowledge management and measurable results. Networks are widely recognized as crucial for fostering innovation in knowledge-intensive industries, particularly for fledgling small companies functioning in these areas, given their relative newness and limited scale. However, there is a lack of discourse regarding the potential range of network functions for accessing resources in various knowledge-intensive sectors, resulting in unique techniques for establishing networks and distinctive configurations of networks. There is a lack of empirical research that compares networking behavior in various knowledge-intensive industries. Existing studies that examine network features often concentrate on a particular sector or include technology-intensive enterprises in general, which encompass firms from many sectors. This fails to consider the existence of diversity and the specific factors that contribute to it within different sectors.

Previous studies on network typologies fail to comprehensively capture the processes described by participants within the setting of technology-based incubators. Several interviewees discovered that their networks were primarily formed before they started working at MaRS, emphasizing the diverse influence of networks encouraged by incubators on particular companies. The MaRS Administration has the capability to oversee and evaluate the effects of networking efforts in several domains, including formal collaborations, external investments, and cooperative research and development activities. The university technology business incubator (UTBI) is a contemporary instrument used by entrepreneurial institutions to provide assistance in fostering new technology-based companies. Nevertheless, the majority of studies focus predominantly on providing descriptions of different incubator models [45]. Very few studies have thoroughly examined the involvement of university-related facilities in offering support for business incubation. Furthermore, none of these studies explicitly concentrate on the UTBI, which is widely recognized as a crucial resource for the growth of new technology-based companies see **Table 6**.

Table 6. Major Studies of UTBI

References	Research sample	Study context	Key contribution/findings
[46]	910 firms (response 56%), 70 incubators (response 66%, UTBIs 15%)	US Department of Commerce, University Park, PA's Institute of Public Administration, Washington, DC; and Pennsylvania State University	This study highlighted the capacity of incubators to foster regional growth. It was beneficial to categorize incubator organizations according to their sponsorship and the types of services they offer to their tenants. An incubator is a network of organizations that offer expertise, education, inspiration, real estate resources, and business support services.
[47]	211 firms (response NA) 117	IC ² Institute, University of Texas at Austin, TX	The research findings corroborated existing knowledge and gave fresh insights on the salary, education, and age of incubator managers. The study identified new metrics

	incubators (response 43%, UTBIs 10%)		of success by utilizing the four previously defined categories of incubation organizations.
[48]	13 incubators (case study, UTBIs 21%)	University of Minnesota, H. Humphrey Institute, Minneapolis, MN	The highlighted elements that contributed to the effectiveness of the incubator in this case study were low-cost development and operation, as well as facilitation of quality management.
[49]	6 incubators (case study, UTBIs 100%) 150 firms (response 32%)	The School of Business and Public Management at George Washington University is situated in Washington, DC	The study, being the first to focus on UTBI, confirmed that university incubators seem to offer the necessary resources and atmosphere for the growth of new technology-based firms (NTBFs). The checklist offered guidance for achieving successful facilities and created a model for evaluating UTBIs.
[50]	36 firms (selected) 9 incubators (56% UTBIs, case study)	The School of Management at Rensselaer Polytechnic Institute, Troy, New York	The study argued that managerial involvement plays a vital role in offering support for incubation, and success is determined by proactive and direct engagement. The efficiency of direct involvement was found to be limited by the constraints of time availability and the firms' lack of responsiveness.

This perspective has been integral to the concept of MaRS as the 'convergence center', which serves as a central point for the interaction between science, commerce, and technology innovation. Although universities can contribute significantly to the growth of spin-off companies by portraying leadership, human capital and knowledge, this case study shows that this contribution is not solely determined by proximity. Companies that originated from academic laboratories were able to maintain existing contacts with scientists, whereas other firms struggled to establish linkages with research organizations. Another commonly held belief regarding high-tech incubators pertains to the significance of fortuitous contacts that result in commercial cooperation. Predictably, the majority of renters examined were able to cultivate new informal connections with other entities within the incubator. Three SMEs and one support association reported that their casual relationships developed into official collaborations.

Nevertheless, the majority of SMEs were unable to use these connections for business objectives. Several participants ascribed this result to the contradictory or distinct commercial interests maintained by the renters. However, the incubator appeared to lack a purposeful plan when it came to selecting residents with conflicting business interests. The study by Zhang, Duysters, and Clodt [51] aligns with earlier research, such as the study conducted by Öberg, Klinton, and Stockhult [52]. Simultaneously, certain tenants have seen that there exists a compromise between rivalry and synergy resulting from these intersecting corporate interests. Stewart and Carayannis [53] provide a momentary glimpse into the development of a single high-tech incubator. It indicates that the networking strategies of enterprises are partially influenced by networks developed by incubators. Håkansson and Ford [54] explored how relevant companies see their networking activities and the benefits they gain from them. Gao et al. [55] also enlarged the understanding of 'networks' within technological incubators, proposing new directions for further empirical research and conceptual advancement.

Table 7. Valuation Model for Technology Incubators

References	Valuation Criteria	Examples of Specific Indicators
[56]	Pooling assets	Organizing development activities and staff training, press conferences, exhibitions, marketing events
[57]	Sharing resources	Sharing office equipment, laboratory facilities, managerial support (e.g. meeting room, reception area, library), testing equipment
[58]	Counseling/ consulting services	Giving free or inexpensive legal, accounting, commercial, and technical help
[59]	Public image	Image of the University/ Government/ Science Park
[60]	Networking	Access to subcontractors, suppliers, and customers; potential for collaboration with other incubator technology companies; and sharing and disseminating of knowledge
[61]	Clustering	creation of a skilled labor pool, externalities from the logistics plan, and externalities from the supporting network (such as the formation of ancillary industries)

[62]	Geographic accessibility	Market, research center, and university accessibility
[63]	Costing	subsidies for computer network access, rent, telecom, and other cost-cutting measures
[64]	Funding	Availability of banking facilities, other finance sources, and venture capital (VC) funding

The Technology Park/Business Incubator [65] offers a platform for the coming together of different elements in a mutually beneficial support structure. Incubators today provide services to both enterprises operating within their facilities and affiliated businesses who choose to work in their own locations. The latest incubators, known as 'third-generation incubators', no longer prioritize low leasing costs. Instead, they place greater emphasis on providing improved business services to both the tenants within the facility and external affiliates. In addition, Dimov [66] provide support to emerging entrepreneurs and also assist those who have completed their training. McAdam and McAdam [67] provide a definitive suggestion regarding the importance of creating science parks as an effective means to support and facilitate the growth of technological companies through incubation programs. The arguments from both sides, in favor or against, suggest that the value of incubator programs depends on the specific circumstances of their inception and the way they are implemented. To evaluate its efficacy, Virtanen et al. [68] construct a framework consisting of various criteria derived from existing literature. They subsequently examine its suitability by applying it to six incubation firms located in Hong Kong Science Park. **Table 7** presents a concise overview of the assessment framework.

VI. CONCLUSION AND FUTURE SCOPE

This study enhances the understanding of how MaRS Innovation Centre and similar technology-based incubators assist in the formation and use of interorganizational networks among firms in incubation. The three main types of networks that the study distinguished are advisory, spin-off, and strategic, while the key enablers that enhance the effectiveness of networks are the interactive community environment, MaRS administrative support, access to key advisors and partners, and the MaRS name recognition. Despite the issue with conflicting business interest, availability of resources and large number of tenants, MaRS provided an excellent environment and support services that helped tenant firms to form valuable networks and improve their development frameworks. These findings also highlight the need for incubator services to be targeted to meet the needs of the various firms in the incubator with a view of encouraging innovation and cooperation. There is a need for future research to inspect the effects of knowledge incubators on the dynamics and viability of tenant firms in the long run. Research across and between incubators, geographical areas and sectors might help to identify a wider range of practice examples and circumstances that affect the success of the network. Furthermore, other studies that quantitatively compare the economic and innovative performance of firms that join these networks would provide insights into the performance benefits of incubation.

CRedit Author Statement

The author reviewed the results and approved the final version of the manuscript.

Data Availability

No data was used to support this study.

Conflicts of Interests

The author declares that they have no conflicts of interest.

Funding

No funding was received to assist with the preparation of this manuscript.

Competing Interests

There are no competing interests.

References

- [1]. M. P. Hekkert, R. A. A. Suurs, S. O. Negro, S. Kuhlmann, and R. E. H. M. Smits, "Functions of innovation systems: A new approach for analysing technological change," *Technological Forecasting & Social Change/Technological Forecasting and Social Change*, vol. 74, no. 4, pp. 413–432, May 2007, doi: 10.1016/j.techfore.2006.03.002.
- [2]. G. Wang, W. Dou, and N. Zhou, "Consumption attitudes and adoption of new consumer products: a contingency approach," *European Journal of Marketing*, vol. 42, no. 1/2, pp. 238–254, Feb. 2008, doi: 10.1108/03090560810840998.
- [3]. N. Chen, N. Chiang, and N. Storey, "Business Intelligence and Analytics: From big data to Big impact," *Management Information Systems Quarterly*, vol. 36, no. 4, p. 1165, Jan. 2012, doi: 10.2307/41703503.
- [4]. Y. Caloghirou, I. Kastelli, and A. Tsakanikas, "Internal capabilities and external knowledge sources: complements or substitutes for innovative performance?," *Technovation*, vol. 24, no. 1, pp. 29–39, Jan. 2004, doi: 10.1016/s0166-4972(02)00051-2.
- [5]. S. A. Alvarez and J. B. Barney, "Entrepreneurial opportunities and poverty alleviation," *Entrepreneurship Theory and Practice*, vol. 38, no. 1, pp. 159–184, Jan. 2014, doi: 10.1111/etap.12078.

- [6]. C. Li, N. Ahmed, S. A. Qalati, A. Khan, and S. Naz, "Role of Business Incubators as a tool for entrepreneurship development: The mediating and moderating role of Business Start-Up and Government Regulations," *Sustainability*, vol. 12, no. 5, p. 1822, Feb. 2020, doi: 10.3390/su12051822.
- [7]. A. Grübler *et al.*, "Regional, national, and spatially explicit scenarios of demographic and economic change based on SRES," *Technological Forecasting & Social Change/Technological Forecasting and Social Change*, vol. 74, no. 7, pp. 980–1029, Sep. 2007, doi: 10.1016/j.techfore.2006.05.023.
- [8]. K. Deyanova, N. Brehmer, A. Lapidus, V. Tiberius, and S. Walsh, "Hatching start-ups for sustainable growth: a bibliometric review on business incubators," *Strategic Management Science*, vol. 16, no. 7, pp. 2083–2109, Jan. 2022, doi: 10.1007/s11846-022-00525-9.
- [9]. R. B. Cooper and R. W. Zmud, "Information Technology Implementation Research: A Technological Diffusion approach," *Management Science*, vol. 36, no. 2, pp. 123–139, Feb. 1990, doi: 10.1287/mnsc.36.2.123.
- [10]. H. Yli-Renko, E. Autio, and H. J. Sapienza, "Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms," *Strategic Management Science*, vol. 22, no. 6–7, pp. 587–613, Jun. 2001, doi: 10.1002/smj.183.
- [11]. B. Clarysse, M. Wright, A. Lockett, E. Van De Velde, and A. Vohora, "Spinning out new ventures: a typology of incubation strategies from European research institutions," *Journal of Business Venturing*, vol. 20, no. 2, pp. 183–216, Mar. 2005, doi: 10.1016/j.jbusvent.2003.12.004.
- [12]. C. Pauwels, B. Clarysse, M. Wright, and J. Van Hove, "Understanding a new generation incubation model: The accelerator," *Technovation*, vol. 50–51, pp. 13–24, Apr. 2016, doi: 10.1016/j.technovation.2015.09.003.
- [13]. F. A. Ayatse, N. Kwahar, and A. S. Iyortsuun, "Business incubation process and firm performance: an empirical review," *Journal of Global Entrepreneurship Research*, vol. 7, no. 1, Jan. 2017, doi: 10.1186/s40497-016-0059-6.
- [14]. C. A. Cancino, A. I. La Paz, A. Ramaprasad, and T. Syn, "Technological innovation for sustainable growth: An ontological perspective," *Journal of Cleaner Production*, vol. 179, pp. 31–41, Apr. 2018, doi: 10.1016/j.jclepro.2018.01.059.
- [15]. M. Neteler, M. H. Bowman, M. Landa, and M. Metz, "GRASS GIS: A multi-purpose open source GIS," *Environmental Modelling & Software*, vol. 31, pp. 124–130, May 2012, doi: 10.1016/j.envsoft.2011.11.014.
- [16]. K. P. Wasdani, A. Vijaygopal, and M. J. Manimala, "Business Incubators: A Need-Heed Gap Analysis of Technology-based Enterprises," *Global Business Review*, p. 097215092210740, Feb. 2022, doi: 10.1177/09721509221074099.
- [17]. N. Bank and W. Kanda, "Tenant recruitment and support processes in sustainability-profiled business incubators," *Industry & Higher Education*, vol. 30, no. 4, pp. 267–277, Aug. 2016, doi: 10.1177/0950422216659567.
- [18]. A. Sivai, "Students' perceptions of distance learning in higher education: a case of independent colleges in KwaZulu-Natal," 2023. doi: 10.51415/10321/4718.
- [19]. C. Vedovello and M. Godinho, "Business incubators as a technological infrastructure for supporting small innovative firms' activities," *International Journal of Entrepreneurship and Innovation Management*, vol. 3, no. 1/2, p. 4, Jan. 2003, doi: 10.1504/ijeim.2003.002215.
- [20]. A. Bergek, S. Jacobsson, B. Carlsson, S. Lindmark, and A. Rickne, "Analyzing the functional dynamics of technological innovation systems: A scheme of analysis," *Research Policy*, vol. 37, no. 3, pp. 407–429, Apr. 2008, doi: 10.1016/j.respol.2007.12.003.
- [21]. R. Vaz, J. V. De Carvalho, and S. F. Teixeira, "Developing a digital business incubator model to foster entrepreneurship, business growth, and Academia–Industry connections," *Sustainability*, vol. 15, no. 9, p. 7209, Apr. 2023, doi: 10.3390/su15097209.
- [22]. Z. Mottiar, K. Boluk, and C. Kline, "The roles of social entrepreneurs in rural destination development," *Annals of Tourism Research*, vol. 68, pp. 77–88, Jan. 2018, doi: 10.1016/j.annals.2017.12.001.
- [23]. E. Tavoletti, "Business incubators: effective infrastructures or waste of public money? Looking for a theoretical framework, guidelines and criteria," *Journal of the Knowledge Economy*, vol. 4, no. 4, pp. 423–443, Feb. 2012, doi: 10.1007/s13132-012-0090-y.
- [24]. A. Bøllingtoft and J. P. Ulhøi, "The networked business incubator—leveraging entrepreneurial agency?," *Journal of Business Venturing*, vol. 20, no. 2, pp. 265–290, Mar. 2005, doi: 10.1016/j.jbusvent.2003.12.005.
- [25]. S. Mukherjee, "Challenges to Indian micro small scale and medium enterprises in the era of globalization," *Journal of Global Entrepreneurship Research*, vol. 8, no. 1, Oct. 2018, doi: 10.1186/s40497-018-0115-5.
- [26]. S. Vedula and P. H. Kim, "Gimme shelter or fade away: the impact of regional entrepreneurial ecosystem quality on venture survival," *Industrial and Corporate Change*, vol. 28, no. 4, pp. 827–854, Jul. 2019, doi: 10.1093/icc/dtz032.
- [27]. K. G. Provan and H. B. Milward, "Do networks really work? A framework for evaluating Public-Sector organizational networks," *PAR. Public Administration Review/Public Administration Review*, vol. 61, no. 4, pp. 414–423, Jul. 2001, doi: 10.1111/0033-3352.00045.
- [28]. J. M. Hite, "Evolutionary processes and paths of relationally embedded network ties in emerging entrepreneurial firms," *Entrepreneurship Theory and Practice*, vol. 29, no. 1, pp. 113–144, Jan. 2005, doi: 10.1111/j.1540-6520.2005.00072.x.
- [29]. U. S. Bititci, V. Martinez, P. Albores, and J. Parung, "Creating and managing value in collaborative networks," *International Journal of Physical Distribution & Logistics Management*, vol. 34, no. 3/4, pp. 251–268, Mar. 2004, doi: 10.1108/0960030410533574.
- [30]. K. Storbacka and S. Nenonen, "Customer relationships and the heterogeneity of firm performance," *Journal of Business & Industrial Marketing*, vol. 24, no. 5/6, pp. 360–372, Jun. 2009, doi: 10.1108/08858620910966246.
- [31]. C. Pietrobelli and R. Rabellotti, "Global value chains meet innovation systems: are there learning opportunities for developing countries?," *World Development*, vol. 39, no. 7, pp. 1261–1269, Jul. 2011, doi: 10.1016/j.worlddev.2010.05.013.
- [32]. I. B. Pettersen, J. Aarstad, Ø. S. Høvig, and A. E. Tobiassen, "Business incubation and the network resources of start-ups," *Journal of Innovation and Entrepreneurship*, vol. 5, no. 1, Dec. 2015, doi: 10.1186/s13731-016-0038-8.
- [33]. W. A. Galston, "Bowling Alone: the collapse and revival of American community," *Journal of Policy Analysis and Management*, vol. 20, no. 4, pp. 788–790, Sep. 2001, doi: 10.1002/pam.1035.
- [34]. K. Aerts, P. Matthyssens, and K. Vandembemt, "Critical role and screening practices of European business incubators," *Technovation*, vol. 27, no. 5, pp. 254–267, May 2007, doi: 10.1016/j.technovation.2006.12.002.
- [35]. C. Maher, M. Hadfield, M. Hutchings, and A. De Eyto, "Ensuring rigor in qualitative data analysis," *International Journal of Qualitative Methods*, vol. 17, no. 1, p. 160940691878636, Jul. 2018, doi: 10.1177/1609406918786362.
- [36]. O. E. Williamson, "Calculativeness, trust, and economic organization," *the Journal of Law & Economics*, vol. 36, no. 1, Part 2, pp. 453–486, Apr. 1993, doi: 10.1086/467284.
- [37]. W. M. Danis, D. S. Chiaburu, and M. A. Lyles, "The impact of managerial networking intensity and market-based strategies on firm growth during institutional upheaval: A study of small and medium-sized enterprises in a transition economy," *Journal of International Business Studies*, vol. 41, no. 2, pp. 287–307, Jul. 2009, doi: 10.1057/jibs.2009.45.
- [38]. B. Hoppe and C. Reinelt, "Social network analysis and the evaluation of leadership networks," *the Leadership Quarterly*, vol. 21, no. 4, pp. 600–619, Aug. 2010, doi: 10.1016/j.leaqua.2010.06.004.
- [39]. B. Hagen, A. Zucchella, P. Cerchiello, and N. De Giovanni, "International strategy and performance—Clustering strategic types of SMEs," *International Business Review*, vol. 21, no. 3, pp. 369–382, Jun. 2012, doi: 10.1016/j.ibusrev.2011.04.002.
- [40]. C. Sá and H. Lee, "Science, business, and innovation: understanding networks in technology-based incubators," *R & D Management*, vol. 42, no. 3, pp. 243–253, May 2012, doi: 10.1111/j.1467-9310.2012.00681.x.
- [41]. T. Büschgens, A. Bausch, and D. B. Balkin, "Organizational Culture and Innovation: A Meta-Analytic Review," *the Journal of Product Innovation Management*, vol. 30, no. 4, pp. 763–781, Apr. 2013, doi: 10.1111/jpim.12021.

- [42]. M. Ehret, D. McDonald-Junor, and D. Smith, "High technology and Economic Development: the BioCity Nottingham Technology Incubator," *International Journal of Entrepreneurship and Innovation*, vol. 13, no. 4, pp. 301–309, Nov. 2012, doi: 10.5367/ije.2012.0095.
- [43]. M. A. Van Weele, F. J. Van Rijnsvoever, M. Groen, and E. H. M. Moors, "Gimme shelter? Heterogeneous preferences for tangible and intangible resources when choosing an incubator," *the α Journal of Technology Transfer/ the α Journal of Technology Transfer*, vol. 45, no. 4, pp. 984–1015, Mar. 2019, doi: 10.1007/s10961-019-09724-1.
- [44]. A. Cavallo, A. Ghezzi, and R. Balocco, "Entrepreneurial ecosystem research: present debates and future directions," *International Entrepreneurship and Management Journal*, vol. 15, no. 4, pp. 1291–1321, Jun. 2018, doi: 10.1007/s11365-018-0526-3.
- [45]. S. M. Hackett and D. M. Dilts, "A Systematic Review of Business incubation research," *the α Journal of Technology Transfer/ the α Journal of Technology Transfer*, vol. 29, no. 1, pp. 55–82, Jan. 2004, doi: 10.1023/b:jott.0000011181.11952.0f.
- [46]. S. A. Mian, "Assessing and managing the university technology business incubator: An integrative framework," *Journal of Business Venturing*, vol. 12, no. 4, pp. 251–285, Jul. 1997, doi: 10.1016/s0883-9026(96)00063-8.
- [47]. C. L. Nicholls-Nixon and D. Valliere, "A framework for exploring heterogeneity in university business incubators," *Entrepreneurship Research Journal*, vol. 10, no. 3, Mar. 2019, doi: 10.1515/erj-2018-0190.
- [48]. P. Voisey, L. Gornall, P. Jones, and B. Thomas, "The measurement of success in a business incubation project," *Journal of Small Business and Enterprise Development*, vol. 13, no. 3, pp. 454–468, Jul. 2006, doi: 10.1108/14626000610680307.
- [49]. F. Lamperti, R. Mavilia, and S. Castellini, "The role of Science Parks: a puzzle of growth, innovation and R&D investments," *the α Journal of Technology Transfer/ the α Journal of Technology Transfer*, vol. 42, no. 1, pp. 158–183, Nov. 2015, doi: 10.1007/s10961-015-9455-2.
- [50]. R. E. Rice, "Media appropriateness.," *Human Communication Research*, vol. 19, no. 4, pp. 451–484, Jun. 1993, doi: 10.1111/j.1468-2958.1993.tb00309.x.
- [51]. Y. Zhang, G. Duysters, and M. Cloudt, "The role of entrepreneurship education as a predictor of university students' entrepreneurial intention," *International Entrepreneurship and Management Journal*, vol. 10, no. 3, pp. 623–641, Jan. 2013, doi: 10.1007/s11365-012-0246-z.
- [52]. C. Öberg, M. Klinton, and H. Stockhult, "Inside the incubator – business relationship creations among incubated firms," *Journal of Business & Industrial Marketing*, vol. 35, no. 11, pp. 1767–1784, Apr. 2020, doi: 10.1108/jbim-12-2018-0391.
- [53]. M. R. Stewart and E. G. Carayannis, "Dystechnia: a model of technology deficiency and implications for entrepreneurial opportunity," *Journal of Innovation and Entrepreneurship*, vol. 2, no. 1, p. 1, Jan. 2013, doi: 10.1186/2192-5372-2-1.
- [54]. H. Håkansson and D. Ford, "How should companies interact in business networks?," *Journal of Business Research*, vol. 55, no. 2, pp. 133–139, Feb. 2002, doi: 10.1016/s0148-2963(00)00148-x.
- [55]. Q. Gao, L. Cui, Y. K. Lew, Z. Li, and Z. Khan, "Business incubators as international knowledge intermediaries: Exploring their role in the internationalization of start-ups from an emerging market," *Journal of International Management*, vol. 27, no. 4, p. 100861, Dec. 2021, doi: 10.1016/j.intman.2021.100861.
- [56]. C. C. Snow, Ø. D. Fjeldstad, C. Lettl, and R. E. Miles, "Organizing Continuous product development and Commercialization: the Collaborative Community of Firms model," *the α Journal of Product Innovation Management*, vol. 28, no. 1, pp. 3–16, Dec. 2010, doi: 10.1111/j.1540-5885.2010.00777.x.
- [57]. C. L. Sprung *et al.*, "Recommendations for intensive care unit and hospital preparations for an influenza epidemic or mass disaster: summary report of the European Society of Intensive Care Medicine's Task Force for intensive care unit triage during an influenza epidemic or mass disaster," *Intensive Care Medicine*, vol. 36, no. 3, pp. 428–443, Feb. 2010, doi: 10.1007/s00134-010-1759-y.
- [58]. N. K. Kakabadse, E. Louchart, and A. Kakabadse, "Consultant's role: a qualitative inquiry from the consultant's perspective," *Journal of Management Development*, vol. 25, no. 5, pp. 416–500, Jun. 2006, doi: 10.1108/02621710610666268.
- [59]. K. F. Chan and T. Lau, "Assessing technology incubator programs in the science park: the good, the bad and the ugly," *Technovation*, vol. 25, no. 10, pp. 1215–1228, Oct. 2005, doi: 10.1016/j.technovation.2004.03.010.
- [60]. M. P. Pérez and A. M. Sánchez, "The development of university spin-offs: early dynamics of technology transfer and networking," *Technovation*, vol. 23, no. 10, pp. 823–831, Oct. 2003, doi: 10.1016/s0166-4972(02)00034-2.
- [61]. S. Liu, N. He, X. Cao, G. Li, and M. Jian, "Logistics cluster and its future development: A comprehensive research review," *Transportation Research. Part E, Logistics and Transportation Review*, vol. 168, p. 102974, Dec. 2022, doi: 10.1016/j.tre.2022.102974.
- [62]. M. J. White, "Urban commuting journeys are not 'Wasteful,'" *Journal of Political Economy*, vol. 96, no. 5, pp. 1097–1110, Oct. 1988, doi: 10.1086/261579.
- [63]. J. G. Sidak and R. W. Crandall, "Competition and regulatory policies for interactive broadband networks," *Social Science Research Network*, Jan. 2001, doi: 10.2139/ssrn.277868.
- [64]. A. Singh, J. Glen, A. Zammit, R. De-Hoyos, A. Singh, and B. Weisse, "Shareholder Value Maximisation, Stock Market and New Technology: Should the US Corporate Model be the Universal Standard?," *International Review of Applied Economics*, vol. 19, no. 4, pp. 419–437, Oct. 2005, doi: 10.1080/02692170500208533.
- [65]. G. Dalmarco, W. Hulsink, and G. V. Blois, "Creating entrepreneurial universities in an emerging economy: Evidence from Brazil," *Technological Forecasting & Social Change/Technological Forecasting and Social Change*, vol. 135, pp. 99–111, Oct. 2018, doi: 10.1016/j.techfore.2018.04.015.
- [66]. D. Dimov, "Nascent Entrepreneurs and Venture Emergence: opportunity confidence, human capital, and early planning," *Journal of Management Studies*, vol. 47, no. 6, pp. 1123–1153, Jul. 2010, doi: 10.1111/j.1467-6486.2009.00874.x.
- [67]. M. McAdam and R. McAdam, "High tech start-ups in University Science Park incubators: The relationship between the start-up's lifecycle progression and use of the incubator's resources," *Technovation*, vol. 28, no. 5, pp. 277–290, May 2008, doi: 10.1016/j.technovation.2007.07.012.
- [68]. P. Virtanen *et al.*, "SciPy 1.0: fundamental algorithms for scientific computing in Python," *Nature Methods*, vol. 17, no. 3, pp. 261–272, Feb. 2020, doi: 10.1038/s41592-019-0686-2.

Publisher's note: The publisher wishes to clarify that they maintain a neutral stance regarding jurisdictional claims in published maps and institutional affiliations. The responsibility for the content rests entirely with the authors and does not necessarily represent the publisher's views.