CHARACTERISTICS OF BUSINESS INCUBATORS INFLUENCING COLLABORATION AMONG MEMBER STARTUP FIRMS

BY

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DISSERTATION

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ABSTRACT

This study considered the socio-physical characteristics influencing collaboration among startup firms in four business incubators. Previous studies have elaborated on how collaboration fosters innovation. However, how business incubators promote collaboration among startup firms remains a subject for exploration. This study situated the incubator communities as social systems following Roger's (2003) conception of a social system and its impact on innovation. The researcher interviewed 44 representatives of firms and one manager per incubator. The study was conducted across four business incubators in the US Midwest. The 44 interview participants represented and provided information on 89 co-founders of the firms. Findings show that business incubators' social, physical, and informational characteristics, namely corporate membership, space configuration, informal and formal networking, industry focus, information environment, and human and social capital, foster collaboration. The study reported nine types of collaborations. Strategic partnerships are the predominant collaboration types among firms. Other collaboration types observed include information seeking, mutual telling, expanded insights, division of labor, advising, actual collaboration, mutual optimism, and one-way information transfer. The study introduced intentional sociality as an explanatory model for how business incubators can promote collaboration among startup firms. Intentional sociality points to three areas of concentration for incubator management. These areas include the location and the design of incubator space, the information environment of business incubators, and the industry focus of the admitted firms. Intentional sociality emphasizes the breadth and depth of relationships among firms and with external entities as a way of promoting opportunities for collaboration.
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CHAPTER 1. INTRODUCTION

1.1 Introduction

This study examines collaboration among 44 startup firms located in 4 different business incubators to understand the characteristics of business incubators that promote collaboration among startup firms. A startup firm is an organization that is established to provide a solution to a social or business problem. A business incubator provides support services for startup firms.

Collaboration is a source of strategic advantage (Ireland, Hitt, and Vaidyanath, 2002). Collaboration is reported to lead to innovation among collaborating firms and has been emphasized as a prime initiative for driving growth (KPMG, 2016; Middleton, 2017). Some sources stress the importance of collaboration for new companies in particular (e.g., World Economic Forum, 2015). Since collaboration has been reported in the literature as having some level of positive influence on a firm’s performance, this study’s overarching goal is to examine the characteristics of business incubators that promote collaboration among startup firms located in them.

1.2 Collaboration

*What is collaboration.* Collaboration as a phenomenon is a subject of research across many academic fields. Mattessich and Monsey (1992) defined collaboration as “a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals” (p. 7). The second part of this definition assumes that all collaborative relationships have some level of formality. If we lessen the formality implied in the definition of Mattessich and Monsey, it can be inferred that all collaborative relationships are expected to be beneficial to all members involved but may not always have well-defined rules of engagement.

This view is shared in the definition of collaboration put forward by a participant in the study conducted by Thomson and Perry (2006, p. 20) as “the act or process of shared creation.” To this study, the “shared” part is more important than the formality of the relationship. Collaboration as a subject of this dissertation is then defined as a shared relationship between two or more startup firms or a startup firm and another entity, with benefit(s) for one or all the members involved in such a relationship. Example of a collaboration that may benefit one include learning through collaboration. Cocreating something will often benefit all the entities
involved. While cocreating will involve contribution by all the entities involved, learning implies giving and receiving. However, it is also possible that members in a collaboration can co-learn.

The subject as well as the focus of studies on collaboration differ across academic fields. For example, studies in the information field often focus on platforms and systems that enable collaboration (Adamczyk & Twidale, 2007; Bénaben, Touzi, Rajsiri, & Pingaud, 2006), and how information institutions work together to solve common problems (Burich, Casey, Devlin, & Ivanitskaya, 2006; Duff et al., 2013; Lee, 2009; Melling & Weaver, 2012; Shim & McClure, 2002; Suh, 2005). Management sciences usually focus on the dynamics of collaboration among for-profit organizations (Baum et al., 2000; Chen & Li, 1999; Pangarkar & Wu, 2013).

The terminologies used in the study of collaboration also differ across academic fields. Management researchers often use terms such as, alliances (Carayannis et al., 2000; Todeva and Knoke, 2005; Gulati, 1998; Gulati et al., 2000; Ireland et al., 2002; Pangarkar & Wu, 2013; Wang et al., 2012), inter-organizational relations (Galaskiewicz, 1985); cocreation (Ceccagnoli, Forman, Huang, and Wu, 2012), and complementarity (Brynjolfsson & Milgrom, 2013; Schmiedeberg, 2008). For simplicity, this study makes no distinction between these terms but equates collaboration and alliance formation. So, the study approaches the literature with this resolve.

**Why collaboration.** This study examines the subject of collaboration as it relates to startup firms in business incubators. Ahuja (2000) established that the tendency for firms to form collaborative relationship is driven by both inducement and opportunity. Inducement refers to the need for assets or resources. According to Ahuja, inducement is the primary driver of collaborative relationship as these assets are not readily obtainable and require time to build up. Collaboration allows firms to have access to assets that in turn create value. The time required to accumulate needed assets is shortened through collaboration. Ahuja stated further that the likelihood that a firm will be approached by another for a potential collaboration is a function of what resources or opportunity, that such firm possess that is beneficial to the potential collaborator.

The central theme of Ahuja’s work is that collaboration emerged “only when actors with inducements to form [collaboration] are successful in finding collaboration opportunities (Ahuja, 2000, pp318).” Similar to Ahuja, Mitchell and Singh (1992) affirmed that for a startup firm
seeking collaboration, factors such as skills, financial constraints, market uncertainties, combine to make the development of new technology something that is practically beyond reach.

Further to inducement and opportunity, Ahuja (2000) also identified two forms of capital that can influence collaboration. The first is technical capital and the second is social capital. Technical capital refers to a company’s stock of technological knowledge and Ahuja concluded that “a firm’s attractiveness to potential partners and hence its opportunities to collaborate are likely to vary positively with its stocks of technical capital (Ahuja, 2000, pp319).”

Social capital on the other hand is the network of existing ties between firms that has the potential of facilitating the formation of collaborative relationship through knowledge and reputation acquisition by well-connected network members (Gulati, 1995, 1999). While technical capital is important to creating and obtaining value from technology, social capital often have facilitative roles such as providing information about possible collaboration opportunities and ensuring that partners are able to assess the reliability of a potential collaborator by virtue of the relationship that has been forged within the network (Gulati, 1995, 1999; Williams & Durrance, 2008).

Benefits of collaboration. Baum, Calabrese, and Silverman (2000) examined the effect of change in startup firms’ collaborative network on startup firms’ early performance. Their study supported that startup firms can improve their performance early in their journey by,

1) establishing [collaborative relationship], 2) configuring them into an efficient network that provides access to diverse information and capabilities with minimum costs…, conflict, and complexity, and 3) judiciously allying with potential rivals that provide more opportunity for learning and less risk of intra-alliance rivalry (Baum, Calabrese, and Silverman, 2000, p. 268).

Further, studies have shown that collaborative relationships have significant benefit to startup firms. Some benefits include creating market entry opportunity (Tallman, 2017), having access to resources that allows a firm to have competitive advantage (Dyer and Singh, 1998; Carayannis, Kassicieh, and Radosevich, 2000; Ireland, Hitt, and Vaidyanath, 2002), having complementary assets (Pisano, 1990), external legitimacy as a result of the market position of the firm collaborating with such startup firm (Baum and Oliver, 1991; Miner, Amburgey and
For startup firms, legitimacy often come from collaborating with a more experienced and well positioned organization. So, if an established firm collaborates with a startup firm, it will confer some level of legitimacy that often compensate for the lack of experience on the part of the startup firm (Baum, Calabrese, and Silverman, 2000).

The motivation for seeking collaborative relationship is grouped into four distinct levels by Todeva and Knoke (2005). These are 1) organizational, this involves learning and competence building, 2) economic, reducing cost and managing risk, 3) strategic, shaping competition, preventing possible failure, acquiring certain product and technology, and 4) political, ensuring favorable market. These are by large related to inducement and opportunity as espoused by Ahuja (2000). Organizational learning and competence building, for example, match up with technical capital as discussed by Ahuja.

1.3 Business incubators and startup firms

Having identified the importance of collaboration explored in the literature in the preceding section, it is important to introduce the literature on business incubators and startup firms. The focus and the theme of literature on business incubators and startup firms is diverse. There are studies that have examined the performance of incubator versus non-incubator firms as well as the characteristics of different types of incubators (Westhead, 1997).

Other studies have examined the performance of firms by studying the differences among the incubators those firms are located. For example, Barbero, Casillas, Ramos and Guitar (2012) compared four business incubators by examining five characteristics of firms located in them. These characteristics include firm growth, participation in R&D programs, input R&D, output R&D, and employment generation cost. Their study found significant differences in three of the five performance categories among the four incubator types. The four types of incubator in the study by Barbero et al. are private, basic research, university, and regional development incubators.

Performance assessment was based on whether the objective of creating the incubators is met. They found that private, basic research, and university incubators met their objectives while
regional incubator does not. In other studies, there are contrasting view about the relevance of incubators to startup firms. Some firms describe incubators as adding value to them while others have reported no value (Westhead, 1997; Mian, 1997; Hansen, Chesbrough, Nohria, & Sull, 2000).

Bøllingtoft (2012) studied two business incubators tagged “bottom-up business incubators.” These incubators were so called because they were self-initiated by individual entrepreneurs as opposed to being owned by private, university, or public entities. Bøllingtoft’s study examined the role of the incubators in facilitating and enabling the conditions for internal networking and cooperation among entrepreneurs. In relation to the current study, Bøllingtoft’s research sought to understand the mechanism put in place by the incubators to enhance collaboration among the entrepreneurs.

Results from Bøllingtoft’s study revealed that there were networking and cooperation activities happening among the entrepreneurs and the incubators were reported to play a facilitating role in this. The findings also showed that for networking among entrepreneurs, physical proximity had a facilitating role while shared values and norms had both facilitating and enabling role (Bøllingtoft, 2012).

1.4 Problem statement

The need for collaboration among firms has been established in extant literature. Dyer, Kale, and Singh (2001) reported that when organizations put in place a dedicated alliance or collaboration function, such organizations are able to develop the expertise needed for competitive advantage. Their study noted that strategic alliance or what the current study calls collaboration is “a fast and flexible way to access complementary resources and skills that reside in other companies (Dyer, Kale, & Singh, 2001, p. 37).” While recognizing that not all forms of collaboration will eventually succeed, Dyer et al. acknowledged that an organization’s ability to establish and manage collaborative relationships effectively will lead to competitive advantage. This is seen in the post-collaboration results of the organizations in their study. It is worth noting that Dyer et al.’s study focused on large established firms as opposed to startup firms, the focus of the current study.
Further to the conclusion of Dyer, Kale, and Singh (2001), other studies have shown that collaboration can improve performance early in a firm’s journey (Baum, Calabrese, and Silverman, 2000). While established organizations such as those in the study by Dyer et al. may have different reasons for initiating a collaborative relationship, Mitchell and Singh (1992) found that startup firms seeking collaborative relationships do so for skills acquisition, financial constraints, and market uncertainties. The lack of these resources and abilities often makes it difficult for startup firms to develop new technologies. Collaboration also allows new firms to have access to market entry opportunities (Alkalali & Malmqvist, 2020; Tallman, 2017).

The literature on startup firms and business incubators is replete with studies examining the influence of incubators on startup firms located in them. For example, incubators are reported to provide values that often come in the form of administrative and support services such as printing services, mailing services, and recruiting (Mian, 1997; Hansen, Chesbrough, Nohria, & Sull, 2000). Since the usefulness of collaboration to both startup and established firms has been emphasized, it is important to go beyond examining how business incubators provide administrative and other support services (Bruneel et al., 2012; Mian, 1997) to understanding the structures or characteristics of business incubators that support collaboration.

To this end, it is necessary to examine the characteristics of business incubators with an impact on collaboration among firms that are located in them. This examination involves studying the principles behind the founding of the business incubators and the activities happening in them. For example, beyond providing administrative services (Mian, 1997), how are business incubators enabling opportunities for startup firms to participate in collaborative relationships within and outside of the incubator? Understanding these characteristics will also involve examining the information environment of the business incubator with specific reference to information sharing among startup firms. Collaboration relies on information sharing (Cricelli & Grimaldi, 2010), and how information is shared among startup firms provides an insight into the structure of interactions among firms and the philosophy supporting such structures.

This study extends academic knowledge in this area by specifically contributing to the literature on startup firms and business incubators.

1.5 Research question
This study answers the question: What are the characteristics of business incubators that promote collaboration among startup firms located in them?

Here, collaboration among startup firms is a dependent variable relying on a business incubator’s characteristics. Hence, for incubator, this study measured (1) the social, informational, and physical characteristics, and for startup firms, it measures (2) the practice of collaboration among them, (3) Firms’ information sharing (4) the expectation of founders about collaboration, and (5) the continuum of collaboration.

1.6 Motivation for the study

I was born in Ebute-Metta in Lagos State, Nigeria. I spent my early years completing elementary education in Ogun State and subsequently returned to Lagos State in 1996 for high school and college education. Post elementary education, I lived in the Nigerian cities of Lagos, Benin City, and Ibadan for a combined 20 years before coming to the United States in 2015 to earn a doctoral degree. Lagos, Nigeria’s commercial capital, is about twice the size of Chicago in land area. Lagos has a population of about 14 million people, which is about five times that of Chicago.

For a couple of years, Nigeria has suffered from a prolonged high unemployment rate. This high unemployment rate is due, in part, to the lower labor absorption rate of established companies and the lack of institutional support for new companies. In the years since I left Nigeria, the unemployment rate has increased almost geometrically. As seen in Figure 1, the unemployment rate across the country has grown from about 7.5 percent in the first quarter of 2015 to about 33 percent in the fourth quarter of 2020. The difference between these periods represents a staggering 340 percent increase in the unemployment rate. In some states in Nigeria, the unemployment rate is as high as 50 percent. Lagos, known as the center of commerce, has an unemployment rate of about 20 percent during the quarter.
Figure 1: Unemployment rate in Nigeria in selected quarter between the 1st quarter of 2015 and the 4th quarter of 2020. Source(s): Statista and NBS (Nigeria)

The high rate of unemployment and the awareness of the need for job creation have led to an increase in entrepreneurial activities in Lagos and other major cities across Nigeria. Among African countries, Nigeria is now one of the top destinations for entrepreneurs looking to start their own companies. Private organizations are now investing in business incubators and technology hubs across the country, especially in Lagos. As shown in Figure 2, Nigeria ranks top among ten African countries with coworking spaces, business accelerator programs, innovation hubs, and business incubators (Shapshak, 2019).
Given this knowledge, the overarching thought for this research is to examine what innovators and policymakers in developing countries, like Nigeria, could learn from the United States and its startup communities to help these growing startup ecosystems. The findings from this study will help our understanding of the startup ecosystem in the United States, especially regarding the characteristics and features of business incubators that can promote collaboration among startup firms.

1.7 Definitions of terms

*Collaboration.* Building on the definition by Mattessich and Monsey (1992) and Thomson and Perry (2006), this study defines collaboration as a shared relationship between two or more startup firms or a startup firm and another entity, with benefit(s) for one or all the members involved in such a relationship.
Business incubator. A business incubator refers to an organization that provides support services for startup firms. These services may include office space, specialized equipment, management training, and various advisory services.

Startup firm. A startup firm is an organization that is established to provide solution to a social or business problem. Startup firms develop and validate scalable business models starting from weak market positions with fewer resources (Katila, Chen, & Piezunka, 2012).

Founder. A founder is an entrepreneur who is the owner of a startup firm in a business incubator. A startup firm can have more than one founder while a founder can also have more than one startup firm.

Continuum. Continuum is used to refer to the range of collaborative activities that is observable among or described by participating startup firms.

1.8 Study contributions

This study contributes to research on business incubators and startup firms by identifying 1) six characteristics of business incubators that impact collaboration by startup firms, 2) founders’ expectation regarding collaboration, 3) the continuum of collaboration among startup firms and 4) information sharing practices during collaboration. The findings from this study are useful for managers and organizations providing support for business incubators.

The study also extends the theoretical understanding of business incubators by introducing “intentional sociality” as an explanatory model for how business incubators can promote collaboration among startup firms. Intentional sociality seeks purposeful or deliberate social relations that emphasize both breadth and depth. It emphasizes the depth of such relationships. Intentional sociality addresses the location or design of incubator spaces, incubator’s information environment, and industry focus of incubator firms. This study contributes to the multidisciplinary literature on collaboration, literature on information sharing in innovation communities, and management sciences’ literature on startup firms.

1.9 Conclusion

This chapter introduced the subject of the dissertation and provided a brief review of some of the past studies on collaboration, business incubators, and startup firms. The
dissertation’s question of interest is to examine the characteristics of business incubators that promote collaboration among startup firms located in them. Studies on business incubators and startup firms have focused on several themes that include, understanding startup firms’ performance, support services provided by an incubator, and differences between incubator and non-incubator startup firms. This dissertation extends the literature on business incubators and startup firms by examining how collaboration is promoted among startup firms as well as understanding founders’ position on collaboration and activities surrounding it. Finally, the dissertation provides insights into information-sharing practices in innovation communities.
CHAPTER 2. REVIEW OF THE LITERATURE

2.1 Introduction

This chapter presents various themes from the literature on collaboration as they pertain to startup firms. Section 2.2 surveys the literature on startup firms and collaboration. Section 2.3 considers the influence of business incubators on startup firms. Sections 2.4 through 2.5 examine social interaction and collaboration, theoretical links between collaboration and other concepts like social networking and innovation respectively. Finally, sections 2.6 through 2.7 discuss the study’s conceptual framing and the methods of the research cited in this review respectively. 2.2 examines research themes on collaboration and startup firms.

2.2 Collaboration and startup firms

Across multiple fields, collaboration as a phenomenon involving two or more entities remains a subject of study. What is studied about collaboration is also as diverse as the different fields where it is studied. In the information field, example studies on collaboration include topics such as; co-authorship networks (Liu, Bollen, Nelson, & Van de Sompel, 2005), and the relationship between information organizations such as public libraries, archives, and museums (Duff, Carter, Cherry, MacNeil, & Howarth, 2013; Rodger, Jörgensen, & D’Elia, 2005). In the management and organizational field, the term “strategic alliance” has the same meaning as collaboration as used in this study. Eisenhardt and Schoonhoven (1996) described a strategic alliance as an inter-organizational relationship involving two or more organizations agreeing to work together while each organization retains its independence. Mattessich and Monsey (1992) defined collaboration as “a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals” (p. 7).

Several scholars have examined the reasons for, and the benefit of collaboration among participating organizations. Some organizations participate in collaboration to find and appropriate resources while others do in search of complementary skills. Gulati, Nohria, and Zaheer (2000) reported that organizations turn to collaboration because they are looking to collaborate with partners who have resources that they lack. Per Stuart (2000), the type of assets that is available in an organization, its usefulness for a potential collaborator, will determine
whether to collaborate or not. Firms prefer organizations with specialized assets or resources that are not available elsewhere (Doh, 2000).

Collaboration provides an opportunity for the joint development of new resources among the participating members. It also allows firms to have access to previously unavailable resources (Ireland et al., 2002). New firms’ survival and growth depend on collaboration. In a study of a Belgian biotech startup ecosystem, Segers (2015) reported that biotech startup firms adopt innovative business models through the provision of R&D and other services to established firms. Sergers concluded that the future of these biotech firms depends on the effectiveness with which they form a strategic partnership.

The trust level between the participating entities in a collaborative relationship will determine the longevity of such a relationship. Trust is considered necessary in collaboration because it encourages a free flow of communication and leads to positive bonds between collaboration partners (Tschannen-Moran, 2001). Organizations in collaboration often institute rules that can counter a lack of trust, but Tschannen-Moran (2001) noted that no collaborative relationship could perform at its best with only rules without some form of trusting.

Collaboration makes learning possible. Almeida, Dokko, and Rosenkopf (2003) found that for startup firms, learning from outside collaborators increases with their size. Per their study, as startup firms grow, many opportunities may become available to access and exploit external knowledge. However, the motivation of firms to learn from these opportunities may decrease. Lavie and Rosenkopf (2006) reported that collaboration provides firms with opportunities for both exploration and exploitation. Exploration and exploitation represent two broad patterns of learning behavior. Exploitation is a path taken when firms form collaboration to exploit existing knowledge while exploring involves discovering new opportunities. Rosenkopf and Nerkar (2001) concluded that collaboration is necessary because all firms can’t possess all the required inputs for continuous and successful technological development. Organizations would turn to external sources to meet their need for growth.

Proximity among firms has some influence on collaboration. McAdam and Marlow (2007) established that proximity is perceived differently by firms. The differences in perception come from the stage of growth of the firms. For new startup firms, they view proximity in a positive light. For startup firms that are more advanced in their journey, they see proximity as
potential threats. This view of proximity is because they perceive it would allow other firms to copy or the very extreme steal their intellectual property due to the closeness brought about by proximity (McAdam and Marlow, 2007). This perception is especially true among firms that have developed or owned some innovation or intellectual properties.

Other studies have emphasized proximity and openness among firms as a path to innovation. Laursen and Salter (2014) noted that innovating requires firms to draw from and collaborate with multiple entities that are external to the firms. They claimed that the process of innovating involves openness between participating members. However, to commercialize an innovation requires that an organization implement protection (Laursen and Salter, 2014). This paradox of openness in innovation and the need for intellectual property protection is in the study of McAdam and Marlow (2007). In McAdam and Marlow’s research, firms were more open and willing to co-exist in closer proximity with others when starting but resisted closer proximity as their innovation matures.

Still on proximity and how it influences collaboration among firms, Cooper, Hamel, and Connaughton (2012) examined the motivation for networking among 18 startup firms based in a university business incubator. They found that the physical proximity of resident companies influences who those companies talk to the most. They emphasized the need to take proximity between firms into account when designing a business incubator space. Their findings also show that startup firms engage with other firms in the incubator because of their strong desire for social support. Social support helps in stress management as well as to get access to resources domiciled in other resident firms. The obstacles to networking among the firms were time limitation and lack of ongoing information about resident firms (Cooper et al., 2012).

There are robust discussions of the implication of proximity in the larger body of knowledge on economic geography. These discussions focused on organizations’ location as it affects such topics as access to talents (Florida, 2002), knowledge infrastructures such as universities (Boekema & Rutten, 2003), raw materials, distribution channels, and other factors of production (Porter, 1996). To these studies, a fundamental part of the decision to start a firm is location consideration. Dettwiler, Lindelöf, & Löfsten (2006) and Ferguson & Olofsson (2004) affirmed the importance of the location of a firm in the successful trajectory of such a firm. While access to physical resources plays a critical role in the long-term success of new firms
(Colombo & Delmastro, 2002; Mian, 1996), the positive impact of nonmaterial factors has been demonstrated in the literature as well. For example, scholars have identified the partnership between universities, industry, and government as an enabler for the growth of new firms located in university research parks (Etzkowitz, 2003; Etzkowitz, 2008; Etzkowitz, de Mello, & Almeida, 2005). This relationship has been labeled the “Triple Helix” by scholars researching the subject.

This triple helix of university-industry-government often acts as potential collaboration sources for startup firms. The translation of academic research into valuable and impactful products and the bridging of the gap between academia and industry have been the narratives driving the establishment of university-backed startup firms (Clarysse, Wright, Lockett, Van de Velde, & Vohora, 2005; Link & Scott, 2005; Phan, Siegel, & Wright, 2005). Through on-campus business incubators, universities provide nurturing environments for new firms, which have a high potential for failure (Rothaermel & Thursby, 2005a). According to the United States Bureau of Labor Statistics (2017), 38.1% of firms established in March 2014, employing on average between four to seven people were no longer in existence in March 2017. Increasing the time frame, the failure rate for firms of comparable size established in 2007 was 68.8% by 2017, according to the same report.

Entrepreneurs could establish new firms in co-located workspaces other than business incubators. However, locating these firms in business incubators, where they will have access to some form of opportunities, will help the new firms grow and connect to resources. The next section examined the literature on the influence of business incubators on startup firms as they move through different growth stages.

2.3 Influence of business incubators on startup firms

Some of the central themes of the studies on incubators and companies located in them include the importance of incubators to the survival of new firms (Colombo and Delmastro, 2002; Mian, 1996; Schwartz, 2013; Sherman, 1999), the measurement of incubators’ performance (Aerts et al., 2007; Bergek and Norman, 2008; Mian, 1997; Pena, 2004; Phan, Siegel, & Wright, 2005), differences between firms incubated inside and outside university business incubators (Clarysse et al., 2005; Link & Scott, 2003, 2005; Löfsten & Lindelöf, 2002; Siegel, Westhead, & Wright, 2003b; Quintas et al., 1992), and networking among firms in
university business incubators (Bakouros et al., 2002; Bøllingtoft & Ulhøi, 2005; Rothaermel & Thursby, 2005a; Rothaermel & Thursby, 2005b; Schwartz & Hornych, 2010; Vedovello, 1997). Colombo and Delmastro (2002) assert that new firms with a technology focus have a greater probability of succeeding if located in an incubator that provides the requisite resources for growth. These include physical space, capital, coaching, common services, and networking connections (Entrepreneur.com, n.d; Mian, Lamine, & Fayolle, 2016).

Campos, Somoza, and Salmador (2011) noted that startup firms with technological products employ a high proportion of qualified employees. According to Wiens and Jackson (2015), the job-creating capability of these firms has an overall positive effect on the strength of the economy and the continual growth of the country. When compared to startup firms in general, startup firms with technological products produce faster average employment growth rates (Storey & Tether, 1998). Technology-based firms are especially important because of their capacity for spinoffs (Jaffe, Trajtenberg, & Henderson, 1993; Maurseth & Verspagen, 2002). Startup firms founded in incubators have shown higher growth rates, a higher propensity to adopt advanced technologies, aptitude required for participating in international R&D efforts, capacity for high-level collaborative arrangements, and easy access to public subsidies (Colombo & Delmastro, 2002).

Importance of incubators to the survival of startup firms. The contribution of incubators to the success of startup firms have been explored by a few studies. Colombo and Delmastro (2002) conducted a study to establish the effectiveness of incubators that house startup firms. They compared a group of 45 firms located in an incubator against a control group of firms located outside an incubator. They considered the personal characteristics of founders, motivation for choosing entrepreneurship as a path, the growth of the firms, propensity towards networking, and access to public subsidies. They report that firms located in an incubator show higher growth rates than their off-incubator counterparts, with growth being measured using commercial agreements, technological agreements, and number of employees. They also report that firms in incubators more easily adopt advanced technologies, participate in international R&D programs, and engage in some form of collaborative arrangement. One of their findings is that startup firms located in an incubator within a university have access to better human capital.
In another study, Sherman (1999) conducted surveys and telephone interviews with firm managers, community stakeholders, and incubator managers to examine the effectiveness of business incubation programs in helping startup businesses to survive and grow. Sherman reports that the rate of failure for firms in incubators was significantly lower than for all startups reported by other studies.

Mian (1996) examined the services provided by incubators to startup firms. The author reports that among the tenant firms, there is a significant relationship between the frequency of use of certain resources provided by the incubator and tenant firms’ perception of the incubator as a value-adding entity. The resources reported include mail sorting, photocopier, receptionist, facsimile/fax, custodian maintenance, security, and telephone. The firms, however, did not perceive cafeteria use, assistance in legal or government regulation, personnel recruiting, and tax matters as value-adding services. Mian concludes that business incubators provide a nurturing environment for new firms.

To track the long-term survival of firms after graduation from incubators, Schwartz (2013) conducted a large-scale matched-pairs analysis of 371 incubator firms (after their graduation) from five German business incubators and a control group of 371 comparable nonincubated firms. The analysis of Schwartz covers 10 years. The summary of Schwartz’s findings indicated that business incubators have no real impact on the long-term survival of new firms. Schwartz reports that for three incubator locations, the analysis reveals statistically significant lower chances of survival for those firms receiving support from an incubator, in contrast to what Sherman (1999) reports. While Schwartz (2013) indicated a lack of incubator influence on the survival of startup firms, many other studies regarded business incubators as providing services that are perceived as useful by startup firms (Allen & Rahman, 1985).

Assessing incubator performance. Several studies have attempted to quantify the performance of incubators based on a variety of indicators. Mian (1997) proposes three categories through which the performance of university technology-based incubators can be evaluated. The first category is performance outcomes. This category is focused on issues such as program sustainability and growth, tenant firms’ sustainability and growth, and contributions to the sponsoring university’s mission. The second category is management policies and their effectiveness, and the third category is services to tenants and their added value. Bergek and
Norman (2008) like Mian (1997) propose a theoretical framework that can serve as a basis for identifying best-practice incubator models. This framework is formed of three components: selection—how firms are chosen for the incubator (is the selection process rigorous or not?); business support—what types of business support services are available; and mediation—what ways incubators act as bridges to critical resources needed by the new firms.

It has been reported that most incubators admit startup firms by concentrating either on the characteristics of the firms’ market or on those of the firms’ management team (Aerts et al., 2007). In fact, Aerts et al. (2007) reports that firms’ survival rate is positively related to a more balanced screening profile that include an assessment of the capability of the proposed founder (s) to be able to lead a new firm in the chosen area. Pena (2004) explored factors related to human capital and organizational resources that help in overcoming barriers to survival during the infancy of startups. Pena shows that founders with advanced education and business management experience performed better than those without such skills. Some scholars are skeptical that researchers can measure incubators’ performance accurately. For example, Phan, Siegel, and Wright (2005) report that there is no available systematic framework for evaluating the effectiveness of incubators.

Differences between startup firms based on incubator affiliation. Clarysse et al. (2005) compared the goals and objectives of several research institutions for creating new companies. They examined the different incubation strategies employed to achieve these goals in terms of the resources utilized and activities undertaken. In their view, incubators can either be resource deficient or competence deficient. Link and Scott (2003) examined the influence of science parks on the academic missions of universities and reported that a formal relationship between the university and the science park positively impacts the rate of publication, patenting, extramural funding, the ability to hire preeminent scholars, and the placement of doctoral students after graduation.

Löfsten and Lindelöf (2002) investigated startup firms located in university research parks and those located elsewhere to identify ways support provided by the incubators differ across the two. They reported that there is no evidence of a direct relationship between being located in a university incubator and profitability, though the proportion of startup firms in university incubators with connections with universities is comparatively high. Similarly, Siegel
et al. (2003a) examined the impact of university affiliated business incubators on the research productivity of firms. They report that firms located in university affiliated business incubators have higher research productivity than firms not located in university affiliated business incubators.

Conversely, in exploring performance differences between firms located in university affiliated incubators and those outside university affiliated incubators, Siegel et al. (2003b) state that firms’ benefits from being located on a university can be considered negligible. They noted that this may be due to imprecise estimates of these benefits for different types of university affiliated business incubators. Quintas et al. (1992) report how firms located in university affiliated business incubators benefit from collaboration, but that there are mismatches between academic research output and the R&D needs of university affiliated firms.

Business incubators in universities in the United States and around the world offer built-in advantages for new companies in those incubators and for the universities that host the incubators. Specialization is one such advantage, as when a university with academic and research strength in biotechnology hosts startup firms focusing on the biomedical domain in its incubator (Link & Scott, 2005). Positive outcomes for both the startups and the university are not guaranteed, however, if the incubator is not supported properly by the host university.

2.4 Social interaction and collaboration

In a 2000 publication in Harvard Business Review, Hansen, Chesbrough, Nohria, and Sull wrote extensively on the importance of networking in a business incubator. In their article titled Networked Incubators: Hothouses of the New Economy, they reported that only 26 percent of 350 incubators surveyed worldwide provide organized networking that enables startup firms located in them to acquire resources and collaborate with others quickly. On the need for networking, they identified four questions entrepreneurs must ask before joining a business incubator.

The first question is whether the companies in the business incubator are related to one another by industry or by technology. The answer to this question will help an entrepreneur decide whether the focus is consistent with their vision. Second is to examine the strength of the companies’ portfolio, strategic partners, and external advisers of the business incubator. The
third question considers whether the business incubator maintains some form of organized mechanisms to encourage cooperation or networking among firms. The last examines the relationship between a business incubator and outside strategic partners and how the relationship will be beneficial to the startup firms.

Other studies have examined social interaction and its influence on collaboration among startup firms. For example, some studies introduced the concept of homophily as an explanatory concept for how firms form relationships. McPherson, Smith-Lovin, and Cook (2001, p. 416) define homophily as the “principle that contact between similar people occurs at a higher rate than among dissimilar people.” The authors go on to state that “the pervasive fact of homophily means that cultural, behavioral, genetic, or material information that flows through networks tends to be localized.”

Homophily implies that the closer people or organizations are in terms of social characteristics, the closer the network between them. According to McPherson, Popielarz, and Drobnic (1992), homophily works by structuring the flow of information and other social resources through the network. Anagnostopoulos, Kumar, and Mahdian (2008) state that homophily is one of three factors that are the cause of correlation in social networks, the other two being influence and environment. Centola (2010) contends that homophily and strong interpersonal influence in social ties can improve the diffusion of innovation through social networks.

Some studies have examined how the location of startup firms affect their social interaction. For example, Vedovello (1997) sought to determine the extent to which a university facilitates the relationship between the university and firms in the university-affiliated incubator. The author concludes that a university-affiliated business incubator can facilitate the establishment of informal and human resource links, but links related to research activity are not substantially facilitated. This finding seems to indicate that universities do not foster a significant type of social interaction in their affiliated business incubators. However, other studies have found that knowledge does flow from the university to incubator firms. Rothaermel and Thursby (2005a) report that this occurs via contractual/formal and noncontractual/informal routes and that it increases the absorptive capacity of the firms, which is positively related to firm performance.
Rothaermel and Thursby (2005b) sought to know how the strength of the tie between the sponsoring university and incubator firms affects the latter’s chances. Their findings indicate that strong ties to the sponsoring university reduce the likelihood of firm failure, because of strong intellectual property protection, quality signaling effect, and involvement of potential investors. One downside of strong ties between incubator firms and the university, however, is that they retard graduation from the incubator. Weak ties, such as informal interaction with the faculty, do not have an effect in terms of outright firm failure or timely graduation.

Bakouros et al. (2002) find that informal links between incubator firms and universities were more prominent in the three parks they studied than formal links and that joint research activities were absent. Schwartz and Hornych (2010) likewise report the presence of informal relationships and affirm that there is a need for trust-based relationships between incubated firms. Bøllingtoft and Ulhøi (2005) propose that there are two main categories of factors that can facilitate or hinder networking in an incubator, the first being individuals and their relationships with each other and the second mechanisms related to the construction of the incubator.

**Knowledge flow among organizations.** According to Acs, Braunerhjelm, Audretsch, and Carlsson (2009), the efficiency of knowledge production in an organization is enhanced by the historically developed stock of scientific-technological knowledge. The more knowledge is available to an organization, the greater the capability of such an organization to create more by working with and/or building on the already available knowledge (Cohen & Levinthal, 2000; Tsai, 2001; Zander & Kogut, 1995).

Organizations in a cluster are reported to have access to external sources of knowledge. That is, knowledge generated by a firm within a business cluster is accessible to other firms within the cluster (Jaffe et al., 1993; Thompson & Fox-Kean, 2005, cited in Acs, Braunerhjelm, Audretsch, & Carlsson, 2009). This phenomenon has been referred to in the literature as knowledge spillovers (Rothaermel & Thursby, 2005a). Hence, while new firms within a cluster may pay to have access to existing sources of knowledge, the environment can provide them with the opportunity to freely appropriate new knowledge that is created by incumbents but not used by them (Kirzner, 1973; Schumpeter, 1934; cited by Acs, Braunerhjelm, Audretsch, & Carlsson, 2009).
The importance of knowledge spillovers for sustaining innovation in business clusters has been emphasized by scholars in the fields of economics and innovation studies. Porter (1998) argues that clusters continue to be effective, despite the changes in organizational structures in the global business environment. Porter states that competitive advantages are increasingly tied to local factors, such as knowledge, relationships, and motivation, which distant rivals cannot match. Relationships contribute significantly to knowledge spillover and according to Porter, the location of a firm in relation to those of other firms impacts both relationship formation and access to knowledge. There is evidence in the literature to support a demonstrable increase in knowledge spillovers within clusters, including those in research and technology parks. Gilbert, McDougall, and Audretsch (2008) find that industry clustering and technological knowledge spillovers have strong positive relationships with product innovation, but weaker relationships with sales growth of the firms in their sample. Their results do show that industry clustering and technological knowledge spillovers are positively correlated.

Clearly, from the preceding sections, scholars have identified factors such as networking, the location of business incubators, differences in business incubator types, as influencing the growth or performance of startup firms. Not many of these previous studies have examined the social and physical characteristics of business incubators that have the potential to promote collaboration among startup firms. The current study examines this question. The examination of this question among startup firms is necessary. It is necessary because many of the reviewed studies emphasized that collaboration among startup firms often leads to a competitive advantage.

2.5 Theoretical linkages between collaboration, social networking, and innovation

The overarching interest in this study is to understand the social and physical characteristics of business incubators that promote collaboration among the firms located in them. One of the goals of collaboration, especially in organizational settings, is that collaboration partners will acquire some level of benefits. Benefits can come as product innovation or learning for startup firms. This section is a discussion of some theories about the advantage of collaboration, and how social interactions or networking among firms affect collaboration. Besides, the section provides the connection between collaboration and innovation. It does this by showing that, since innovating is always the focus of new firms, collaboration is an effective
way new firms can rapidly innovate while using as little resources as possible. The section provides a theoretical discussion of other concerns associated with collaborative relationships.

Collaborative advantage. There have been both theoretical (Huxham, 2003) and exploratory (Kanter, 1994) discussions of collaborative advantage. Kanter (1994) asserted that organizations acquire corporate assets each time they engage in collaboration with a valuable partner. These corporate assets that come as a result of collaborating, Kanter calls collaborative advantage. Without these forms of corporate assets or other benefits accruing as a result of collaboration, Huxham (2003) advised not to pursue any partnership whatsoever. Huxham (2003) believes that real advantage can only come out of collaboration if partners could not achieve alone, the result that emerges because of collaborating.

Kanter (1994) identified that collaboration or cooperative arrangements between organizations range along a continuum from weak and distant to strong and close. For a collaborative relationship to be productive, Kanter mentioned that it must achieve five levels of integration. The integration must take place at the strategic, tactical, operational, interpersonal, and cultural levels. Kanter’s theorization explains collaboration among established entities with functioning systems and operations that can devote significant resources to the process of collaborating. This theoretical lens may not capture in full, the practice of collaboration among startup firms. Startup firms have little or no resources that may be devoted to managing collaborative relationships.

For successful collaboration, partners must be able to create new values together rather than getting something back for what was put in (Kanter, 1994). Partners must also value the skills each member of the collaboration brings in. For collaboration to be considered active and beneficial, the participating entities must develop mechanisms that will handle the organization and interpersonal differences. Effective management of differences among participating entities, per Kanter (1994), will ensure collaboration members achieve real value for the collaboration.

Huxham (2003) noted that collaborative advantage may not always appear as an end product of collaboration. Collaborative advantage, per Huxham, may come in non-obvious forms, as the learning that takes place, or the connection forged during the process of collaborating. To effectively manage collaborative relationships and obtain an advantage in the process, Huxham (2003) identified five themes that must be addressed by the partners. These
themes include having common aims, balancing power structure, ensuring trust, agreeing on membership structure, and addressing the leadership of the collaboration earlier in the process. Huxham reported that when a collaborative relationship is not well managed, collaborative inertia can emerge. Per Huxham, collaborative inertial occurs when the output from the collaboration is negligible, or the rate of output is extremely slow.

**Collaboration through social networking.** Owen-Smith (2016) defined a network as a concrete pattern of relationships among entities in a social space. This definition of network prescribes all networks to be social in nature. However, not all networks are composed of social elements; a computer network is one such network. The present study rephrases the definition of Owen-Smith (2016) by defining a social network as a concrete pattern of relationships among entities in a social space.

A social network is primarily composed of nodes and ties. Ties are the connectors, that is, the relationships formed between nodes. A node could refer to a person or an organization or a combination of both. Nodes can have attributes: for example, in a class there could be students with different genders, pursuing different majors, and at different academic levels (see Marin & Wellman, 2011). These attributes often distinguish the individual nodes in the network (Crossley et al., 2015). Seminal studies such as the work of Granovetter (1973) on the strength of weak ties and the work of Travers and Milgram (1967) on the small-world theory leading to the proposition about the six degrees of separation have provided us with foundational knowledge on the functioning of social networks.

Granovetter (1973) established the importance of weak ties for the seeking of opportunities. He argued that strong ties often limit an individual’s opportunities, whereas weak ties frequently act as a bridge by means of which individuals can access resources outside of their immediate network. This proposition has had strong import for most studies examining the characteristics of collaboration in most settings and applies to the present study. Building on some of these earlier works, scholars have identified opportunities and resources that are available through social networks. One fundamental resource is known in the research literature as social capital, which is simply the advantage accruing to a network member for being part of the network (Burt, 2001).
Burt (1992) and Putnam (2000) cited in Owen-Smith (2016) confirm that through social networks, individuals and communities have access to social capital. Social capital is captured from embedded resources in social networks (Lin, 2017; Coleman, 1988). According to Lin, embedded resources in social networks affect the flow of information and an individual’s social credentials and exert influence on the agents. In organizational studies, it has been established that networks create status and category differences in markets (Podolny, 1993; Zuckerman, 1999, as cited in Owen-Smith, 2016).

Networks contribute strongly to the performance of innovative locales such as business clusters, incubators, and research parks, as has been shown in studies examining clusters in the Silicon Valley, for example (Porter, 1998; Owen-Smith & Powell, 2004). In a study of interfirm ties between entrepreneurial firms within the garment industry in New York, Uzzi (1997) reports that trust is an explicit and primary feature of the network of these firms. Social networks also inspire conformity in thought and action (Galaskiewicz, 1991; Mizruchi, 1992 cited in Owen-Smith, 2016). Finally, social networks help in shaping the diffusion of technologies (Rogers, 1962; Mark, 1998 in Owen-Smith, 2016).

Elements of a successful collaboration. Rogers (2003) identified the basic elements necessary for a given innovation to diffuse and Cooke & Morgan (1998) identify similar elements as necessary for firms to build capacity for innovation. The present study uses the term “collaboration,” in which innovation occurs across firms, as equivalent to “associational capacity” in Cooke and Morgan (1998). So, the question arises that if collaboration is necessary for successful innovation by a firm according to Cooke and Morgan (1998), what then are the elements of successful collaboration?

Mattessich and Monsey (1992) define collaboration as a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals. They note that successful collaboration yielded the following benefits: it can reduce individual expenses in planning, research, training, and other development activities in the early stage of a new initiative and when overhead expenses are shared, duplication of cost and effort is avoided.

Mattessich and Monsey (1992) conducted an extensive review of the literature across multiple fields and identified six categories of factors that determine whether or not a collaboration is successful: environment, member characteristics, process and structure,
communication, purpose, and resources. Similar to Mattessich and Monsey (1992), in their book on managing to collaborate, Huxham and Vangen (2013) contend that membership and status in collaboration are sometimes ambiguous. Citing Roberts and Bradley, (1991), they concluded that having an explicit membership, where the parties know and agree on who is involved and in what capacity, is a key definitional element of collaboration.

Huxham and Vangen (2013) discuss the negotiation of purpose in collaboration, identifying what they call “characterizing episodes” in this process. Some of the categories of “characterizing episodes” include: “cohesive group episodes,” where the members of the group agree to take collective action in which they know their organizations would have no interest; “disinterested organization,” where one organization seems not to agree with the group; Another issue that is tied to member characteristics is “trust.” Gulati (1995) defines trust in an interorganizational collaboration as the expectation that partners have about their collaboration and about their partners’ future behaviors in relation to meeting those expectations.

Innovation through collaboration. Researchers have examined innovation by a range of individual actors, including programmers who contribute to open source projects such as software development (Hippel & Krogh, 2003); professional athletes who develop their own sports equipment (Franke & Shah, 2003); and seemingly ordinary users of products who become product innovators (Von Hippel, 1976, 1986, 2005; Von Hippel & Katz, 2002). Scholars have also looked at communities (Hippel & Krogh, 2003; Franke & Shah, 2003; Von Hippel, 1976, 1986, 2005; Von Hippel & Katz, 2002) to identify the common mechanisms necessary for the diffusion of innovation as discussed by Rogers (2003). In the communities studied by these scholars, innovation often emerge as a result of collaboration among the community members.

Innovation is a core component of entrepreneurial activities, which promote job creation, and by extension innovation provides opportunities for the citizens of countries that provide supportive environments for it (D. G. Birch, 1987; D. L. Birch, 1989; Decker, Haltiwanger, Jarmin, & Miranda, 2014; Klette & Førre, 1998; Goos, Konings, & Vandeweyer, 2015). Innovation results in wealth creation and sustenance and is a major factor in the differing levels of job creation in developed and developing economies (Bhidé, 2009).

Rogers (2003) defined innovation as an idea, practice, or object that is perceived as new by an individual or other user group. He identified the main elements in the diffusion of
innovation to be the innovation itself, communication channels, time, and a social system. The last three elements mentioned above have been presented in the research literature in different forms as drivers of innovative activities (Mulgan, Tucker, Ali, & Sanders, 2007; Pérez-Luño, Medina, Lavado, & Rodríguez, 2011). For the sport community studied by Franke and Shah (2003), a social system allows for innovation to diffuse through collaboration among the community members.

To emphasize the importance of collaboration in organizations’ innovation process, Cook and Morgan (1998) noted that successful innovation is ever more dependent on what they referred to as the associational capacity of a firm. They report that the associational model correlates high capabilities in social interaction and communication, particularly in the forms of high trust, learning capacity, and networking competence, with the economic and social success of a firm. Where Rogers (2003) contends that without the innovation, there is no basis for talking about the need for a communication system, a social system, and the time required for diffusion, Cooke and Morgan (1998) considered associational capacity a prerequisite for innovation. Going further, Cooke and Morgan (1998) stated that innovation is a collective and iterative endeavor rather than an act of heroic individualism.

Collaboration continuum. Depending on the partners involved, collaborative relationships can take several shapes and forms. This section describes a continuum of collaboration that matched the focus of this study. Waibel, Zorich, and Erway (2009) introduced a continuum for a collaborative relationship among library, archive, and museum. The continuum starts with **contact** (Figure 3), which they referred to as the first point of the meeting where potential collaboration members explore options. The second stage is **co-operation**. At this stage, the different entities agree to work together, informally, on something that would result in a small but tangible benefit to all involved. At the third stage, which is **co-ordination**, there are formalized procedures that guide members who previously chose to engage in a co-operative relationship. This formalized procedure helps to move the interactions beyond what only offers small benefits to the entities involved. The fourth stage they had named **collaboration**. This stage is the point at which individual entities involved are now co-creating together and getting involved in shared creation.
This study uses co-creation to replace collaboration in Waibel et al. (2009), to give it a more appropriate label. The rationale is that the continuum itself describes the stages involved in collaborating, using collaboration as part of those stages confuses the reader. The last stage on the continuum is convergence. Convergence is a state, in which collaboration around a specific function or idea, has become extensive, engrained, and assumed. At this point, it is no longer recognized by others as a collaborative undertaking. This continuum aptly explains the collaboration discussed by the founders in this study. The study used four out five to describe the collaboration among the startup firms. These four are contact, co-operation, co-ordination, and co-creation. The study used these four because all of the descriptions of collaboration encountered fall under either of them.

2.6 Conceptual framework

This study asks, “What are the characteristics of business incubators that promote collaboration among startup firms located in them?”

A business incubator is an organization that provides support services for startup firms. These services may include office space, specialized equipment, management training, and various advisory services. The thesis here is that incubators have the potential to promote
collaboration among the entities located in them, thereby enhancing the possibility for innovation based on these collaborative relationships. This collaborative relationship can occur among startup firms or between startup firms and other established organizations within or outside such incubators.

The focus of this study, however, is to understand the characteristics of business incubators that enable them to promote collaboration among startup firms. This study assumes that business incubators are a social environment. It is already established that social systems help with the diffusion of innovation (Rogers, 2003). The operationalization of the research concepts linking Rogers (2003) to the present study is depicted in Figure 4, followed by further explanation. In Figure 4, Level 2 is a particularization of Level 1, and Level 3 presents the aspects of the variables about which data were collected.

According to Rogers (2003), innovation is diffused within a social system, with a social system being defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal (p. 23). The present study extrapolates from Rogers’ theoretical framework, positing that a social system is needed not only for the diffusion of innovation but also for promoting collaboration. As have been discussed previously, collaboration among firms leads to the creation of innovative product and services. Hence, per Figure 4, while innovation requires a social system to diffuse, collaboration is also better promoted in a social system. This position is supported by the conclusion of Cooke and Morgan (1998):
Successful innovation is becoming ever more dependent on the associational [or relational or collaborative] capacity of the firm—that is its capacity for forging cooperation between managers and workers within the firm, for securing cooperation between firms in the supply chain, and for crafting co-operative interfaces between firms and the wider institutional milieu, be it local, regional, or national. (p. 9)

The present study argues that business incubators can be regarded as social systems, because based on the definition of Rogers (2003), incubators are comprised of a set of interrelated units. These may include: management teams involved in the day-to-day running of the incubators, the registered startups that work within the space, informal and formal networking activities that bring the startups within the incubators together, configuration of the incubators’ physical space that often enable interaction, other members of the immediate community in which the incubators is based, and companies within the vicinity and in distant locations who interact with the incubators at multiple levels.

Building on the assertion of Cooke and Morgan (1998) that organizations need to build relational capacity to enhance innovation, the present study understands “relational” here as equivalent to “collaborative.” It is therefore crucial to understand how incubators foster this relational or collaborative capacity in startups hosted by the incubators. This capacity in turn enables innovation on the part of startups either within the incubators or with entities outside of the incubators.

This study organizes its investigation of collaboration among firms in business incubators by measuring aspects of two variables: the incubator and the member startup firms’ collaboration. As will be shown, key characteristics of the incubator include corporate membership, space configuration, informal and formal networking, industry focus, information environment, and human and social capital. Key characteristics of collaboration include the actual practice of collaboration, information sharing, expectation of startup founders, and the continuum of collaboration. These are spelled out in Figure 4.

2.7 Methods used by previous studies

Understanding the methodological approach of previous studies provides some direction for the current study. Several choices guide the methodology that any research adopts. Research
emanating from similar epistemology can use a different method of data collection, for example. While understanding previous research helps shape the methodological focus of the current study, this research bases the final decision on the uniqueness of its question and research settings.

The methodologies used by previous studies to conduct research about business incubators, though diverse, often share some form of commonalities. Mian (1996) collected data via onsite interviews of incubator managers and their staff. The interview data was supplemented by information obtained through mail surveys administered to the client firms of the incubators. Mian’s study included 6 university technology business incubators chosen from a sampling frame of 30. According to Mian, the criteria for choosing these six was that they (a) were sponsored by a major university in the US; (b) represented both public and private university types; (c) were generally viewed as successful or otherwise unique; and (d) were at least five years old. Similar to Mian, Sherman (1999) conducted surveys and telephone interviews with firm managers, community stakeholders, and incubator managers.

Shah (2000), who studied equipment innovation in three sports communities (skateboarding, snowboarding, and windsurfing) took a different approach. The study utilized a snowballing approach to identify individuals connected to important innovations within these three communities. The researcher contacted these individuals and asked them to help provide information about people who had excellent knowledge of the history of innovation in each of the selected sports. This approach was repeated to reach other participants. In all, the study identified 10 important equipment innovations for snowboarding, 7 for skateboarding, and 40 for windsurfing. The data collection after identifying the potential participants was via one-on-one telephone interviews, and the interviews were semi-structured.

Franke and Shah (2003), who also studied innovation in equipment, had two sets of criteria for selecting communities of interest. The first was that community members must be engaging in innovative activities, and the second was that there must be diversity in community makeup and structure. The second criterion was included to ensure they covered a broad range of community and user characteristics, thereby enhancing the generalizability of their findings. In their study, which covered four communities of sports innovators, they conducted several qualitative interviews to develop a deeper understanding of the contributions of the communities.
to the innovation processes. The researchers mailed paper questionnaires to three of the communities and sent emails containing a link to the online version of the research question to the fourth.

Link and Scott (2005) studied the determinants of the formation of university spin-off companies within associated research parks. The authors conducted an interview and surveys at 51 research parks in the US in order to determine the percentage of research park organizations that were university spin-off companies. Schwartz and Hornych (2010) started their data collection by obtaining information about startup firms in Germany. To do this, they browsed through the websites of 26 incubators, and created a dataset that included all startup firms in these incubators. The final dataset included 778 startup firms. They designed and sent out a standardized questionnaire based on prior studies. These questionnaires were mailed to all 778 firms initially with a follow-up via email. The final response rate was 20.7%.

Schwartz (2013) investigated how incubators impacted firm survival positively. Selection was based on the age of the incubator, with a required minimum operation time of 13 years; 5 incubator locations were chosen for the study. Researchers conducted in-person interviews with the managers of each incubator regarding the operations of the incubators. The researchers obtained information about current and past startup firms from the incubator managers interviewed. A total of 462 firms were identified across the 5 incubators. The final set used in the analysis was composed of 371 firms. This was after adjusting for firms who used the incubators’ address without necessarily being located in the incubator during the period considered in the study.

There is a commonality across these studies. While a few involve a survey of participants, the majority primarily involves interviewing participants. For example, Mian (1996) interviewed incubator managers and their staff, and Sherman (1999) conducted both surveys and telephone interviews with managers and other incubator stakeholders. The remaining studies, Shah (2000), Link and Scott (2005), and Schwartz (2013), conducted interviews. Interview as a qualitative data gathering method helps a researcher get to the “why” of a phenomenon, it allows the interviewee to provide details, unrestricted. Interviews provide an opportunity for serendipitous learning, where researchers can unfold layers by probing research participants for additional insights as they provide answers to written interview questions. Similar to these
previous studies, the current study used in-depth interviews with managers of incubators and founders or representatives of startup firms. The study supplemented interview data with observation and document analysis.

2.8 Conclusion

Scholars have investigated the contribution of business incubators to the long-term survival of startup firms, with some narrowing the focus to compare the impacts of university-affiliated incubators and for-profit business incubators. These studies present a range of conclusions that do not form a consensus. Some studies show that business incubators do positively impact the survival of startup firms and others report little or no influence.

One point of agreement across previous studies is that business incubators make available support services that are necessary for most new firms. These services are also provided at scales that cannot be matched, were startups to randomly rent office spaces elsewhere. The present study understands this positive impact to stem from the functioning of a business incubator as a social system, a concept set forth by Rogers (2003) and further asserts that as a social system, business incubators can promote collaboration among resident firms. Hence, the goal of this study is to identify the characteristics of business incubators that promote collaboration among firms.
CHAPTER 3. RESEARCH DESIGN

3.1 Introduction

This research analyzes characteristics of four business incubators alongside aspects of collaboration among their member startup firms as described by 44 founders or co-founders or senior members of the startup firms. The 44 interviews yielded information about 89 co-founders of the firms. Additional data comes from four interviews with incubator managers. In section 2.6, the study presented a conceptual framework (Figure 4) of the relationship between business incubators and collaboration by startup firms. The present chapter discusses the study’s setting, population and the sample size, and explains the strategy used to recruit participants. This chapter then presents the content of the interview guide and the observation rubrics, as well as the approach taken in analyzing the research data.

3.2 Research Setting

The research was conducted in four business incubators in the Midwest United States identified as A, B, C, and D. Table 1 provides an overview of these four study sites.

Table 1. An overview of incubator characteristics across research sites

<table>
<thead>
<tr>
<th>Business incubators</th>
<th>Year founded</th>
<th>No of startup firms (As of June 2019)</th>
<th>Industry focus</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2004</td>
<td>63</td>
<td>Technology (General)</td>
<td>University</td>
</tr>
<tr>
<td>B</td>
<td>2014</td>
<td>28</td>
<td>Technology (General)</td>
<td>University</td>
</tr>
<tr>
<td>C</td>
<td>2012</td>
<td>212</td>
<td>Technology (General)</td>
<td>Nonprofit organization</td>
</tr>
<tr>
<td>D</td>
<td>2015</td>
<td>216</td>
<td>Technology (Healthcare)</td>
<td>City government</td>
</tr>
</tbody>
</table>

*Incubator A.* This is a 43,000-square-foot business incubator built as a part of a university research park. As of June 2019, the research park is home to 126 companies of which 63 are startup firms. These 63 startup firms are housed inside of incubator A, which doubles as the administrative office for the entire research park community. Incubator A is a vehicle through which the university is helping early-stage technology companies to launch successful scientific and research-based startup companies.

Incubator A has a number of labs and scientific resources that are intended to enable these firms to innovate at scales that may never be possible if they were located somewhere else.
Investment in lab resources, according to a manager at incubator A, is due to the incubator’s focus on scientific and research-based firms. Labs range from basic to full fitted out for chemical and life science companies. Other facilities available to firms include shared co-location facilities such as server space, server room, and a data center.

There are four shared conference rooms that can host from 8 to 25 people at a time. Each of the conference rooms is equipped with a Polycom conference phone, whiteboard walls, a liquid crystal display (LCD) television for laptop hookup, and wireless and hard-wired connections. Other equipment includes built-in projection system and laptop. The incubator has another space that is frequently used for conference-style meetings. It can hold 50 people and even more if arranged theatre-style. This space is the most visible open space within incubator A when one enters the building, and it has a built-in projection system and laptop. On a regular day, entrepreneurs within incubator A eat their lunch and have casual meetings in this space.

Particular features that distinguish incubator A from incubators C and D is the floor plan and membership structure. While both incubators C and D price membership per head or per full-time employee for each firm, incubator A charges startup firms based on the size of the office space. This implies that all firms in incubator A have their own office space. There is nothing like shared and dedicated desks as are available in both incubators C and D. The implication is that entrepreneurs at incubator A often only connect physically in spaces such as the open conference area, kitchen, and other random meeting points, unlike entrepreneurs at incubator C and incubator D who often sit side by side and at the same desks during the work day.

Like the other incubators, incubator A provide other services, such as a mentoring program through which experienced entrepreneurs and experts provide mentorship and professional guidance to startup firms. Professional help received by startup firms includes legal advice, recruitment strategies, and grant writing. Entrepreneurs who participated in the study confirmed that they receive help in applying for grant programs such as the government’s small business innovation research (SBIR) grant. The SBIR program is a prestigious grant that is awarded to innovative businesses, mainly in the sciences, to help them scale and overcome the financial challenges associated with starting a new company (Small Business Innovation Research, n.d.).
Incubator B. Incubator B is part of a 34,000-square-foot entrepreneurial center also owned by a university. The center in which incubator B is located was established to foster entrepreneurship and its incubator program is just a part of this larger vision. Membership is open to students of the university, faculty members, and local entrepreneurs.

Incubator B had fewer startup firms during the period in the field in comparison to the other three. It only admits a handful of companies per year and these are taken through an accelerated program to help steer them in the right direction for success. There were only 28 startup firms in the 2019 cohort. The incubator’s membership page states that startup firms should only apply to be part of the incubator if they have participated in the yearly business case competitions sponsored by the center. These competitions are open to aspiring entrepreneurs and offer cash prizes. Unlike incubators C and D, incubator B does not accept solo founders. For a startup firm to be accepted, the firm needs to have a team in place. Some of the benefits available to entrepreneurs at incubator B include entrepreneurship education, a range of programs and events, mentorship, funding, technology commercialization, and partnerships and industry relations.

In terms of floor plan, the entire center can be divided into two broad areas, a large co-working space referred to as “the theatre” and the incubation space. The co-working space has the capacity to seat 1,200 people. Because the center where the incubator is located also runs individual membership, the co-working space is mostly used by individual members who are part of the university or the immediate community. These individual members are not part of the incubator, as only teams with startup ideas can apply to join the incubator. This co-working space is equipped with shared desks and chairs, sofas, open meeting spaces, and writing boards. The incubation space is dedicated to the startup firms. The incubator space is physically separated from the co-working space. The firms have access to dedicated desks and storage space; mail, printing, and fax services; and conference rooms for conducting business activities. The layout of the incubation space is such that while startup firms do have their privacy, the space is open enough to help foster impromptu meetings and collaboration. Entrepreneurs can see each other across the space, as they are only divided by cubicles that is just about three feet tall.
Like incubator A, incubator B also has extensive lab resources in conjunction with many research labs at the university. The tenancy of each of the startup firms in incubator B is, however, assessed every six months and renewal by the management of the incubator is based upon favorable performance. Because of this, the incubator management organizes monthly “check-in” sessions with the companies for founders to share experiences among themselves and for incubator management to help answer critical questions founders may have. Among other services, incubator B also provides firms with professional services that include a legal clinic and grant writing.

**Incubator C.** This 75,000-square-foot business incubator supports technology-focused startup firms and institutional members. It is owned by a nonprofit organization. It supports startup firms intending to build technology to solve varieties of problems, and so their products must have a technology component. The firms can have their focus on any industry however, and thus incubator C is regarded as a broad-based incubator. Incubator D, by contrast, is a special-purpose or industry-focused incubator, as will be discussed below.

Incubator C is located in a metropolitan area and offers traditional co-working space in addition to private office spaces and meeting rooms to accommodate many stages of a company’s growth. As of June 2019, this incubator housed 295 organizations, out of which 212 were startup firms. In terms of its floor plan, incubator C was divided between reserved and shared membership. Reserved membership gives a startup firm access to dedicated desks, while shared members work within a shared space. Spaces dedicated to reserved members were partitioned away from shared members. A number of universities also have membership and rent office spaces in incubator C to enable their students have access to incubator resources. The researcher used the university membership to gain access to the space prior to recruiting participants for the study.

Membership in incubator C for startup firms is flexible and exists in a number of categories. Membership options include night and weekend, shared, reserved, growth stage, and designers and developers. Night and weekend membership is for entrepreneurs building their startup on the side. During the period in the field, this membership category was priced at $175 per month. Members have access to a variety of shared workspace options all day Saturdays and Sundays and 5 p.m. to 8 a.m. Mondays to Friday. This membership also provides access to two
workshops during the work week. The shared membership option is for early-stage entrepreneurs. The cost is $350 per month and shared members get 24/7 access to an open, collaborative environment, a variety of seating options, technology, and tools. Additional benefits are access to all types of seminars, workshops, and office hours.

Reserved membership is for growing companies with two to eight staff members. It costs $500 per month. Members in this category have access to all the benefits available to shared members, in addition to having their own dedicated workstation, lockable under-desk storage, and additional reserved area conference rooms. Growth stage companies pay $600+ monthly and have access to shared membership amenities in addition to other benefits. Growth stage companies ideally have customers for their products and are in the process of scaling their companies. Designers and developers provide design and development services to startup firms. This membership category is $300 per month. They have access to shared membership amenities at a discounted rate.

Startup firms at incubator C are welcome to stay as long as they want, provided they are making progress on their products. Membership fee is charged per head or per full-time employee. Therefore, as startup firms increase their staff, they either have to pay more or move out of the incubator altogether to a more cost-friendly space. One of the strategies used by startup firms that are interested in receiving continued membership benefits as their staff increase in number is keeping a shared membership in the incubator while the majority of the staff work from a cheaper location outside of the incubator.

Incubator C hosts a variety of regular workshops and meetings for startup firms. The average number of workshops or seminars per month is 10. There were as many as 18 workshops or seminars in the month of August 2019 alone. Topics of these varied, and attendance was not limited to employees of startup firms in the incubator, as the workshops/seminars were open to the larger startup community in the city. Membership in the incubator gives employees of the startup firms the opportunity to attend all of these events for free. The incubator provides mentorship, recruiting, and diverse other professional services for member firms.

Incubator D. This incubator occupies a 25,000-square-feet space in a metropolitan area. It supports entrepreneurs and technology innovators in the field of medical devices, healthcare IT, and diagnostics and biopharmaceuticals. As such, incubator D is an example of an industry-
focused incubator, unlike the other incubators in this study. In terms of its floor plan, it is split between reserved and shared membership areas. There are more than six small meeting rooms, an auditorium, a classroom, a kitchen, a copy room, and a restaurant.

The membership of incubator D includes startup firms and corporate partners, with membership types falling into two broad categories—global and local. Global members are startup firms located across the US and in countries such as Canada, Israel, and Germany. Within the local category, firms have either shared or premium membership. Shared membership allows startup firms to work from the shared desks while having access to all of the incubator’s programs, services, and facilities. Premium membership ensures that members get dedicated desks in addition to all of the benefits available to shared members. As of May 2019, there were a total of 216 startup firms and 56 partner organizations listed on the incubator’s website.

A manager at the incubator mentioned that the exposure received by listed companies and access to the U.S. market are some of the reasons for international membership. Companies located outside of the city and the US that are members of incubator D benefit primarily through various virtual meetings and training, opportunity to connect with large healthcare organizations, access to venture capitalist firms, and proximity to peer startup firms. On its membership application page, the incubator listed reasons startup firms may want to join the incubator, which include access to strategic partners, finding investors, and access to mentor networks.

At incubator D, just like at incubator C, the membership fee is charged per full-time employee, so that a firm’s cost for membership increases as the number of people working for the firm increases. As was also the case at incubator C, startup firms often want to keep their membership even as their team continues to grow, so they will rent office space outside of the incubator where majority of the staff members will work and then pay for a shared membership at the incubator. Typically, firms remain at the incubator if their team is under five employees and will consider an outside space once the team exceeds this number.

Like incubator C, incubator D also organizes workshops and trainings covering different topics and questions in the startup journey. Attendance is both local and virtual and free to startup members. Incubator D maintains a network of mentors who are knowledgeable in specific areas of interest to these new companies. Corporate members include large healthcare systems and insurance companies that are looking to partner with the startup firms.
3.3 Study population, sample size, and unit of analysis

The study was conducted among startup firms in the four business incubators described in the preceding section. To select an appropriate sample size, the researcher turned to the qualitative research literature for suggestion. Morse (1994) suggested between 30 – 50 interviews for studies using ethnography and grounded theory approaches, while Creswell (2013) suggested 20 – 30 interviews. To align with these suggested number of interviews, the researcher sets the number of startup firms to be included per incubator at 15, making an expected total of 60 across the four incubators. This number was thought to be adequate to capture the depth and breadth of the subject of study based on earlier sample suggestions from the literature on qualitative research.

A startup firm in an incubator was the unit of analysis and the unit of measurement was a founder or senior member in the startup. A senior member of a startup firm is someone with knowledge of the firm, due to factors such as years spent with the firm or position. The number of startup firms that eventually participated was 44: 13 from incubator A, 5 from incubator B, 15 from incubator C, and 11 from incubator D. In addition to the 44 firms, one manager was interviewed from each of the four incubators.

3.4 Recruiting research participants

The researcher’s academic department awarded $2000 as a form of support for the field study. The original data collection plan included three locations, incubators A, B, and C. Incubator D, a fourth location, was included for two reasons. First, some of the founders interviewed at Incubator B and Incubator C made references to this incubator as a place where startup firms are likely to find collaboration more attractive. This is, according to them, because incubator D only hosts startup firms that are focused on the healthcare industry. Second, more participants for the study were needed because of the lower-than-expected participation rate at incubators B and C.

To recruit participants at incubators B, C, and D, the researcher first called the incubator managers, who had been informed about the study in advance. The managers had requested that the call for participants be routed through them, and they in turn forwarded the call to all the firms through the incubators’ Slack channels. The calls were sent two weeks ahead of the
researcher’s visit with all the details about the researcher’s availability and venue of meeting. Only one participant at Incubator B responded; no participants at incubators C and D reached out did so. Because of this low response rate, the decision was made to send targeted invitations via email to all the startup firms at each location.

This was possible because the researcher, as a member, had access to the member-only section of the websites of incubators B and C, where contact information for all startup members was available. Contact information for firms in incubator D was on the incubator’s website. The researcher received the consent of the managers at incubators B, C, and D to send a reminder message to the listed email addresses of the firms. The details of the researcher’s emails and calls to the startup firms are found in Table 2 below.

Table 2. Breakdown of participant recruiting

<table>
<thead>
<tr>
<th>Incubators</th>
<th>Population</th>
<th>No of times recruiting information was sent by manager on behalf of researcher</th>
<th>No of firms that responded to recruiting information sent by manager</th>
<th>No of recruiting email sent by researcher per firm</th>
<th>Average no of calls made by researcher per firm</th>
<th>No of firms that responded to researcher’s email</th>
<th>Completed interviews OR Sample</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>63</td>
<td>0</td>
<td>N/A</td>
<td>3</td>
<td>2</td>
<td>17</td>
<td>13</td>
<td>21%</td>
</tr>
<tr>
<td>B</td>
<td>28</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>12</td>
<td>5</td>
<td>18%</td>
</tr>
<tr>
<td>C</td>
<td>212</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>19</td>
<td>15</td>
<td>7%</td>
</tr>
<tr>
<td>D</td>
<td>216</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>14</td>
<td>11</td>
<td>5%</td>
</tr>
<tr>
<td>All</td>
<td>519</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>62</td>
<td>44</td>
<td>8%</td>
</tr>
</tbody>
</table>

N/A = not applicable; Response rate = (Completed interviews / Population) X 100

Startup firms were only called if a phone number was listed on the company’s page. Calls were placed two days after sending initial emails. In some cases, founders or representatives of startup firms were called multiple times in the course of the two weeks in the incubator. These calls, for scheduling purposes, were made to startup firms that had agreed to participate in the study. The researcher called potential participants who did not respond to email a maximum of two times.

As indicated in Table 2, the researcher made contact with 17 startup firms in incubator A, 13 of which participated in the study; the researcher made contact with 12 of the startup firms in incubator B via email and phone, 4 of which participated in interviews, along with 1 recruited through the manager’s Slack message. The researcher made contact with 19 startup firms in
incubator C, 15 of which participated in interviews. The researcher made contact with 14 startup firms in incubator D, 11 of which participated in the study.

Table 3 presents the dates of data collection. One element of the recruiting strategy was meeting founders, who had already received email messages, during lunch to invite them to take part in the study. The high number of interviews in the week of February 4 through 10 was due to the addition of interviews rescheduled from the previous week due to heavy snowfall.

Table 3. Dates in the field for data collection (December 2018 – April 2019)

<table>
<thead>
<tr>
<th>Week of</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>Th</th>
<th>F</th>
<th>No of interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 3 – 9</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Jan 7 – 13</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Jan 14 – 20</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>2</td>
</tr>
<tr>
<td>Jan 21 – 27</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>Jan 28 – Feb 3</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>2</td>
</tr>
<tr>
<td>Feb 4 – 10</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>14</td>
</tr>
<tr>
<td>Feb 11 – 17</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>7</td>
</tr>
<tr>
<td>Feb 18 – 24</td>
<td>A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Feb 18 – 24</td>
<td>-</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Feb 25 – Mar 3</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>9</td>
</tr>
<tr>
<td>Mar 18 – 24</td>
<td>A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Apr 8 – 14</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>D</td>
<td>1</td>
</tr>
</tbody>
</table>

A, B, C, and D = incubators

As noted above, 44 interviews were conducted with founders or senior members and 4 interviews with incubator managers, for a total of 48 interviews; 45 were conducted on site and 3 were conducted remotely. The three interviews conducted remotely were with two startup founders and one incubator manager who were unable to be physically present when the researcher was in the field. One interviewee was out of town the week of the interview; another was actually based in a second office in the U.S. Pacific region; and the third, the incubator manager, had a scheduling conflict.

For these three interviews, the researcher used Zoom, an internet-based video conferencing platform. Electronic versions of the consent forms as well as other research materials were sent to the interviewees through email, which they printed, signed, and sent back to the researcher through the same medium. For the onsite interviews, the researcher’s access to
each of these sites provided the opportunity to schedule a room for each interview. In one or two of the interviews, the interviewees also offered to schedule a room for the meeting.

3.5 Interview guide, observation rubrics, survey, and data collection

Interview guide. The questions asked in the interview guide for firms centered around the practice of collaboration among firms, their expectations, the continuum of collaboration, and information sharing. The remaining questions gathered the demographic information of the founders and employees of the startup firms. Table 4 shows the measurement of the variables. The interview questions with examples in Table 4 were based on the reviewed literature (Cooke and Morgan, 1998; Mattessich and Monsey, 1992). For the four incubator managers, the interview guide asked questions about their role in the incubators and the role that business incubators play in collaborative relationships among the firms (see Appendix B). At the beginning of each interview, the researcher provided the participant with the definition of collaboration to help with understanding and interview clarity.
Table 4. Measurement of Variables

<table>
<thead>
<tr>
<th>Variables and measures</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incubator</strong></td>
<td>How does your company benefit from being in this incubator?</td>
</tr>
<tr>
<td></td>
<td>How does your company view collaboration with other companies?</td>
</tr>
<tr>
<td></td>
<td>Would you say this incubator encourage collaboration?</td>
</tr>
<tr>
<td></td>
<td>If incubator encourages collaboration in what ways?</td>
</tr>
<tr>
<td></td>
<td>[Follow-up question(s) about specific ways collaboration is encouraged]</td>
</tr>
<tr>
<td></td>
<td>If collaboration is not encouraged, why not?</td>
</tr>
<tr>
<td></td>
<td>Has your company participated in collaboration with any company?</td>
</tr>
<tr>
<td><strong>Collaboration – practice, expectation, and</strong></td>
<td>If yes, I’d like to make a short list of the companies you’ve participated in a collaboration with and then discuss each one a bit.</td>
</tr>
<tr>
<td><strong>continuum</strong></td>
<td>How did the collaboration with [your collaborator] start?</td>
</tr>
<tr>
<td></td>
<td>What is produced or what service is offered by [your collaborator]?</td>
</tr>
<tr>
<td></td>
<td>If no, why do you think your company has not participated in collaboration with other companies?</td>
</tr>
<tr>
<td></td>
<td>If you have an opportunity to participate in a collaboration, what product or service category will your potential collaborator come from?</td>
</tr>
<tr>
<td></td>
<td>What will inform your choice of a collaborator?</td>
</tr>
<tr>
<td></td>
<td>What was the nature of this collaboration? What happened?</td>
</tr>
<tr>
<td></td>
<td>Is [your collaborator] located at incubator, or was it at the time?</td>
</tr>
<tr>
<td></td>
<td>Is [your collaborator] a startup or established firm?</td>
</tr>
<tr>
<td></td>
<td>What were the successes?</td>
</tr>
<tr>
<td></td>
<td>What were the challenges?</td>
</tr>
<tr>
<td></td>
<td>Did you overcome the challenges or not?</td>
</tr>
<tr>
<td></td>
<td>How did you overcome or why didn’t you overcome the challenges?</td>
</tr>
<tr>
<td><strong>Collaboration – Information sharing</strong></td>
<td>How do you determine what information to share when you participate in a collaboration with other companies?</td>
</tr>
<tr>
<td></td>
<td>How do you share information during collaboration? Do you have preference for any medium?</td>
</tr>
<tr>
<td></td>
<td>What time are you most comfortable sharing information during a collaboration? [before, during or after collaboration] What informs this choice?</td>
</tr>
<tr>
<td><strong>Incubator – Information environment</strong></td>
<td>What procedure is in place to encourage information sharing?</td>
</tr>
<tr>
<td><strong>Collaboration – Demographics and history</strong></td>
<td>Please tell me a little about your company</td>
</tr>
<tr>
<td></td>
<td>How did you come to be located in this incubator?</td>
</tr>
<tr>
<td></td>
<td>When was your company started?</td>
</tr>
<tr>
<td></td>
<td>When did your company first move into this incubator?</td>
</tr>
<tr>
<td></td>
<td>When will your company graduate from this incubator?</td>
</tr>
<tr>
<td></td>
<td>How many people are employed by your company?</td>
</tr>
<tr>
<td></td>
<td>Was your company founded by one individual or a group of people? How many are they?</td>
</tr>
<tr>
<td></td>
<td>If more than one founder, are all the founders still actively involved?</td>
</tr>
<tr>
<td></td>
<td>What is the highest education of the founder (s)?</td>
</tr>
<tr>
<td></td>
<td>How much capital have you raised so far? (an estimate is fine)</td>
</tr>
<tr>
<td></td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
</tr>
<tr>
<td></td>
<td>Degree earned (University, Program)</td>
</tr>
</tbody>
</table>

*Given that this was a semi-structured interview, probing questions were occasionally asked following participants’ response to each question*
Observation rubrics. The observation in the field was guided by specific rubrics that included the following questions: (1) Are people from different firms sharing the same workspace? (2) Do people have spaces where they can meet for group discussion outside of the general space? (3) Does each company have its own office? (4) What words are written on the walls? (5) What is the layout of each incubator? (6) What is the square footage? (7) What are the floor plans like? (8) How are the incubator spaces organized? (9) What is the number of firms in the incubator? (10) What is the number of people present? (11) What type of programming and social functions take place? (12) What type of literature is present? (13) Is there sound or is everywhere silent?

Data Collection. An audio recorder was used as the primary data collection tool for the interviews. After each interview, the audio file was transferred to a secure location on the researcher’s university online storage platform. Extra writing implements (pens, pencils) were taken along for interviewees who might need them. The researcher maintained a field notebook that was used to capture observational data.

3.6 Data transcription and analysis

The 48 interviews ran a total of 1102 minutes, with each interview taking on average 23 minutes. The shortest interview lasted about 11 minutes and the longest about 51 minutes. The assembled transcripts are equivalent to 133,000 words or 308 single-spaced pages. This text included responses to both open- and closed-ended questions.

The quantitative data resulting from closed-ended questions was placed into three tables to analyze using IBM’s SPSS software: one table of data on the 44 firms, a second on the 89 founders, and a third on the 4 incubators. Frequencies were generated on this data – one on demographics and the other on present or absent of collaboration. The transcription and cleaning of the interview data was an ongoing process through the period of data collection and extended after returning from the field. In all, substantial data transcription was completed early May 2019. The interview data was analyzed for incubator characteristics affecting collaboration as well as characteristics associated with startup firms using Microsoft Excel and MAXQDA2020.

The research employs thematic analysis to make meaning of the data. Thematic analysis is a “method for systematically identifying, organizing, and offering insight into patterns of
meaning (themes) across a data set” (Braun & Clarke, 2012). By thematically analyzing the data, the researcher was able to identify the common elements in what participants said about the role of the incubators in enhancing collaboration and was able to make sense of the commonalities. The study utilized a three-phase abridged form of the six-phase approach to thematic analysis by Braun and Clarke (2012) described below:

**Familiarization with the Data.** The researcher first became familiar with the data during the interviewing process and through continued listening to the audio recordings while transcribing. After transcription, each transcript was then read a minimum of three times while the researcher annotated, based on the responses to each of the questions as well as in respect to the main research question. This stage did not involve looking for specific answers; it provided general maps of ideas as they emerged from the interview data. It gave the researcher an opportunity to learn about the overall dataset as well as specific subsets that were considered to contain more insights about the topic of the research. The researcher annotated how startup founders across the four incubators described such topics as the configuration of the space in which they work, the administration of the incubators, opportunities available to the startup firms by virtue of being in an incubator, their interest in socializing with other entrepreneurs, and their primary reasons for joining an incubator.

**Generating initial codes.** The next phase in the data analysis was developing descriptive codes that conveyed the meaning of the texts by staying close to the data as much as possible. While the researcher made an effort to stay close to the data and interviewees’ literal meaning, codes were occasionally used to convey underlying meanings that may not be obvious in the text. Examples of transcripts and the codes used to convey the ideas in them are shown in Table 5. After generating initial codes for each question for a single participant, the researcher read through texts from other participants, identifying additional codes for the same question and applying the initial codes wherever they were relevant. This process was repeated across each data item.
Table 5. Example of coded transcripts

<table>
<thead>
<tr>
<th>Question</th>
<th>Transcript</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>How does your company benefit from being located in this incubator?</td>
<td>Firm 15: “Yeah, so, um, there’s a lot. So, it’s in the, generally in the life sciences space and there’s a lot of, there’s a lot of life sciences, um, medical biotech, uh, other similar companies here. Um, so I think we, we benefit from having access to a couple of things. One being around other people who are tackling similar problems and then being able to tap into, um, the relationships that [the incubator] offers.”</td>
<td>Companies in similar domain, Incubator resources, Other founders, Community</td>
</tr>
<tr>
<td>How does your company view collaboration with other companies?</td>
<td>Firm 41: “Yeah, so, uh, as a startup you never have enough full-time resources as you might have if you were at a big company. So, I used to work for [corporation], and I've worked for [corporation]. I've worked for large companies before and large companies have all the resources you can imagine. There's an entire department dedicated towards regulatory affairs and an entire department that does disposable tubing set design. And an entire, another department that does, you know, whatever it is, software design, those kinds of things. As a startup, you never have the resources.”</td>
<td>Startup firms lack resources, established firms have resources, Collaboration enables access to resources, Collaboration provide opportunity</td>
</tr>
</tbody>
</table>

**Searching for and reviewing potential themes.** According to Braun and Clarke (2006), a theme “captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set” (p. 82). Here, the researcher examined the data to find areas of overlap and commonality between codes. The codes were then analyzed to identify the ones clustering around a particular topic, and codes having similarity were merged to create themes. Table 6 provides the comprehensive codes for the two questions in Table 5.
<table>
<thead>
<tr>
<th>Start-up firm</th>
<th>Coded responses to question 1 (How does your company benefit from being in the incubator?)</th>
<th>Coded responses to question 2 (How does your company view collaborative innovation with other companies?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Access to resources, being with entrepreneurs in life sciences, mentoring, investors, technical assistance, the network of the incubator</td>
<td>Issues with intellectual property protection, potential competitors, preference for complementary collaborator, general business practice, too early</td>
</tr>
<tr>
<td>2</td>
<td>Branding, Legitimacy, funding, recruiting, mentoring</td>
<td>Can derail focus (if care is not taking). Should be mutually beneficial</td>
</tr>
<tr>
<td>3</td>
<td>Administrative, training, professional help, prestige (because of the university affiliation), mentoring</td>
<td>Essential</td>
</tr>
<tr>
<td>4</td>
<td>Community (being around other entrepreneurs)</td>
<td>Essential, helps with shared resources</td>
</tr>
<tr>
<td>5</td>
<td>Professional services (legal help), Workshops, co-learning with other entrepreneurs, mentoring</td>
<td>Essential</td>
</tr>
<tr>
<td>6</td>
<td>Mentor, advisory services, learning from other founders</td>
<td>Essential, should be complementary</td>
</tr>
<tr>
<td>7</td>
<td>Mentors, networking with other founders, learning</td>
<td>Beneficial</td>
</tr>
<tr>
<td>8</td>
<td>Access to specialized knowledge pool, network of similar startups, mentors, training, building Connections</td>
<td>Valuable</td>
</tr>
<tr>
<td>9</td>
<td>Workshops, networking</td>
<td>Should be mutually beneficial</td>
</tr>
<tr>
<td>10</td>
<td>Networking, learning from fellow founders, encouragement, getting inspiration from fellow entrepreneurs</td>
<td>Prefers to work alone, engages in it to acquire technology</td>
</tr>
<tr>
<td>11</td>
<td>Opportunity for collaboration, mentoring, networking</td>
<td>Frontier of innovation, helps with technology acquisition</td>
</tr>
<tr>
<td>12</td>
<td>Prestige, legitimacy, membership size, Inspiration (through interaction with other members), mentoring, networking, access to investors</td>
<td>Should be complementary</td>
</tr>
<tr>
<td>13</td>
<td>Access to potential customers, Workshops, mentors</td>
<td>Important, Joint product development</td>
</tr>
<tr>
<td>14</td>
<td>Access to established companies, mentors, healthcare-focused cohort</td>
<td>Should be mutually beneficial</td>
</tr>
<tr>
<td>15</td>
<td>Network, access to investors, learning, mentoring</td>
<td>Should be complementary</td>
</tr>
<tr>
<td>16</td>
<td>Access to investors, professional Connections, incubator’s industry Connections</td>
<td>Resource optimization</td>
</tr>
<tr>
<td>17</td>
<td>Legitimacy (physical address), mentors, being in the same space with other entrepreneurs</td>
<td>Joint problem solving</td>
</tr>
<tr>
<td>18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>Connections with other startups, shared experience with other startups, potential for collaboration</td>
<td>Beneficial</td>
</tr>
<tr>
<td>20</td>
<td>Networking, legitimacy</td>
<td>Necessary, can help with stability, mutual benefit</td>
</tr>
<tr>
<td>21</td>
<td>Workshops, mentoring, place to work, learning,</td>
<td>Important (best way to do what we do)</td>
</tr>
<tr>
<td>22</td>
<td>Mentors, workshops, networking, working space, Connections</td>
<td>Can help with credibility</td>
</tr>
<tr>
<td>23</td>
<td>Workshops, place to work</td>
<td>-</td>
</tr>
<tr>
<td>24</td>
<td>Access to other startups, space to sit, exposure, networking, legitimacy</td>
<td>-</td>
</tr>
<tr>
<td>25</td>
<td>Community engagement (networking),</td>
<td>Invaluable</td>
</tr>
<tr>
<td>26</td>
<td>Mentor network, corporate image, workshops, connection with other entrepreneurs, cross-promotion with other entrepreneurs, legitimacy,</td>
<td>A way to acquire technology</td>
</tr>
<tr>
<td>27</td>
<td>Learning, connections with known brands, networking, access to other entrepreneurs</td>
<td>Complementary (helping people who also are helping your startup)</td>
</tr>
<tr>
<td>28</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>29</td>
<td>Legitimacy, connections to people that matter</td>
<td>Important</td>
</tr>
<tr>
<td>30</td>
<td>Connections with people that matter, workshops, professional services, mentoring</td>
<td>Important</td>
</tr>
<tr>
<td>31</td>
<td>Access to skilled people, recruiting</td>
<td>Complementary, Technology acquisition</td>
</tr>
<tr>
<td>32</td>
<td>Office space, networking, mentoring, connection with right people, professional services</td>
<td>Important, Technology acquisition</td>
</tr>
<tr>
<td>33</td>
<td>Workshops, mentors, low cost office space, administrative services</td>
<td>Essential, intellectual property protection, should be complementary, competition, technology acquisition,</td>
</tr>
<tr>
<td>34</td>
<td>Legitimacy, workshops, mentors, administrative resources,</td>
<td>Need for overlap, competition, better with established companies</td>
</tr>
<tr>
<td>35</td>
<td>Access to mentors</td>
<td>-</td>
</tr>
<tr>
<td>36</td>
<td>Networking, exposure</td>
<td>Essential, technology acquisition</td>
</tr>
<tr>
<td>37</td>
<td>Access to university, access to talents</td>
<td>Learning opportunity, technology acquisition, need for overlap</td>
</tr>
<tr>
<td>38</td>
<td>Cost savings, services provided (space, internet, communication, electricity etc.), access to student interns, mentors, workshops</td>
<td>Important, help with financing, vital for growth</td>
</tr>
<tr>
<td>39</td>
<td>Reasonable rent, mentoring, professional services, workshops, connection with university (lab equipment usage helps save cost)</td>
<td>Important</td>
</tr>
<tr>
<td>40</td>
<td>Networking, professional services</td>
<td>Important</td>
</tr>
<tr>
<td>41</td>
<td>Closer to customers, recruiting from university, collaborative research with university labs, networking</td>
<td>Rarely</td>
</tr>
<tr>
<td>42</td>
<td>Administrative services, mentors, professional services,</td>
<td>Need for overlap, opportunity for Learning</td>
</tr>
<tr>
<td>43</td>
<td>Mentors, network of other entrepreneurs</td>
<td>Essential, technology acquisition</td>
</tr>
<tr>
<td>44</td>
<td>Mentors, workshops</td>
<td>Essential, technology acquisition</td>
</tr>
</tbody>
</table>
In Table 7, the themes formed from the codes were matched to the four sub-categories of the research question. The first category addressed social and physical characteristics of a business incubator that promotes collaboration among startup firms. The second category addressed the expectation of startup founders in a business incubator regarding collaboration. The third category focused on the continuum of collaboration among startup firms in a business incubator. The fourth category is on information sharing during collaboration.

The researcher reviewed all the codes for relevance and completeness in the process of creating the themes. This process involves asking questions such as whether a theme is better left as a code, potential quality of a theme (whether it actually reveals something useful about the research question), what the theme includes or excludes and whether meaningful data exist to support the theme (Braun & Clarke, 2012).

The themes in Table 7 are the final abstractions from the illustrative codes in Table 6. These themes also include the codes from the answers to the remaining questions from Table 4. They correspond to the responses provided by the interviewees and are explained as answers to the research question in chapter 4. The discussion of the findings in sections 4.5 to 4.8 is based on these themes.
<table>
<thead>
<tr>
<th>Research question</th>
<th>Themes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social, physical, and informational characteristics of a business incubator that promote collaboration among startup firms</td>
<td>Incubator’s corporate membership</td>
<td>Corporate membership means incubator-affiliated professional organizations and established companies that can benefit from the innovation emerging from startup firms. These members are valuable to the startup firms as they are potential sources of collaboration.</td>
</tr>
<tr>
<td></td>
<td>Space configuration (proximity between startup firms)</td>
<td>This describes the way the work areas of an incubator are configured. It is the physical distance between the startup firms as they work in the incubator.</td>
</tr>
<tr>
<td></td>
<td>Informal and formal networking programs to promote learning and social activities</td>
<td>Informal and formal networking is the summation of all programs, social and educational, organized by business incubators over twelve months period.</td>
</tr>
<tr>
<td></td>
<td>A single-industry focus among incubator member firms</td>
<td>A single-industry focus among incubator member firms means that an incubator only admits a startup firm whose product or service is focused on a single industry.</td>
</tr>
<tr>
<td></td>
<td>Information environment</td>
<td>Information environment of business incubators consist of information systems and sources that business incubators provide for the startup firms.</td>
</tr>
<tr>
<td></td>
<td>Human and social capital through mentoring programs</td>
<td>Mentoring services mean a structured advising that is set up by an incubator where professionals with requisite knowledge in the domain a startup firm is operating are paired occasionally with such startup firm in order to provide necessary guidance.</td>
</tr>
<tr>
<td>The expectation of startup founders in a business incubator regarding collaboration</td>
<td>Collaboration as an essential process for growth (e.g., acquisition of new technology)</td>
<td>This is a description by founders that imply that startup firms desiring of growth will benefit from collaboration.</td>
</tr>
<tr>
<td></td>
<td>Collaboration comes with risks (intellectual property theft, competition)</td>
<td>Risk of intellectual property theft means startup firms are exposed to potential theft of their unique ideas and core innovations. Possibility of collaborating with a competitor.</td>
</tr>
<tr>
<td></td>
<td>Collaboration requires a support structure</td>
<td>Structure means incubator-specific guidelines that can enhance collaboration.</td>
</tr>
<tr>
<td>The continuum of collaboration among startup firms in a business incubator</td>
<td>Contact</td>
<td>The first point of meeting where options are explored by potential collaboration members.</td>
</tr>
<tr>
<td></td>
<td>Co-operation</td>
<td>Firms agree to work together informally on something that would result in a small but tangible benefit to all involved.</td>
</tr>
<tr>
<td></td>
<td>Co-ordination</td>
<td>Formalized procedures are required to guide members who previously chose to engage in co-operative relationship in order to move the interactions beyond what only offers small benefits.</td>
</tr>
<tr>
<td></td>
<td>Co-creation</td>
<td>The stage at which individual entities involved are now co-creating together and getting involved in shared creation.</td>
</tr>
<tr>
<td>Information sharing during collaboration</td>
<td>Openness based on trust</td>
<td>This is an idea that within the startup community, people readily share details of their invention because they trust the community to adhere to certain norms that protect intellectual capital from being exploited.</td>
</tr>
<tr>
<td></td>
<td>Protection through a non-disclosure agreement</td>
<td>This is a legal way of protecting intellectual capital before engaging in substantial information sharing during collaboration.</td>
</tr>
<tr>
<td></td>
<td>Shared only as a need-to-know basis</td>
<td>This way each member of the collaboration is only able to see an information that is relevant to a task that must be performed.</td>
</tr>
</tbody>
</table>
3.7 Conclusion

The study utilized interviews and observation as the methods of data gathering. Interviews were conducted with 48 participants, comprising 44 firm representatives and 4 incubator managers. The 44 interviewees representing the firms provided information on 89 co-founders. In each of the incubators, participants were recruited with help from incubator managers and through multiple rounds of emails and calls by the researcher. The researcher was in the field between December 3, 2018 and April 14, 2019. The final data from all sources is equivalent to 133,000 words. This includes 1102 minutes of data from interviews. The cleaning and transcription of the data started in the field, in-between interviews.

The data from closed-end questions were organized into three tables for analysis using IBM’s SPSS software: one of data on the 44 firms, a second on the 89 founders, and a third on the 4 incubators. Frequencies were generated on this data. Using thematic analysis, the data from open ended questions were analyzed for characteristics of business incubators that promote collaboration among startup firms using Microsoft Excel and MAXQDA2020.
CHAPTER 4. FINDINGS

4.1 Introduction

This chapter presents the findings from the field research, arranged in section headings. The first sets of the research findings described the demographic information of startup founders across the four incubators, followed by a description of collaborators and non-collaborators. The remainder of the chapter presents answers to the research question. These answers were organized under four sections, and the first section focuses on the characteristics of business incubators promoting collaboration among startup firms. The second section is on the expectation of startup founders regarding collaboration, the third on the continuum of collaboration, and the last is on collaboration types.

4.2 Descriptive statistics on startup firms

This section provides descriptive information about the 44 startup firms in the study and their 89 co-founders across the four incubators. Table 8 presents an overview of all the 44 startup firms, 35 of which are collaborative innovators. The firms were grouped by incubators and descriptions of products and services offered by each startup firm are provided. Overall, startup firms in incubator C constituted 34% of the startup firms participating in the study, followed by incubator A at 30%, incubator D at 25%, and incubator B at 11%.
Table 8. Startup firms overview

<table>
<thead>
<tr>
<th>Business Incubators</th>
<th>Startup firms</th>
<th>Collaborators (Yes/No)</th>
<th>Product types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incubator A</strong></td>
<td>Firm 1</td>
<td>Yes</td>
<td>Interpretation of medical imaging</td>
</tr>
<tr>
<td></td>
<td>Firm 2</td>
<td>Yes</td>
<td>Crop image acquisition to measure crop health</td>
</tr>
<tr>
<td></td>
<td>Firm 3</td>
<td>Yes</td>
<td>Converts Agricultural waste into fertilizers</td>
</tr>
<tr>
<td></td>
<td>Firm 4</td>
<td>Yes</td>
<td>Smart sensors for structural health monitoring</td>
</tr>
<tr>
<td></td>
<td>Firm 5</td>
<td>Yes</td>
<td>Spacecraft motion systems for small satellites</td>
</tr>
<tr>
<td></td>
<td>Firm 6</td>
<td>Yes</td>
<td>Home robotics</td>
</tr>
<tr>
<td></td>
<td>Firm 7</td>
<td>Yes</td>
<td>Advanced bionic limbs</td>
</tr>
<tr>
<td></td>
<td>Firm 8</td>
<td>Yes</td>
<td>Software for better treatment decisions for cancer patients</td>
</tr>
<tr>
<td></td>
<td>Firm 9</td>
<td>Yes</td>
<td>Experiment design</td>
</tr>
<tr>
<td></td>
<td>Firm 10</td>
<td>No</td>
<td>Heat technology</td>
</tr>
<tr>
<td></td>
<td>Firm 11</td>
<td>No</td>
<td>Fruit vaccine</td>
</tr>
<tr>
<td></td>
<td>Firm 12</td>
<td>No</td>
<td>Analyzes remote sensing data for agricultural operation</td>
</tr>
<tr>
<td></td>
<td>Firm 13</td>
<td>No</td>
<td>Toy</td>
</tr>
<tr>
<td><strong>Incubator B</strong></td>
<td>Firm 14</td>
<td>Yes</td>
<td>Creating alternative protein</td>
</tr>
<tr>
<td></td>
<td>Firm 15</td>
<td>Yes</td>
<td>QuantX used to assist radiologists in reading breast MRI</td>
</tr>
<tr>
<td></td>
<td>Firm 16</td>
<td>Yes</td>
<td>Biotech developing migraine medication</td>
</tr>
<tr>
<td></td>
<td>Firm 17</td>
<td>Yes</td>
<td>NGO for medical emergency</td>
</tr>
<tr>
<td></td>
<td>Firm 18</td>
<td>No</td>
<td>Easy 401K transfer</td>
</tr>
<tr>
<td><strong>Incubator C</strong></td>
<td>Firm 19</td>
<td>Yes</td>
<td>Email-based Newsletter</td>
</tr>
<tr>
<td></td>
<td>Firm 20</td>
<td>Yes</td>
<td>Organization transformation consultancy</td>
</tr>
<tr>
<td></td>
<td>Firm 21</td>
<td>Yes</td>
<td>Connecting romance authors and readers</td>
</tr>
<tr>
<td></td>
<td>Firm 22</td>
<td>Yes</td>
<td>Social app for answering plant questions</td>
</tr>
<tr>
<td></td>
<td>Firm 23</td>
<td>Yes</td>
<td>Audiobooks for <em>everything else</em> on the internet but books</td>
</tr>
<tr>
<td></td>
<td>Firm 24</td>
<td>Yes</td>
<td>Geotagged podcasting</td>
</tr>
<tr>
<td></td>
<td>Firm 25</td>
<td>Yes</td>
<td>Education technology</td>
</tr>
<tr>
<td></td>
<td>Firm 26</td>
<td>Yes</td>
<td>Ethnic events</td>
</tr>
<tr>
<td></td>
<td>Firm 27</td>
<td>Yes</td>
<td>Risk management</td>
</tr>
<tr>
<td></td>
<td>Firm 28</td>
<td>Yes</td>
<td>Investment scout</td>
</tr>
<tr>
<td></td>
<td>Firm 29</td>
<td>Yes</td>
<td>Freight-forwarding perishable goods</td>
</tr>
<tr>
<td></td>
<td>Firm 30</td>
<td>No</td>
<td>Renting baby materials</td>
</tr>
<tr>
<td></td>
<td>Firm 31</td>
<td>No</td>
<td>Management consulting</td>
</tr>
<tr>
<td></td>
<td>Firm 32</td>
<td>No</td>
<td>Experiential design</td>
</tr>
<tr>
<td></td>
<td>Firm 33</td>
<td>No</td>
<td>Building services</td>
</tr>
<tr>
<td><strong>Incubator D</strong></td>
<td>Firm 34</td>
<td>Yes</td>
<td>Healthcare education</td>
</tr>
<tr>
<td></td>
<td>Firm 35</td>
<td>Yes</td>
<td>Interactive digital playbook for surgical efficiency</td>
</tr>
<tr>
<td></td>
<td>Firm 36</td>
<td>Yes</td>
<td>Health education</td>
</tr>
<tr>
<td></td>
<td>Firm 37</td>
<td>Yes</td>
<td>Virtual reality for patient education</td>
</tr>
<tr>
<td></td>
<td>Firm 38</td>
<td>Yes</td>
<td>Medical inventory control</td>
</tr>
<tr>
<td></td>
<td>Firm 39</td>
<td>Yes</td>
<td>Clinical decision support system for detecting cancerous cells</td>
</tr>
<tr>
<td></td>
<td>Firm 40</td>
<td>Yes</td>
<td>Transparent surgical safety process</td>
</tr>
<tr>
<td></td>
<td>Firm 41</td>
<td>Yes</td>
<td>Home dialysis machine</td>
</tr>
<tr>
<td></td>
<td>Firm 42</td>
<td>Yes</td>
<td>Healthcare data integration</td>
</tr>
<tr>
<td></td>
<td>Firm 43</td>
<td>Yes</td>
<td>Vendor relationship management</td>
</tr>
<tr>
<td></td>
<td>Firm 44</td>
<td>Yes</td>
<td>Lifestyle management for people with chronic conditions</td>
</tr>
</tbody>
</table>

*Founders.* This section reports information on the startup founders organized as four variables. These variables are age of founders, gender of founders, ethnicity of founders, and
highest education of founders. The 44 founders/managers interviewed provided information on the 89 founders/co-founders.

1. Age of founders. This captures the age of each of the founders and co-founders of the 44 startup firms in the study at the time of data collection. There were more founders in their 30s (35%) than in any other age group. Sixteen percent of all founders are in the 50s to 70s age group while 68% are in the 20s to 40s age group.

Table 9. Age of founders

<table>
<thead>
<tr>
<th></th>
<th>Incubator A (n = 26)</th>
<th>Incubator B (n = 12)</th>
<th>Incubator C (n = 27)</th>
<th>Incubator D (n = 24)</th>
<th>All (N=89)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20s – 40s</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>50s – 70s</td>
<td>15%</td>
<td>19%</td>
<td>19%</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Not given</td>
<td>15%</td>
<td>0%</td>
<td>22%</td>
<td>16%</td>
<td>16%</td>
</tr>
</tbody>
</table>

The majority of the founders in the 50s to 70s age group are in the university-affiliated incubators. Nineteen percent of the founders at incubator A (n = 26) and 33% of founders at incubator B (n = 12) fall into the 50s to 70s age group. This reflects the fact that founders and co-founders of startup firms in these incubators tend to be faculty members, in contrast to incubators C and D where founders/co-founders in the 20s to 30s age group constitute 48% and 55% of the totals, respectively.

2. Gender of founders. As seen in Table 10, the majority of the founders (75%) are male; 19% of the founders are female. No data on the gender on 5% of the 89 founders/co-founders was collected.

Table 10. Gender of startup founders

<table>
<thead>
<tr>
<th></th>
<th>Incubator A (n = 26)</th>
<th>Incubator B (n = 12)</th>
<th>Incubator C (n = 27)</th>
<th>Incubator D (n = 24)</th>
<th>All (N=89)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>92%</td>
<td>58%</td>
<td>56%</td>
<td>88%</td>
<td>75%</td>
</tr>
<tr>
<td>Female</td>
<td>8%</td>
<td>42%</td>
<td>26%</td>
<td>12%</td>
<td>19%</td>
</tr>
<tr>
<td>Not given</td>
<td>0%</td>
<td>0%</td>
<td>18%</td>
<td>0%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Incubator A has fewest female founders, 8%. Incubator B has the highest female founders, 42%. This result shows significant gender gap across the startup firms, affirming previous findings about gender distribution in entrepreneurship and startup communities.

3. Founders’ ethnicity. The study classified ethnicity into six categories that include White, South Asian, East Asian, African American, African, and Hispanic. These are classified from the way interviewees described their ethnicity during the interview. The study did not use any predetermined category. African is used to distinguish between African American and Blacks who indicated they are from an African country. As shown in Table 11, founders who identified as White represent 67% of founders across all incubators.

Table 11. Ethnicity of startup founders

<table>
<thead>
<tr>
<th></th>
<th>Incubator A (n = 26)</th>
<th>Incubator B (n = 12)</th>
<th>Incubator C (n = 27)</th>
<th>Incubator D (n = 24)</th>
<th>All (N = 89)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>White</td>
<td>77</td>
<td>58</td>
<td>56</td>
<td>79</td>
<td>67</td>
</tr>
<tr>
<td>South Asian</td>
<td>0</td>
<td>25</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>East Asian</td>
<td>19</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>African American</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>African</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Not given</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

Founders identifying as Hispanic are 4% and those identifying as Black, either as African American or African, are 5%. Eighteen percent of founders reported that they are from Asia. The result in Table 11 shows that founders of Asian origin (South and East) combined form the second-largest group after White at 18%.

4. Founders’ highest education. Highest education of founders measures the highest academic qualification obtained by a startup founder. Since this is a single measure for each startup firm, the total is 44 instead of 89. That is, for a startup firm with two founders, one having a doctorate and the other having a master’s degree, the doctorate is taken as the highest education for such startup firm. Overall, Table 12 shows that 45% of founders across the 44 firms have doctoral degrees.
Table 12. Highest education of founders

<table>
<thead>
<tr>
<th></th>
<th>Incubator A (n = 13)</th>
<th>Incubator B (n = 5)</th>
<th>Incubator C (n = 15)</th>
<th>Incubator D (n = 11)</th>
<th>All (N=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorate</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>77%</td>
<td>80%</td>
<td>20%</td>
<td>27%</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Academic and Professional Master’s</td>
<td>15%</td>
<td>20%</td>
<td>47%</td>
<td>64%</td>
<td>39%</td>
</tr>
<tr>
<td>Bachelor</td>
<td>8%</td>
<td>0%</td>
<td>33%</td>
<td>9%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Doctoral degrees are prominent among founders of startup firms in university-affiliated incubators. At incubator A, one of the two university-affiliated incubators, 77% of founders hold a doctoral degree and at incubator B, another university-affiliated incubator, 80% of founders do. This reflects the primary focus of these incubators being to help commercialize startup ideas emerging from faculty and students within the universities.

Firms. This section reports data collected on the 44 startup firms organized as 5 variables. These variables are startup founding year, number of founders per firm, number of employees per firm, capital raised at time of study, and number of firms having external offices while keeping their incubator membership.

1. Startup founding year. All the startup firms that participated in the study were founded in 2008 or later. However, there was variation, in terms of older and newer startups, across the incubators: as shown in Table 13, 27% of the firms in incubator A were founded between 2008 and 2013, and all of the startup firms in incubator C were founded between 2014 and 2019.

Table 13. Founding year of startup firms

<table>
<thead>
<tr>
<th></th>
<th>Incubator A (n = 13)</th>
<th>Incubator B (n = 5)</th>
<th>Incubator C (n = 15)</th>
<th>Incubator D (n = 11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008–2013</td>
<td>27%</td>
<td>11%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>2014–2019</td>
<td>73%</td>
<td>89%</td>
<td>100%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Startup firms at incubator A had the longest tenure. According to an interview with a manager at incubator A, the long tenure of some startup firms at the incubator is due to the nature of their products. Startup firms that tend to stay longer in the incubator are involved in manufacturing and extensive clinical trials that are longer processes. In her words, “I think our
focus on commercialization of scientific technology is a very difficult thing. I mean, oftentimes the companies that are in this type of entrepreneurship need a longer runway than most companies. They are dealing with very different issues than many other entrepreneurs.” (Manager, Incubator A)

2. Number of founders per firm. The number of founders across the 44 startup firms varies. In a startup firm where there is more than one founder, each of the founders is referred to as “co-founder.” As shown in Table 14, about half of all the startup firms in the study were co-founded by two people compared to 27% having been founded by just one person.

Table 14. Number of founders across startup firms

<table>
<thead>
<tr>
<th></th>
<th>Incubator A (n = 13)</th>
<th>Incubator B (n = 5)</th>
<th>Incubator C (n = 15)</th>
<th>Incubator D (n = 11)</th>
<th>All (N=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 founder</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>2 co-founders</td>
<td>62%</td>
<td>60%</td>
<td>27%</td>
<td>54%</td>
<td>48%</td>
</tr>
<tr>
<td>3 co-founders</td>
<td>23%</td>
<td>40%</td>
<td>13%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>4 co-founders</td>
<td>0%</td>
<td>40%</td>
<td>0%</td>
<td>9%</td>
<td>4%</td>
</tr>
<tr>
<td>5 co-founders</td>
<td>0%</td>
<td>0%</td>
<td>7%</td>
<td>0%</td>
<td>2%</td>
</tr>
</tbody>
</table>

This result shows a trend regarding the ideal number of startup founders. The need for a co-founder of a startup firm has several possible explanations. Some of the founders admitted they did not have the technical skill to execute their ideas and as a result needed to recruit a co-founder with a technical background.

3. Number of employees per startup firm. The variable of employees per startup firm captures the number of people employed by each of the startup firms in the study. While there was variation across the incubators in terms of the size of the firms located in them, more than half of the startup firms in the study have between one to five employees, as is shown in Table 15.
Table 15. Number of employees across all the startup firms

<table>
<thead>
<tr>
<th>Incubator A</th>
<th>Incubator B</th>
<th>Incubator C</th>
<th>Incubator D</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 13)</td>
<td>(n = 5)</td>
<td>(n = 15)</td>
<td>(n = 11)</td>
<td>(N = 44)</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>1–5</td>
<td>62</td>
<td>100</td>
<td>53</td>
<td>36</td>
</tr>
<tr>
<td>6–10</td>
<td>31</td>
<td>0</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>11–20</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>21–30</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
</tbody>
</table>

Eighteen percent of startup firms in incubator D as shown in Table 15 have between 21 to 30 employees. Firms in incubator B all have between one to five employees.

4. Capital raised at the time of the study. Capital raised captures the amount of external money that has been raised by each startup firm in the study to support growth. Several startup firms in this study have raised some initial capital with a few of them raising as much as $10 million. As shown in Table 16, 9% of the firms in incubator D have raised larger amounts of capital than that. In incubator C, 73% of the startup firms are either using personal money, a situation they consistently referred to as “bootstrapping,” or are relying on family and friends for financial support.

Table 16. Capital raised by startup firms

<table>
<thead>
<tr>
<th>Incubator A</th>
<th>Incubator B</th>
<th>Incubator C</th>
<th>Incubator D</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 13)</td>
<td>(n = 5)</td>
<td>(n = 15)</td>
<td>(n = 11)</td>
<td>(N = 44)</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>$25K–$100K</td>
<td>23</td>
<td>20</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>&gt;$100K–$500K</td>
<td>8</td>
<td>0</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>&gt;$500K–$1 million</td>
<td>8</td>
<td>20</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>&gt;$1 million–$10 million</td>
<td>23</td>
<td>60</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>&gt;$10 million</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Not given</td>
<td>38</td>
<td>0</td>
<td>73</td>
<td>27</td>
</tr>
</tbody>
</table>

A combined 27% of startup firms in incubator A, incubator D, and incubator B report raising capital in the range of $500,000 to $10 million. Just 2% (n = 1) of all the firms have been able to raise funding in excess of $10 million. This represents a startup firm at incubator D, the healthcare-focused business incubator.
5. Startup firms maintaining external offices. This measures the number of startup firms that have offices elsewhere in addition to keeping their incubator memberships. Twenty-seven percent of all firms maintain external offices. As shown in Table 17, more than half of the startup firms in incubator D maintain external offices. None of the startup firms at incubator B have an external office.

Table 17. Startup firms with external offices

<table>
<thead>
<tr>
<th>Incubator</th>
<th>Incubator</th>
<th>Incubator</th>
<th>Incubator</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (n = 13)</td>
<td>B (n = 5)</td>
<td>C (n = 15)</td>
<td>D (n = 11)</td>
<td>(N=44)</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Startup firms with external office location as % of startup firms per incubator</td>
<td>15</td>
<td>0</td>
<td>20</td>
<td>64</td>
</tr>
</tbody>
</table>

Startup firms maintaining external office locations do this to reduce the fees for membership in the incubators where such fees are based on the number of employees. Startup firms that have grown to a certain number of employees prefer to pay for an external office space while keeping a single membership at the incubator, so they have access to incubator resources and connections. External office space is cheaper than additional memberships. This is typical for startup firms at incubators C and D, two incubators in which pricing is based on the number of employees per startup firm. Incubator A’s pricing is based on office size and not dependent on employee size, and incubator B’s price is per desk space.

In summary, a typical startup firm in the study was founded between 2014 and 2019, has two co-founders, and employs between one and five people. Typical founders are males, in their 30s, have graduate degrees, and are white.

4.3 Differences between collaborators and non-collaborators

The research question asks: What are the characteristics of business incubators that promote collaboration among startup firms located in them? Here, collaboration among startup firms is a dependent variable relying on a business incubator’s characteristics, which consisted of (1) corporate membership, (2) space configuration, (3) informal and formal networking, (4) a single-industry focus among member firms, (5) information environment, and (6) human and
social capital. This study found that there is a positive relationship between a business incubator and collaboration by startup firms located in it.

A startup firm is a collaborator if it has engaged in a shared relationship with one or more startup firms or another entity, with benefit(s) for one or all the members involved in such a relationship. A non-collaborator is not involved or not planning to be involved in any form of shared relationship with other entities. The interview data established that 80% or 35 of 44 firms interviewed are collaborators. The percentages of collaborators in each incubator are 69% at incubator A (n = 13), 80% at incubator B (n = 5), 73% at incubator C (n = 15), and 100% at incubator D (n = 11). As a study that interviewed founders of 44 startup firms out of 519 startup firms in the four incubators, it is safer to not interpret these percentages in isolation of the stories told by the founders. Combining these statistics with the stories told by the participants helps us better understand the dynamics of an incubator environment as it affects collaboration among the firms located in it. The following four examples from the findings show firms that are collaborators and non-collaborators.

Firm 19 is one of the collaborators. It is a newsletter startup firm that curates daily breaking news stories across culture, science, sports, politics, business, and more. It puts them all in a 5-minute read for its subscribers using email as the distribution channel. It was established in 2016 and joined the incubator in 2017. Firm 19 had three co-founders and at the time of the interview six employees and had raised $90,000 in capital. A co-founder explained how the startup firm collaborates with other newsletter companies to drive subscriber growth:

In the newsletter space specifically, we do collaborations with like eight newsletter partners. One of the big things is, [we are] not only learning how they’re acquiring customers and vice versa but like we do these things called cross promos or swap. There’s a finance millennial newsletter called [company], if you just want to know like what’s going on in business worlds quickly, that’s what they do. So, we have a partnership with them where every six weeks we go in and say like in our business section, hey, want to learn more about business, checkout [company]. And then in their section at the bottom [they include], hey, while you’re using a single email, check out [Firm 19]. So, it drives subscribers to both companies.
Firm 44, a healthcare startup firm is another collaborator. It runs a program that provides lifestyle management for people with three or more chronic health conditions. It was established in 2012 and moved to the incubator in 2015. This startup has one founder who holds a JD degree and employed nine people at the time of data collection. The senior staff discussed the company’s ongoing collaboration with near- and on-site clinics and stated the importance of collaboration thus:

So, part of our model is partnering with near-site and on-site clinics. For our program to work, we have to have physicians say, yes, this is a great idea. Yes, I’ll offer your program. So, if we have the near-site and on-site clinics on our side, the physicians can strongly recommend for the enrollees to be in our program and they can walk right across the hall to their . . . guide. So, we’ve been working with [these near- and on-site clinics] for almost a year now, I would say.

The founder of Firm 29, another collaborator in the sample, discussed a recent collaboration between his startup firm and a large shipping company. Firm 29 is an automated freight forwarding platform designed for the perishable goods industry. It was founded in 2017 and moved to the incubator the same year. The startup has one founder, and he was also the only employee at the time of interview. He has a bachelor’s degree in business administration and has worked about 20 years in the shipping industry.

I just signed two strategic partnerships with companies in the logistics industry. One is a company called [company], which is the biggest container company in the world. They’re based out of [country]. They have a platform that I need, so, I’ve signed an agreement with them to use [it]. I already signed an agreement with a [company] funded company that’s also in logistics, and they have a tracking device.

Finally, one more firm in the study is an example of a non-collaborator. Firm 18 makes 401k transfer seamless as employees switch from one company to another by connecting several 401k providers. The startup firm was co-founded by two people in 2018 and at the time of the interview had four employees and had raised close to US$1 million. Responding to why his startup firm has not engaged in collaboration, the co-founder replied that, “A lot of times, unless
if they’re the most strategic partners, it’s not a good idea. And you don’t know what the most strategic partner for you is while you’re a startup.”

**Information sharing among collaborating firms.** This study describes information sharing among firms in three ways. The first is the openness of founders to sharing information based on their trust for the members of the incubator community. The second involves enacting a non-disclosure agreement for certain collaboration types, and the third is sharing information only with members of a collaboration who has the right to know. These three are discussed subsequently.

1. Openness about information sharing based on trust. A recurring belief, among founders who are open about information sharing, is that an idea alone is worth nothing. Accordingly, a company that steals an idea must have the resources to execute it. Many firms believe this is not always an easy task. The co-founder of Firm 6 recalled, “We kind of adopted a pretty loose attitude towards that early on. A lot of people are protective and don’t like to say anything and ideas do get stolen, but I don’t think it’s as common as people think.” The founder of Firm 29 stated, “At this stage, I’m not very picky and whatever they want from me, I’m going to give them.”

Identifying openness as a function of trust, the co-founder of Firm 41 expressed a positive view: “I feel like the startup world is fairly honest and you can take people’s word for the most of it. If they say, hey, I won’t share this with anybody, then they likely won’t.” Some of the founders in this category were much less concerned about the potential for intellectual property theft during collaboration. The founder of Firm 40 said:

None of them want to do what I do. It’s too hard. They can try, you know, I would challenge them to give it a shot. I like to see them get away with it. They can try it. That’s fine. I mean plagiarism, of course, is the greatest compliment that somebody can pay. But it’s not an easy road.

Along these lines, the co-founder of Firm 6 said of other firms: “They’re not going to just duplicate it unless it’s really easy to do. We’ve never felt our stuff is that easy to do. So, as a result, we’ve been pretty open about it.”
2. Protection through a non-disclosure agreement. While some founders in the study voiced confidence in the idea of openness based on trust, they also raised concerns over what to share and how to manage the process of sharing. Founders acknowledge that sharing intellectual property may be necessary when collaborating with other firms, but that they fear that collaborators may steal their intellectual property. The founder of Firm 38 discussed how to navigate this issue:

For the partnership to work, [the partner is] going to have to get [the details of] your technology, especially being a hospital and healthcare technology . . . [You need to make] sure that you’re covered legally and also [make] sure that [it is] strategic enough that it warrants you sharing your IP with a potential competitor or a potentially larger company that can take you out.

Other founders did contend that information sharing during collaboration should be protected through a non-disclosure agreement that must be signed by all the parties. This view is particularly prominent among the founder/co-founders/senior staff members of firms that are building patentable technologies. According to the co-founder of Firm 41, “We put [an] NDA in place if we’re going to be sharing something that’s extremely confidential.”

3. Shared only on a need-to-know basis. Another way startup firms safeguard against idea theft is by implementing what the co-founder of Firm 5 referred to as information compartmentalization. This involves sharing details only with those who need to know. The co-founder explained, “So I’m sort of trained in compartmentalizing information into a need to know. So that somebody doesn’t put together the full picture.”

Founders described using diverse channels for information sharing during collaboration. These include in-person communication, email, phone, other online group communication channels like Slack, and different teleconferencing platforms. Among these different information-sharing platforms, founders preferred in-person or face-to-face communication, offering comments such as “we try to do in-person meetings as much as we can,” and “I always prefer face-to-face if possible.”

The study did not observe any differences in information sharing behavior among the firms. It does not make a difference which incubator a firm is located, the behaviors described above cut across all the collaborating firms. However, as discussed in the next section, the
environment and the design of a business incubator space influence the frequency of interactions among firms and hence behaviors that lead to information sharing.

4.4 Characteristics of business incubators promoting collaboration

This study found six characteristics of business incubators that positively influence collaboration by startup firms located in them. These characteristics include:

1. Corporate membership
2. Space configuration
3. Informal and formal networking
4. A single-industry focus among its member firms
5. Information environment
6. Human and social capital

This section will describe each of these six characteristics. Following each description, a set of statistics and several narratives are presented that affirm and explain the relationship between the independent and dependent variables. The numerical data, while not always statistically significant, are trend data suggestive of a relationship, especially in combination with the narrative information. Table 18 provides an overview of the relationship between each characteristic and each of the four incubators. Incubator A is strong in informal and formal networking and human and social capital, but weak in corporate membership, space configuration, industry focus, and information environment. Incubator B is strong in corporate membership, space configuration, and human and social capital, but weak in informal and formal networking, industry focus, and information environment. Incubator C is strong in corporate membership, space configuration, information environment, and human and social capital, but weak in informal and formal networking and industry focus. Incubator D is strong in all six characteristics: corporate membership, space configuration, informal and formal networking, industry focus and human and social capital. All four incubators are strong in human and social capital.
Corporate membership. Corporate membership are incubator-affiliated professional organizations and established companies that can benefit from the innovation emerging from startup firms in an incubator as well as being of value to the startup firms themselves. Established companies become corporate members of an incubator for reasons such as acquiring a startup firm or acquiring certain technologies from startup firms. These corporate members are potential collaborators, as they are able to provide resources, both financial and technical, that are often lacking in startup firms. Relevancy of corporate membership to an incubator is tied to how the startup firms in the incubator can benefit from such membership.

How does this study measure more versus fewer corporate membership? This was done by manually counting the number of corporate members listed on the website of each incubator. These are all registered members of the incubator that are not startup firms. Incubator B calls them “Council.” Incubator C groups them into the categories of accelerator, alumni, corporate partner, education partner, growth stage companies, tenant, university partner, and venture partner. Incubator D calls them “partners.” Incubator A did not have any information on its website about corporate membership. In all, incubator B had 29 corporate members, C had 86, and incubator D had 58.

Table 18. Summary of findings across the four incubators

<table>
<thead>
<tr>
<th></th>
<th>Corporate membership</th>
<th>Space configuration</th>
<th>Informal/formal networking</th>
<th>Industry Focus</th>
<th>Information environment</th>
<th>Human/Social capital</th>
<th>Collaborators as % of all firms in sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incubator A</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>69</td>
</tr>
<tr>
<td>Incubator B</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>80</td>
</tr>
<tr>
<td>Incubator C</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>73</td>
</tr>
<tr>
<td>Incubator D</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>100</td>
</tr>
<tr>
<td>ALL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>
As Table 19 shows, of the 44 startup firms, 26 are in an incubator with more corporate members and 18 are in an incubator with fewer or no identifiable corporate members. The results in Table 19 shows that 85% of startup firms in incubators with more corporate members are collaborators compared to 72% of firms in incubators with fewer corporate members.

Table 19. Corporate membership and collaboration

<table>
<thead>
<tr>
<th></th>
<th>More corporate members</th>
<th>Fewer corporate members</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>26</td>
<td>18</td>
<td>44</td>
</tr>
<tr>
<td>Collaborators as % of all firms</td>
<td>85%</td>
<td>72%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Firm 41 described an opportunity that emerged as a result of the incubator’s corporate membership. Firm 41 is developing an affordable home dialysis machine. The idea was generated, and initial development began in 2014; the company was formed in 2016 and moved to the incubator in the same year. The firm had two co-founders and four employees and had raised about $4 million as seed funding at the time of the interview. The co-founder who participated in the interview noted:

We’ve had a meeting with an insurance company, a large insurance company that approached [the incubator] and said, hey, who do you have that could help us save money on delivering healthcare? And [the incubator] said, well, we’ve got this company [that is] developing an affordable home dialysis machine. Would you like to talk to them? We got several meetings with this large insurance company directly as a result of our membership here that we would not have gotten had we not been here.

Firm 34, a collaborator, described how the incubator’s corporate membership helped the startup firm to acquire a major partner. Firm 34 is focused on connecting international medical students with short-term training in the US. It is one of the many startup firms that have offices outside of the incubator but has kept its incubator membership. It was established by two co-founders in 2013 and joined the incubator in 2017. As at the time of the interview, Firm 34 had twenty-five full-time and five part-time employees. It has raised over $3 million in capital. The co-founder described how the incubator’s corporate membership had opened up a major opportunity with a healthcare system for his startup firm:
We met through office hours. It was like absolutely great partnership directly through [the incubator]. You know, through that partnership he referred us to another physician who was a medical director at [a big healthcare system], and we started working with that physician. And over time, we’ve now signed a contract with [the healthcare system].

The co-founder of Firm 39, a collaborator, mentioned that the startup firm gets more value from the incubator’s corporate members than other characteristics. Firm 39 is building an expert system that connects to a hospital radiology system and interfaces with an image viewer. This clinical-decision support system helps physicians more accurately understand and analyze what they are seeing and render a more accurate diagnosis. The firm was founded by four people in 2012 and moved to the incubator in 2018. The firm had raised $18 million at the time of interview. Regarding the incubator’s corporate membership, the co-founder noted:

The value that I’m getting [from the incubator] is from the partners of the incubator more than sitting next to a company that does something completely different…. Since we make software, [we] need hardware. Our software has to run on the hardware or interact with other software systems. It needs to be able to have a technical ecosystem in which it can flourish. If you’re starting a software company in this day and age, you must understand who are the other related ancillary hardware and software companies that you must interact with. You don’t have a choice. And they become obvious partners for collaboration in order to make your mission possible. So, we have to integrate with a PACS system [picture archiving and communication system]. It’s basically the big massive hard drive that holds all these ultrasound images or X-rays. But when you look at them, it’s like opening up a photo in Microsoft Paint or an Adobe Photoshop. You want to analyze and manipulate that image so you can truly understand what’s going on within the image. So, the image is just data. That viewer is software that allows you to manipulate the data. So, our software is like an APP that helps analyze the data. Understanding that ecosystem is an important means for achieving some collaborative innovation because then you and those partners can create a value chain that the end customer realizes the benefit that didn’t exist from the incumbent hardware software. So, we add value to them, they enable us, and the end customer can now have the combined
intelligence of two organizations. And then you look at each other side by side and say, I can help sell your stuff. You can help sell my stuff. Let’s cut a deal.

An interview with a manager at incubator D shows that the incubator has established corporate membership in the healthcare industry to help startup firms who are interested in partnering with established companies. According to the manager, the incubator has over 50 plus industry partners that partner with us and collaborate on different aspects of innovation. So, if a startup is interested in partnering with a pharmaceutical company, partnering with a health system, partnering with a payer, we have access to different groups like that.

A manager at incubator A reiterated that the incubator has as its mission the building of relationships between the startup community and established companies or professional organizations. However, though incubator A is surrounded by established companies in the larger research park of the university where it is located, there are no indications of ongoing partnership between the companies in the larger research park and the startup firms within the incubator. The incubator, according to the manager interviewed, was established with a vision of encouraging collaborative relationships between the startup community and the more-established companies in the research park. According to her,

It was actually a part of the vision that the large corporations would work with the startups, the startups would work with the large corporations. That’s one of the value propositions that the large corporations will say that they’re here, why they’re here. We know that, especially in the [agricultural] tech space, there’s a lot of collaborations between the larger companies and the startup.

A manager at incubator C observed that the incubator has formed relationships with corporations with the aim of helping startup firms who might be interested in connecting with these corporations. Incubator C is well known for its diverse technology-based startup community and its influence helps promote startup firms in the incubator by giving them exposure to various companies that may be interested in collaborative relationships. It sends out weekly updates that inform its corporate members and other entities of the progress of its startup
firms. The manager noted that the incubator “has connections and resources with over a hundred corporations in town that if [startup firms are] looking to make that enterprise level connection, [they] can do that.”

**Space configuration.** Space configuration captures the physical distance between startup firms as they work in the incubator. The absence of walls and barriers and founders sitting next to or across the table from another founder means greater proximity and encourages more collaboration than would occur if each startup firm has private office space. This open workspace configuration is a feature in three of the incubators in the study, two of which specifically make access to this a core element of the shared form of membership, as opposed to reserved. Proximity among the startup firms is greater for those who are in shared category.

Space configuration was measured first by estimating the square footage per startup firm across the four incubators. As Table 20 shows, incubator D has the least distance between startup firms, 115 square feet, followed by incubator C, 353 square feet.

Table 20. Estimated square feet per startup firm across the four incubators

<table>
<thead>
<tr>
<th></th>
<th>Incubator A</th>
<th>Incubator B</th>
<th>Incubator C</th>
<th>Incubator D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total square feet</td>
<td>43,000</td>
<td>34,000</td>
<td>75,000</td>
<td>25,000</td>
</tr>
<tr>
<td>Number of startup firms</td>
<td>63</td>
<td>28</td>
<td>212</td>
<td>216</td>
</tr>
<tr>
<td>Square feet per startup firm*</td>
<td>682</td>
<td>1214</td>
<td>353</td>
<td>115</td>
</tr>
</tbody>
</table>

*Square feet per startup firm = Total square feet / number of startup firms

These estimated distances between startup firms do not take into account the space dedicated to reserved and other non-startup members as well as incubator management. Taking these into account means the real distances between startup firms in the shared category in incubators C and D are smaller than the estimates in Table 20, which are based on the entire incubator square footage. This is also applicable to incubator B, where there are fewer startup firms in a space of 34,000 square feet but they have a dedicated section within the space.

In addition to calculating the square footage per startup firm, space configuration was also measured by observing the physical configuration of the four business incubators vis-à-vis the locations of the startup firms in them.
In the shared space in incubators C and D, tables and chairs were arranged in parallel. Anybody with a shared membership can sit anywhere within the shared space, and there are no demarcations on any of the tables. No startup firm has a dedicated spot. This means there is a high probability of sitting next to a different founder each time. Three or more founders were observed seated at one table on a busy day. Everyone is visible to everyone within this space. All 15 startup firms in incubator C that participated in the study and 9 of the 11 at incubator D that did have shared memberships that allow their employees to work exclusively in this shared space.

In incubator B, the space was not configured according to the types of membership offered. Startup firms at incubator B have their own cubicles, but the demarcation between cubicles is not significant, as cubicle walls are about 3 feet high. This means founders of different firms are visible to one another. Incubator B also has a large co-working space for the employees of startup firms who may just want to work outside of their assigned cubicle. This large co-working space is equipped with chairs, tables, sofas, and writing boards.

Firms in incubator B occupied an area that is about the size of a table tennis field, approximately 3000 square feet out of the center’s 34,000 square feet shown in Table 20. Hence adjusting for this, the real distance between firms in incubator B is about 110 square feet.

At incubator A, firms have their own private offices and thus were observed to have the least proximity across the four incubators considering what is reported about incubator B in the preceding paragraph. Founders in incubator A do have the opportunity of being together during lunch, which some prefer to have in an open conference area near the kitchen. They can also meet by schedule or by chance in one of the meeting rooms, or during events at the incubator.

As Table 21 shows, of the 44 startup firms that participated in the study, 31 are in an incubator that puts them in physical proximity to other firms, while 13 are in an incubator that does not. The 31 firms in the former category are located in incubators B, C, and D, and the 13 firms in the latter category are located in incubator A. Consequently, 84% of all firms in incubators with shared spaces are collaborators compared to 69% of all firms in the incubator where firms maintain private offices.
Table 21. Incubator space configuration and collaboration

<table>
<thead>
<tr>
<th></th>
<th>Shared space</th>
<th>Private space</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 31</td>
<td>N = 13</td>
<td>N = 44</td>
<td></td>
</tr>
<tr>
<td>Collaborators as % of all firms</td>
<td>84%</td>
<td>69%</td>
<td>80%</td>
</tr>
</tbody>
</table>

A co-founder of Firm 21 puts space configuration into better perspective by giving an example of an ongoing relationship between her startup firm and another in the incubator. Firm 21 is an online community that connects romance authors and readers. It is a sales and marketing tool for authors and a book discovery tool for readers. It was established in 2017 and moved to the incubator in 2018. This startup firm has 2 co-founders and employs 6 full-time and 2 part-time workers. At the time of interview, the firm had raised over $200,000 in capital. The co-founder explains space configuration this way:

To be around others who are having a similar experience just makes you feel less alone. And I think that’s a huge thing. But also, in terms of the ability to collaborate, there’s another company here called [Firm 23]. I had met their founder and they turn written content into audio. And so, there’s potentially some synergy between his company and my company. I’ve known him for a few months, but we just met, sat down for an hour or two, like two days ago. He said, you know, you could do x, y or z and even if I don’t do that with you, I can show you how to set up this on your site. He’s like, well, we could build that technology for you and implement it on your site. That wouldn’t have happened had I not been in [the incubator]. It just wouldn’t, you know, that’s a factor of seeing each other here all the time and saying, you know what, we should talk and let’s see if we can figure out something that we can do together to support each other’s businesses. Like that wouldn’t have happened if I were just at home. It wouldn’t have happened if I were at, WeWork [WeWork is a co-working space for business of all types] because WeWork’s just different. Everybody has their own little office. You can have an accountant next to a startup. That’s not the same thing. They’re small business owners. They’re, well they’re both business owners and entrepreneurs, but it’s not the same experience.

A senior staff member at Firm 14 acknowledged that appropriate incubator space design can lead to better interactions among startup firms. Firm 14 has a variety of biotech platforms.
The startup firm is researching novel approaches of creating alternative proteins such as meat products from naturally occurring fungi-like mushrooms. It was established in 2016 by two people with doctorate degrees and employed five people at the time of this study. The firm had raised over one million dollars as capital at the time of interview. The senior staff member offered the opinion during the interview that an incubator’s space should be designed in a way that “everybody can literally get around a table and face each other and have those conversations.” According to her, the incubator has “done a good job of creating different spaces that facilitate that collaboration.” The different spaces to which this senior staff member was referring include private meeting rooms for two people only, conference rooms such as the one in which the interview was conducted, and other types of meeting spaces.

The founder of Firm 38 described the space configuration of the incubator as providing opportunities for founders to approach one another by keeping barriers to an absolute minimum. Firm 38 was established to solve the problem of underused medical equipment in hospitals. It does this by monitoring equipment usage data and computing what is called an efficiency score for each piece of equipment to help healthcare organizations better manage equipment distribution and purchasing decisions. The firm was established by two co-founders in 2017 and joined the incubator in 2018. At the time of the interview, this startup firm employed seven people and had raised over $700,000 in capital. Referring to the incubator’s physical space, the co-founder stated “I mean it’s wide open. Everybody’s working on something, everybody’s approachable.”

The incubator space provides the opportunity to be around other entrepreneurs, according to a co-founder of Firm 25. Firm 25 is an education technology company that enhances leadership within the educational ecosystem. The startup firm is a software-as-a-service platform that guides education leaders through various key milestones in the process of improving their leadership ability. It was established by three co-founders in 2017 and moved to the incubator in 2018. At the time of the interview, Firm 25 had four full-time and three part-time employees and had received about $30,000 in grant monies. In the co-founder’s words, “Once you’re here you see the value of collaboration [because it allows] access to other founders and [help] to collaborate with other people.” He shared an example of recent collaboration with another startup firm in the incubator:
I actually needed a company to help me better market my company, like enhance our website, digital marketing, things like that. We were looking for many companies, you know, we kind of interviewed many companies around the city and the nation and we ended up actually hiring somebody who’s located here. And that’s because they were like my last meeting and when I met with them, they really understood my company. They understood what my company does, what we were trying to do. Like they were just very well versed in what our company does. So that really made it easy to hire them. And now we’re working together and having meetings.

The co-founder of Firm 24 echoed the other founders’ views on incubator space. Firm 24 is a mobile app that spontaneously delivers podcast geotagged around a city. It works in such a way that as people go about their daily routine, they can get a small bite-size story about the people and places around them. The startup was established by two co-founders in 2016 and moved to the incubator in 2017. At the time of the interview, it employed two people. According to the co-founder, “We’re all in a workspace together, so you’re seeing each other’s faces all the time.”

Founders in incubator A, where space is not shared, mentioned the benefit of the incubator as being the lower cost of space as opposed to the opportunity to be close to other startup firms. They noted that a comparable amount of space outside of the incubator was outside their reach at this early stage. A co-founder of Firm 6 expressed this view. Firm 6, a home robotics company, was established by three co-founders in 2014 and moved to the incubator in 2015. At the time of the interview the firm had 10 employees and had raised $3.5 million in capital. According to the co-founder, “having [a] space and an office is nice and having right sized office spaces is good because it’s hard to find a commercial lease for just 600 square feet.” A senior member at Firm 2 made a similar point:

So since we’re a young company, a[n] early stage company right now, primarily, it’s cost, you know, for us to rent space, have access to high speed internet, conference rooms, meeting rooms, things like that would be expensive for us to do this out in a standard commercial office space environment, probably two to three times more costly than we spend here.
Informal and formal networking. Informal and formal networking means the total number of all programs, social and educational, organized by business incubators over a twelve-month period. Incubators refer to these programs as events and they appear on their events calendars. The average of this is calculated. Events such as workshops provide the opportunity for startup founders to acquire knowledge that can help them build a scalable company. There are also opportunities for founders to participate in social activities organized by the incubators. These often act as opportunities for networking with other founders within the incubator as well as with representatives of established companies.

How does this study measure networking-rich and networking-poor? The study measures networking-rich and networking-poor by counting the number of monthly informal and formal networking programs organized by each of the incubators over twelve months, and the specific focus of each program. An event calendar entry about a deadline for submitting a certain application is considered as networking-poor because such an event does not involve physical meetings. However, an event calendar entry about an upcoming talk on how startup firms can enter a certain market segment is regarded as networking-rich, because of its potential to bring founders and other individuals together in the same space.

Monthly informal and formal networking programs were identified on the events calendars of the websites of the incubators and then counted manually. The number of monthly events organized by the incubators varied across the four. The average number of monthly events was 15 in incubator A, 24 in incubator B, 10 in incubator C, and 8 in incubator D. Based on the criteria presented above, incubators A and D were considered networking-rich while incubators B and C were considered networking-poor.

As Table 22 shows, of the 44 startup firms, 24 are in an incubator that is networking-rich, while 20 are in an incubator that is networking-poor. There were more collaborators among the startup firms in networking-rich incubators than firms in networking-poor incubators. This implies that it is important for management of business incubators to curate the kind of programs that will enhance interactions among founders in order to promote collaborations. Consequently, 83% of all firms in networking-rich incubators are collaborators compared to 75% of all firms in networking-poor incubators.
Table 22. Incubators’ monthly informal and formal networking and collaboration

<table>
<thead>
<tr>
<th>Networking-Rich</th>
<th>Networking-Poor</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 24</td>
<td>N = 20</td>
<td>N = 44</td>
</tr>
<tr>
<td>Collaborators as % of all firms</td>
<td>83%</td>
<td>75%</td>
</tr>
</tbody>
</table>

This importance of an incubator being networking-rich is sustained by a response provided by a senior staff member at Firm 35, a startup firm that at the time of the interview continued to have incubator membership despite having moved to an external office location. Firm 35 is a digital healthcare technology company. The company’s product is an interactive digital playbook that directs surgeons and other medical personnel through surgical procedures. It was established by two co-founders in 2015 and moved to the incubator the same year. At the time of the interview, Firm 35 employed 25 people and had raised $4.5 million in capital. He posited that

[the incubator] represent an opportunity for us to network with people that are likeminded and, you know, continue to grow our network. You never know who you’ll meet over there. It could be your next customer or your next collaborator or, you know, someone who might help inspire you to solve a problem or a challenge that you’re currently working on.

The founder of Firm 27 shared a similar view about the value of an incubator that is active in informal and formal networking opportunity. Firm 27 provides risk management for companies; its services include information security, security risk assessment, audits, and attestations. It was established in 2017 and joined the incubator the same year. This startup firm has one founder and at the time of the interview had not raised any outside capital. The founder mentioned that events that involve face-to-face contact, such as workshops and socials, offer startup firms ideal opportunities to connect with other founders and especially those not located within the incubator:

There is [an] opportunity to connect with people [working outside of here] as well as people working in this space. [The incubator] has a lot of workshops and public events where they bring in companies and entrepreneurs. So, it’s a learning experience for us. And I definitely feel there’s a lot of opportunities to collaborate.
According to the founder of Firm 1, the greater the number of events organized by incubators, the better the chances of meeting potential collaborators. Firm 1 is an early-stage software startup company with a focus on leveraging artificial intelligence and computing techniques in the interpretation of medical imaging exams. This firm was founded in 2018 and joined the incubator in 2019. The firm has one founder and at the time of the interview had not raised any outside capital. During the interview, the founder stated that, “as you attend more of these kinds of events and meetings, you have opportunity to meet more people.”

A co-founder of Firm 3, an agricultural-based startup firm, described how someone from his startup firm was able to meet a partner through one of many networking programs at the incubator. Firm 3 produces bioreactors that convert agricultural wastes such as manure and vegetable waste into safe biofertilizer that can then be used to provide nutrition to plants. This firm was established in 2018 and joined the incubator as an affiliate member the same year. The company has two founders and at the time of the interview employed three people and had raised $25,000 through grants. In response to a question about the importance of events in forming collaborative relationships, he recalled,

We were able to talk to a [professional] and learn more about his views on agriculture, what farmers need [and] what problems they have. They are another agricultural company and he informed us about [an event] and showed us some of the problems that he faced when first contacting farmers and learning about the ag space and how he overcame them. So, [he] helped show us by example the problems that they face and how to be prepared for them in advance.

Informal and formal networking programs act as venues for startup firms to assess potential collaborators among the participants. While founders are mostly averse to collaborating with firms with competing ideas, events do bring in companies and people who may have complementary ideas. One of the two co-founders of Firm 22 contended that the various workshops and socials did benefit the firm. Firm 22 is a social application and a social platform for people interested in the world of plants. It was established in 2014 and joined the incubator the same year. At the time of the interview, it had an office outside of the incubator but was
keeping its membership with the incubator; it had nine full-time and three part-time employees. The co-founder noted:

> There are all sorts of workshops that are all about helping each other solve each other’s problems. There’s all sorts of meetups and events where people are actually talking to other people from other companies, not just like, hey, how’s life? But more like how [to] work together to make it here.

While startup founders identified informal and formal networking programs as avenues to connect with potential collaborators, some also believed that incubators need to improve in this area. The founder of Firm 29 had one suggestion: incubators should help facilitate meetings between startup firms and established companies in the same business domain. In his words,

> In terms of some potential opportunities for improvement, I think it would be nice for [the incubator] to facilitate more gatherings of similarly minded companies. So, a gathering of just the device companies monthly or something along those lines to kind of share their challenges and their successes.

A single-industry focus among its member firms. A single-industry focus among an incubator’s member firms means that it only admits startup firms focused on creating a product or service for a single industry. In this study, though all the business incubators can be generally described as admitting startup firms making technology products or services, three of the incubators have a broad-industry focus and one has a single-industry focus (incubator D).

How did this study determine single- versus broad-industry focus? The stated visions of each of incubator were analyzed and the specific types of startup firms that are admitted were identified. While incubators, A, B, and C confirmed that they only admit startup firms developing technology products or services, they do not mandate that those products and services be intended for a particular industry. Incubator D, on the other hand, admits only healthcare-focused startup firms. Single-industry focus versus broad-industry focus is thus determined based on these differences between the four incubators.

Table 23 relates incubators with single- and broad-industry focus to levels of collaboration on the part of firms in those incubators. All the firms in the study that were located
in an incubator with a single-industry focus were collaborators compared to 73% of firms located in incubators with broad-industry focus.

Table 23. Single-industry focus/broad-industry focus and rate of collaboration

<table>
<thead>
<tr>
<th></th>
<th>Single-industry focus</th>
<th>Broad-industry focus</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>11</td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td>Collaborative innovators as % of all firms</td>
<td>100</td>
<td>73</td>
<td>80</td>
</tr>
</tbody>
</table>

One of the ways a single-industry-focus incubator encourages collaboration is that it often brings together startup firms with complementary products. The founder of Firm 40 offered an example of this during an interview. Firm 40’s product is designed to make the surgical safety process transparent. It seeks to optimize care during surgery by engaging the patient in the process as well as managing safety issues. This firm was founded by one person in 2014 and moved to the incubator in 2015. At the time of the interview, it employed one person and had not raised any outside capital. In the founder’s words,

We put together a collaborative effort with [other companies] and responded to an RFP from [a city’s telemedicine network] looking for a solution to take care of patients from the moment that they register for a surgical procedure all the way through recovery. Well, [my startup firm] only did part of that, but if we layered it with [other companies’] product, we could answer those needs…. So, you know, it was an interesting process because the stimulus for that wasn’t my company, nor was it the other company [in the incubator]. The stimulus came from a company located in [another city]. [They] called me, told me what they wanted to do because it’s not quite their business. Their business is telehealth and they wanted to get into patient care software a little bit and answer this RFP. . . . We’re now negotiating [the] proposal that we put forward to install the products up there. So, it’s obviously going to turn into something.

The founder of Firm 40 explained that the ability to collaborate was the greatest benefit his company had received from the incubator. He is a professional who had practiced general surgery for more than 30 years before starting his company. He further described an ongoing collaborative effort with startup firms in the incubator and other established companies. He provided the schematic of this relationship (Figure 5 below).
The description in Figure 5 is that of eight companies integrating their different services to provide a unitary “total surgical experience.” This is a new relationship that was being formed and these companies are diverse in terms of size as well as in terms of their level of maturity. Some of them are just starting out, while others have been in business for more than 10 years. The success of the previous project led to the current collaboration effort described in Figure 5. In this new collaboration, individual firms are providing specialized services that include digitized informed consent, vendor tray management, supply chain, patient-generated health data (PGHD), digital financial and process management, patient identity management, and medication pulls.

A co-founder of Firm 37, a collaborative innovator, shared how his company is building on relationships cultivated with other startup firms at the incubator. Firm 37’s product is a virtual reality platform for patient education and provider training. It was established by three co-founders in 2017 and became a member of the incubator in 2018. At the time of interview, Firm 37 employed six people and had raised $500,000 in capital. The co-founder stated,
I’ve had conversations with other founders who [provide] complementary services in the same segment. And I can see eventually there’s some sort of collaboration there, whether that’s a data partnership or product partnership. Some of these people have sensors and wearables. I provide virtual reality content as a service. You can see that being complementary. Some of our partnerships are in certain segments like chronic care and diabetes. I have learned from device CEOs who are based here about the market and about their experiences working with certain customers.

One of the co-founders of Firm 42 reiterated the advantages that can accrue from collaborating with other startup firms. Firm 42 does data integration for healthcare companies through a product that helps vendors pull information out of the medical records in order to conduct analytics. The firm was established by three co-founders in 2016 and joined the incubator the same year. At the time of interview, Firm 42 employed 10 people and had raised $500,000 in capital. Underscoring the opportunity that comes with being in a niche incubator with other healthcare-focused organizations, the co-founder noted, “As we collaborate, we can create new content together that we can resell as partnership.”

This point about the niche incubator offering an opportunity for collaboration was also made by a co-founder of Firm 43. According to the co-founder, Firm 43 is a “vendor relationship management platform for health systems, hospitals and different healthcare institutions to source vendors and perform due diligence on them”. This startup firm was established by two co-founders in 2018 and joined the incubator in 2019. At the time of the interview, it employed four people. According to the co-founder,

There’s, you know, 200 companies here that do other things. Some are parallel to us or complementary. So, we can talk to each other about, you know, we have a hospital contact that’s looking to solve for x. Well, we do y and a little bit of x, you guys do x. And a little bit of y, well, let’s figure out how we can improve our offering and we can really solve this problem together.

Another facet of the importance of a single-industry focus was revealed when co-founders or senior staff members in startup firms expressed the type of collaborative relationships they would prefer to have. For example, Firm 2 is an agricultural software
company. It acquires farm data, which include pictures of agricultural fields in the U.S. Midwest and around the world, using airplanes. It then processes the data to provide farmers with a quantitative assessment of the health of the crop at different growing stages throughout the season. Firm 2 was founded by two people in 2015 and moved into the incubator in 2018; at the time of the interview, it had seven employees. A senior manager at the firm shared the company’s interest in participating in collaborative relationship:

Bigger companies that work in the agriculture space are of great interest to us and we’re of great interest to them. And, you know, the obvious outcome there is, we might get purchased by a larger company, a [company] or one of these big agriculture companies because [of] their interest in our unique technology that they don’t have.

A senior manager at Firm 15 acknowledged that collaboration is better supported in a niche-focused incubator. Firm 15 makes software that assists radiologists in reading magnetic resonance imaging of breasts. It was established by five co-founders in 2011 and moved to the incubator in 2013. At the time of the interview, three of the co-founders were still with the startup, it had two employees, and it had raised $2 million in capital. During the interview, the senior staff, referring to the incubator, remarked,

This is a generalist incubator. There’s a book company over there, there’s everything [here] . . . It’s different than a place like [incubator D], which is like specifically [a] healthcare incubator . . . where everyone is healthcare related and there’s just much more. Whereas [here], yes, there’s a lot of science stuff that comes out of it, but there [are] companies of all types here.

The founder of Firm 7 expressed a similar sentiment. Firm 7 develops advanced bionic limbs that are within a reasonable price range. The startup firm was established in 2015 and moved to the incubator in 2017. The firm was formed by two co-founders, only one of whom is still with the company. At the time of the interview, it employed four full-time and three part-time staff and had raised $700,000 in capital. Referring to the incubator, the founder of Firm 7 observed, “The thing about this incubator in particular is that the companies that are here are very widespread.”
Being around founders who are working on similar ideas but who are not competitors is seen as helpful by the co-founder of Firm 16. Firm 16 is a biotech company that is developing a new migraine medication. It was established in 2016 and moved to the incubator in 2017. At the time of the interview, this startup had one full-time employee and had raised over $1 million in capital. The co-founder noted that “having a community here of other people who are working on the same thing, kind of build[s] some sort of camaraderie, and community that you can be a part of.”

Lack of overlap or complementary skills and products were noted as factors that reduced the level of collaboration. A senior staff member in Firm 2 put it this way:

We don’t collaborate much with other companies located here because if the company is not doing similar work to ours, there is no natural reason to collaborate. There is nothing that we can do for each other than to share our experiences with finding investment capital and things like that.

*Information environment.* The study assessed the information environment of the incubators by counting the information sources and systems in each business incubator. The study described incubators with more information systems and sources as information-rich and those with fewer information systems and sources as information-poor. As shown in Table 24, 85% of firms that were located in information-rich incubators were collaborators compared to 72% of firms located information-poor incubators. Other aspects of the information environment of the incubators are discussed below.

Table 24: Information environment and collaboration

<table>
<thead>
<tr>
<th></th>
<th>Information-Rich N = 26</th>
<th>Information-Poor N = 18</th>
<th>All N = 44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborators as % of all firms</td>
<td>85%</td>
<td>72%</td>
<td>80%</td>
</tr>
</tbody>
</table>

As a common denominator, all four incubators maintain websites where information about the incubators and the firms can be found. Each website contains the mission and vision statement of the specific incubator and information on the startup firms.

Business incubators circulate information regularly to members and everyone who maintains a mailing subscription. Incubators B, C, and D all have subscription lists for events
and newsletters. Through these lists, the management of each incubator shares updates and the progress of startup firms with all registered members, including potential collaborators and interested members of the public. Information sent out includes updates on what companies are doing. Incubator A maintains a library of books on entrepreneurship as a physical information resource that can be consulted by founders. Incubators A, B, and D maintain lists of startup firms on their websites and these lists are open to everyone. To see the list of startup firms available in Incubator C, membership of the incubator is required as the list is closed to non-members.

Some founders however noted that having the list of startup firms open to the public on the incubator’s website is a good thing. The founder of Firm 3 noted: “There are several huge benefits to being a part of [the incubator], but I’d say one of the main benefits is just being in their network, like being listed on their website, for example. That's how you got a hold of me. I've also been contacted by investors.”

Other elements of the information environment of the incubators include Slack channels created to enhance the connection between firms. Incubators B and C maintain Slack channels through which members can connect. Firm 25 observed, “there's a lot of channels. There's Slack, there's the website, there are different ways that we've been collaborating.” The usefulness of Slack channels and websites for easy connection with other incubator members was noted by the founder of Firm 27: “[With] Slack, I can reach out to any member. I think the member section of [the incubator website] allows us to get a message [that is sent to us] as you did. So, you have an opportunity to [send a] message. So, if you find somebody you can message them.”

*Human and social capital through mentoring.* Human and social capital emerged in the form of professional volunteer members of an incubator that are able and willing to provide mentoring services to the founders. Mentoring program refers to an incubator’s pairing of a professional with knowledge of the domain in which a startup firm is operating with the founder of that firm. Mentors are self-nominated individuals vetted by the business incubators to ascertain that they can truly assist startups.

All four of the incubators offer mentoring programs. Such programs were identified as a means by which startup firms connect with or are introduced to potential collaborators. Because all four incubators provide mentoring programs, no meaningful statistical pattern can be
identified. However, narratives from the interviews point to the positive influence of mentoring programs on collaboration.

Startup firms refer to incubators’ mentoring programs as an avenue through which they connect with specialists with years of experience in an area of interest. Founders referenced mentoring programs as one of the benefits they derive from the incubators. Founders mentioned that mentors often have people in their network who can help their firms take advantage of particular collaborative opportunities. Each of the managers interviewed referenced the availability of mentoring services as a way of helping startup firms to connect with established professionals outside the incubators.

The co-founder of Firm 6 put one of the benefits of the mentoring program into perspective during an interview:

There were one or two key interactions that really helped the trajectory of the company that happened [here at the incubator]. One of them was meeting one of our first advisors who had been giving a talk here and we talked to him afterwards. May not have been someone we [would have] discovered and sought out directly. It was a fairly obvious connection.

This founder went on to relate that, among other benefits he had provided, this mentor had created a connection that helped link the founder’s startup firm with an acceleration program in [country].

A co-founder of Firm 8 expounded on the importance of the incubator’s mentoring program. Firm 8 designs software that incorporates various different health data of the patient like laboratory tests, demographic information, imaging data, into predictive models to help physicians to make better treatment decisions for their patients. It was established by two co-founders in 2016 and joined the incubator in 2017. At the time of the interview, the firm employed two people. The co-founder recalled:

There are a couple of [mentors] from industry, Pharma Industry, which [were] particularly useful to us and [have] given us a lot of free time. The incubator here has given us free time with [them] to walk us through what the regulatory space around
healthcare looks like. And you know what, it’s like, designing drugs, working with drug companies, going through FDA approval et cetera. And so, that’s been really useful. Talking with entrepreneurs who have successfully had businesses, bouncing ideas off them, you know like, that the problem we’re solving is x and the way we’re positioning the solution is y, you know, what do you think? And they give us feedback on that. So, that’s the second major service that, you know, the incubator here has provided that we’ve used, significantly.

Mentors are crucial to the survival and growth of startups, in the view of the co-founder of Firm 34, who stated that “to succeed in the healthcare space, you need a certain specialized knowledge and people to advise you on how to best work with [the] health care system.”

A co-founder of Firm 9 acknowledged that the mentoring program is one significant benefit the incubator community has provided. Firm 9 provides services to the nutrition industry in relation to preclinical research. It was established in 2018 by two co-founders and at the time of the interview had no full-time employees. According to the co-founder, “most [of the] benefit has mostly been mentorship and guidance.”

Mentors help connect startup founders with additional sources of help beyond the incubator. This is reflected in an interview with the founder of Firm 26. Firm 26 deploys technology to organize ethnic events and offer consulting services. It was established in 2017 and moved to the incubator the same year. The founder was the only employee at the time of interview. Recalling how she learned to solve a certain problem her startup firm was facing, the founder said,

So, [Firm 26] through some of the mentors here, learned about [a] program at a university legal clinic. And they offered that service, you know, and of course I met the person in charge so that helps. Meeting people definitely helps.

The senior staff member of Firm 14 who participated in the study discussed the way startup firms gain access to industry experts through the mentoring program at the incubator:

I would say there’s a fair amount of mentorship, formal and informal, that happens. And so you have, whether it’s directors, whether it’s industry experts, whether it’s, you know,
maybe there’s just several folks that have a full-time job or are doing something different, but had volunteered to come in a couple of hours a week and literally they just set up an office hour and people can come in and pick their brain and you can have a conversation about something that, you know, otherwise you wouldn’t get someone with tremendous industry expertise on to do for free.

4.5 The expectation of startup founders regarding collaboration

The expectation of startup firms regarding collaboration falls into three categories of collaboration as an essential process for growth (e.g. acquisition of new technology), collaboration comes with risk (intellectual property theft, competition), and Collaboration comes with risk (intellectual property theft, competition), and collaboration requiring a support structure.

**Collaboration as an essential process for growth.** Startup firms see collaboration as an essential process for growth. The co-founder of Firm 8 said: “So, critical to the success of our company is forming good partnerships with health care organizations.” Firm 8 collaborates with hospital systems during clinical trials. The founder of firm 40 puts it this way: “There are half a million Apple healthcare apps, so that you probably don’t need more healthcare [apps]. Not too many. The real question is, I sort of feel as the frontier of innovation is collaboration.” Firm 40 is involved in multiple collaborations with both startups and established firms.

As an essential part of growth, startup firms see collaboration as a way to acquire technology and to save on the cost of developing new technologies from scratch. According to the co-founder of Firm 5, “If a company wants to do this and you know, my company [has] developed this, you sort of get together and enhance both of those rather than just doing it in parallel.” Firm 5 is developing motion systems for small satellites. The founder of Firm 36 said, “I want to use their technology to create my solution. I don’t want to have to reinvent their technology to make my solution.” The founder of Firm 29 stated:

So, we don’t have any intellectual property [right now]. But to get started, [it] is faster to do it this way while we develop our own platform in-house. In a year or two, whenever we’re ready, we can roll it out and tell [our collaborators] we really enjoyed working with you, but now we have our own intellectual property.
Collaboration comes with risks such as competition and incompatibility. Next, collaboration is perceived as undesirable because of concerns such as the difficulty of protecting intellectual property, the risk of collaborating with potential competitors, and incompatibility. Founders consider it self-defeating to engage in collaboration with companies that share a similar market or customer base. The co-founder of Firm 15 puts it this way: “It can be tough to know exactly who [is a competitor or] who could be a potential competitor.”

Regarding partner incompatibility, the co-founder of Firm 18 said, “A lot of times, unless if they’re the most strategic partners, it’s not a good idea. And you don’t know what the most strategic partner for you is while you’re a startup.” Not all founders see competition as a risk as the senior member of Firm 24 noted: “We're not as afraid of competition as we're more aware that together you can actually make things more possible.”

Collaboration requires a support structure. Finally, on the expectation of startup firms, founders observed that incubators can put structures in place to enhance collaboration. Structure is defined as the specific guidance, rules of engagement, program of action, and so on, that is put in place for the purpose of supporting or encouraging collaboration between startups or between startups and established companies. The founder of Firm 29 suggested, “When a company joins [the incubator], [the] staff [of the incubator] can say, okay, he’s in logistics, this mentor is in logistics, or maybe we’ve got to bring a mentor in logistics.” The founder of Firm 23 made this recommendation:

[The incubator managers] think they are [encouraging collaboration] or they are trying. But you know, recurring criticism we’ve heard is we don’t want you to hold our hands, but when you have the roster, you have the list of all the companies that work here, and you have the list of all the things they do. It should be very easy for you to point out, okay, these two can definitely benefit from meeting.

The founder of Firm 36 felt the managers of the incubator could do more and that there did not seem to be any structure in place to promote collaboration:

I would say [the incubator] allows collaboration to occur. It doesn’t proactively encourage collaboration. In other words, since I have been here, maybe once, maybe twice I have been introduced by a[an] [incubator] manager to somebody who’s another
member here who could be helpful to me and me to them. And those once or twice that happened was when I asked, I specifically ask, can you introduce me to somebody who’s working on health education?

The founder of Firm 25 also noted:

I think there could be more structured ways to kind of engage founders with one another or just companies with each other. There's so much, in my opinion, missed opportunity, you know, with so many people being in this space and a lot of collaboration that could be occurring

4.6 The continuum of collaboration among startup firms

Collaboration continuum describes the progression of collaboration among the startup firms. Four of the five continuum described in Chapter two apply to this study. The four include: contact, co-operation, co-ordination, and co-creation.

Contact. This is the first point of meeting, the initial process of starting discussion about collaboration, where options are explored by potential collaboration members. In an incubator, this happens during regular work hour or during special events. Contact can also occur through a founder’s personal effort to make contact with other founders or organizations that will be beneficial to the startup firm. 19 out of 35 collaborators discussed being at this stage in their collaborative relationship. Regarding making effort to initiate contact with other entities, the founder of Firm 37 noted:

We are fundraising currently. So, by coming out here, meeting new investors, meeting people who have those connections, by putting what we're doing out to the community, the [incubator] community, to the people who work here as well as the other founders, that spreads our message.

Other than the immediate incubator environment, founders noted reaching out to potential collaborators through other avenues. The founder of Firm 29 recalled,

I read an article [about the company] and I looked up the name of the person at [the company] who was in that article and I just did a LinkedIn connect with him. And the
gentleman was nice enough to say, I’m not the right person but you should talk to this person.

Getting initial contact started is also influenced by some factors. The founder of Firm 36 expatiates on this:

Collaboration depends on personalities. A lot of people are more extroverted than I am, and they are reaching out to other people, forming relationships and cocreating with them. That’s what satisfies them. That’s how their personality is arranged. I’m not that way. I’m more of an introvert than an extrovert and I don’t reach out to form relationships so that we can work together. I mean I would if serendipitously, you know, I meet somebody and it turns out we have so much in common and we like each other and we’ll work together, but it’s not something that I’m out looking for. So, this subject of collaboration does come back to some extent, learning style and personality.

Co-operation. At this stage, the different entities agree to work together informally on something that would result in a small but tangible benefit to all involved. Six of the 35 collaborators in the study described some form of co-operation. Here, founders and their firms derive the most benefit from observing certain techniques or learning particular tools or processes. For example, co-operation can take the form of founders sharing experiences about the best original equipment manufacturers, especially for those whose startups are focused on hardware. The co-founder of Firm 6 noted,

There’s a company that we are pretty close with. They actually went through [an accelerator] that we were part of [before we did]. [The founder of this company] ended up introducing us to the director of [the accelerator] that’s [based] in [country] for hardware companies.

The co-founder of Firm 15 shared his experience of learning through co-operation from other founders in the incubator:

I’ve gotten feedback from other folks on how they go about setting monthly and quarterly goals using what’s called an OKR format [objectives and key results]. So, setting a goal
for the quarter and then having that quantitative key results of how [we’ll] measure if [we’ve] hit that goal. So that’s something that very specifically came out of a suggestion and a conversation with someone else here that we’ve taken and kind of applied to our own organization.

**Co-ordination and Co-creation.** Co-ordination and co-creation are two stages that have been merged into one. In co-ordination, formalized procedures are required to guide members and the benefit to each contributing members of the relationship is significant. For example, some collaboration involves coordinating with partners that have capacity to validate and test products as shared by the founder of Firm 7:

[We] collaborate with [other organizations] in order to test out [our] products in order to improve on them. [It is also] to get feedback from patients who are using them and from the clinicians who have worked with hundreds of patients over the years to make the best product.

According to the co-founder of Firm 37,

[The hospital network] became an early user, an early adopter of [our] technology and that is absolutely critical for any tech startup. [Startup firms] need early adopters. They help [us to] iterate [our] platform and figure out what works, [and] what doesn’t work.

In co-creation, a step beyond co-ordination, members are now involved in creating together using complementary assets. Co-creation is also referred to in the literature as joint product development or joint service offering. Ten out of the 35 collaborators were engaged in either of co-ordination or co-creation. The co-founder of Firm 39 explains the advantages of co-creation thus:

[You create a] value chain that the end customer realizes the benefit that didn’t exist from the incumbent hardware. So, we add value to them, they enable us, and the end customer can now have the combined intelligence of two organizations. And then you look at each other side by side and say, I can help sell your stuff. You can help sell my stuff. Let’s cut a deal.
4.7 Collaboration types

Collaboration types identify the range of collaborative activities that emerged from the data based on founders’ descriptions of their current collaborative relationship. Nine collaboration types emerged from the data. One startup firm discussed participating in three different collaboration types. Six startup firms described participating in two different collaboration types each. The remaining firms each described participating in only one type of collaboration. Table 25 shows the percentages of firms mentioning participation in each collaboration types. A discussion of these collaboration types followed.

Strategic partnership, mutual telling, and information seeking: Table 25 shows that startup firms reported participating in more strategic partnerships, 51 percent, than any other collaboration typologies. A strategic partnership refers to a relationship between firms that require formalized rules of engagement on resource sharing. Most strategic partnerships or alliances among large commercial organizations take the form of a joint venture. Other forms include equity strategic alliance and non-equity strategic alliance. Equity strategic alliance is a relationship where one firm acquires some equity or a portion of the other for providing financial or other resources. The strategic partnership described by the participants in this study takes some blended form of these three types. For example, in a case, a startup firm was building a tool to be integrated with an existing platform belonging to another organization. Other collaborations take the form of testing, where the relationship involves collaborating with another organization to test the utility of a product.
Table 25: Percent of all firms reporting that they participate in each collaboration types

<table>
<thead>
<tr>
<th>Collaboration types</th>
<th>% of all firms</th>
<th>Example statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic partnership</td>
<td>51</td>
<td>“So, we took our device, brought it to their facility, and then they recruited a bunch of patients and nurses to use our device and then give us feedback on what they liked and didn't like and those kinds of things.”</td>
</tr>
<tr>
<td>Mutual telling</td>
<td>13</td>
<td>“So, it's kind of nice to collaborate with them to figure out sometimes some of the things that they're doing, and they get to figure out some of the things we're doing because it can help us. We could try what they're doing to see if that works for us or vice versa.”</td>
</tr>
<tr>
<td>Information seeking</td>
<td>13</td>
<td>“I was able to ask that company questions [like] why does your product have videos or tutorials embedded? How did you do that?”</td>
</tr>
<tr>
<td>Expanded insights</td>
<td>6.4</td>
<td>“It's really fascinating cause, you'll get these partner companies that will be like, you know, we tried that [it] didn't work, we tried this, have you thought about this one?”</td>
</tr>
<tr>
<td>Actual collaboration</td>
<td>4.3</td>
<td>“So, we put together a collaborative effort with them and responded to an RFP from [a city] telemedicine network looking for a solution to take care of patients from the moment that they register for a surgical procedure all the way through recovery.”</td>
</tr>
<tr>
<td>Division of labor</td>
<td>4.3</td>
<td>“They don't do what I do, so when their customers look for services that I provide, they refer them to me. And for some of the services that I need, I'm going to use their company.”</td>
</tr>
<tr>
<td>Advising</td>
<td>4.3</td>
<td>“The reason why they brought us in [is] to work with them to think about how they create new products and services that are business to consumer versus their traditional business model, which is business to business.”</td>
</tr>
<tr>
<td>Mutual optimism</td>
<td>2.1</td>
<td>“Sometimes, there is no solution. We're just talking. Our relationship [is] conversational. Just kind of like feeling each other's pain and understanding each other's journey.”</td>
</tr>
<tr>
<td>One-way information transfer</td>
<td>2.1</td>
<td>“He's like, well, we could build that technology for you and implement it on your site.”</td>
</tr>
</tbody>
</table>

The prevalence of corporate members in three incubators among the four explains why this type of collaborative relationship is prevalent among 51 percent of the firms. The strategic partnership, more than any other types of collaboration typologies, requires a difference in ability by participating firms. Startup firms often have innovative abilities given their size. Corporate members have resources that include financial and technical. The description of strategic partnership by the founders reflects the influence of incubators’ corporate members. For example, a co-founder of Firm 39, who described participating in a strategic partnership explained: “the value that I’m getting [from the incubator] is from the partners of the incubator more than sitting next to a company that does something completely different.”
The industry focus of a business incubator also plays a part in the type of collaboration typologies formed by the firms. As reported earlier, more startup firms in the business incubator focusing on the healthcare industry (Incubator D) participated in a collaborative relationship. Strategic partnership became prevalent among these firms due to the specialized skills of individual founders or platforms developed by the firms. How these platforms and skills among founders in the industry-focused incubator enhance strategic partnership is reflected in the following response by the founder of Firm 40:

We put together a collaborative effort with [other companies] and responded to an RFP from [a city’s telemedicine network] looking for a solution to take care of patients from the moment that they register for a surgical procedure all the way through recovery. Well, [my startup firm] only did part of that, but if we layered it with [other companies’] product, we could answer those needs.

Following the strategic partnership, startup firms spoke more often about engaging in two other types of collaboration typologies among the nine identified in the Table. These collaboration typologies are; mutual telling and information seeking. There are 13% of the firms participating in each of these collaboration typologies. Mutual telling involves a situation in which founders exchange information. This form of collaboration revolves around the belief that participating members have something unique to exchange with others. In information seeking, a startup firm engages with another firm or multiple startup firms engage with one another to seek out specific information that will be helpful for their organizations.

Open collaborative spaces, informal and formal networking, human and social capital are all characteristics of business incubators contributing to mutual telling and information seeking among firms. Open collaborative spaces allow the founders to cross paths easily, thereby providing an opportunity for serendipitous interactions. Serendipitous interactions that provide insights to problems faced by firms can also result from informal and formal networking events and during formal meetings with mentors. These two collaboration typologies highlight the importance of spaces, networking, and social capital as reported earlier. Business incubators are unique environments compared to other office spaces that could be rented by firms. Their uniqueness is through the provision of opportunities for firms to benefit from the environment. Business incubators can enhance mutual telling and information seeking and sharing among
firms by providing spaces that accommodate such engagements, organizing networking events, and enlisting mentors with the requisite knowledge to help the firms in their area of specializations.

In addition to the three types of collaboration typologies discussed above, the following is the description of the remaining six collaboration typologies observed among the firms.

*Expanded insights:* In cases where collaboration resulted in expanded insights, an organization seeking a solution to a specific problem receives insights from the collaborator that surpasses what is needed to find a solution to the pending problem. The insights shared are useful for problems that might not have been encountered yet. 6.4% of the firms described expanded insights as a collaboration typology.

*Actual collaboration:* A startup firm that falls into this category combines knowledge and skills with another startup firm or an established firm to create a new product for a client that is common to both firms. In actual collaboration, each of the partners brings unique domain expertise to the relationship. The result of the joint effort would not be possible without the combined efforts of the members. As shown in Table 24, 4.3% of the firms described engaging in actual collaboration. In actual collaboration, all participating firms will share the proceeds that come from the final product. The final product is the only reason the collaboration became possible in the first place. The final product is often a product that will serve a third party but bring financial reward to the collaboration members. In a collaboration involving a division of labor, two companies that can meet each other’s needs engage in a reciprocal relationship. Actual collaboration is also different from a strategic partnership in that strategic partnerships involve resource differential among the collaboration partners. Startup firms benefit more from a strategic partnership involving established companies, albeit not all the time.

*Division of labor:* In a relationship involving division of labor, participating firms perform tasks by reciprocity. The collaboration works such that whatever skill or knowledge gap that may exist in one of the participating organizations is supplied by the collaborating organization. As in actual collaboration, 4.3% of the firms described a division of labor as a collaboration typology.

*Advising:* Advising involves a relationship where one partner provides specific knowledge that can be in the form of process knowledge, insights on how to handle regulatory
issues, and ideas on how to attract investments. While incubators provide advising through the assignment of mentors, as reported previously, some startup firms specifically sought collaborative relationships that result in advice-giving or receiving. 4.3% of the firms described advising as a collaboration typology.

**Mutual optimism:** In mutual optimism, the aim is to find a shoulder to rest. It is a relationship that involves sharing concerns, exciting one another on the possibility of success, and just practically becoming one another’s cheerleaders. 2.1% of the firms described mutual optimism as a collaboration typology.

**One-way information transfer:** This involves a situation where information seeking and giving is monotonous. In this kind of relationship, one founder is positioned as an information seeker while the other founder is a provider. Unlike in information seeking, where members in a collaborative relationship act as both seekers and providers of information at some point in the relationship, the seeking and eventual receiving of information in a one-way relationship often proceed in one direction. 2.1% of the firms described one-way information transfer as a collaboration typology among participating startup firms.

Table 26 below shows the distribution of the nine collaboration types across firms in the four business incubators. The Table shows striking patterns. In incubator D, almost every firm discusses participating in strategic partnership. Firms in incubator C are highly collaborative and firms in incubator C are behind others.

The most prevalent collaboration types reported across the four incubators are strategic partnership, mutual telling, and information seeking. From Table 26, 90.9 percent of firms in incubator D, the industry-focused incubator, reported participating in a strategic partnership. This is followed by 53.9 and 20 percent for incubator A and C respectively. Firms in each incubator reported participating in more than one collaboration type. Incubator D is industry-focused and ranked highest in collaboration. A plausible explanation for why strategic partnership is prevalent among firms in incubator D is because the incubator is industry-focused. As discussed earlier, the fact that this incubator is focused on a particular industry allows it to admit firms with complementary rather than competitive products. Complementarity allows firms the opportunity of pursuing relationships with other firms and with external organizations with less fear about intellectual property theft.
Table 26: Distribution of collaboration type cross the four incubators

<table>
<thead>
<tr>
<th>Collaboration type</th>
<th>Incubators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of firms in A</td>
</tr>
<tr>
<td>% of firms in B (n=5)</td>
<td>% of firms in C (n=15)</td>
</tr>
<tr>
<td>Strategic partnership</td>
<td>53.9</td>
</tr>
<tr>
<td>Mutual telling</td>
<td>15.4</td>
</tr>
<tr>
<td>Information seeking</td>
<td>15.4</td>
</tr>
<tr>
<td>Expanded insights</td>
<td>0</td>
</tr>
<tr>
<td>Division of labor</td>
<td>0</td>
</tr>
<tr>
<td>Advising</td>
<td>0</td>
</tr>
<tr>
<td>Actual collaboration</td>
<td>0</td>
</tr>
<tr>
<td>Mutual optimism</td>
<td>0</td>
</tr>
<tr>
<td>One-way information transfer</td>
<td>0</td>
</tr>
</tbody>
</table>

Among the four incubators, firms in C participated more in diverse collaborative typologies. Strategic partnership tops the list of collaboration types among these firms followed by mutual telling. Incubator C is a general-purpose business incubator that admits firms whose products and services are serving clients across several industries. Unlike incubator D, firms in C engages in more collaboration types given the nature of their founders and the firms. While some of the founders in incubator D described themselves as experts in the field of healthcare, founders in incubator C do not consider themselves experts in one industry. The diversity of founders and products explains the diversity of collaboration types among these firms.

Finally, another explanation for firms in incubator D that also applies to firms in incubator A is the nature of the products. Incubator A is a university-owned incubator. Some of the firms in A, while not specifically focusing on one industry, are developing products in the life sciences domain. Some of these products will either integrate with an existing product or will be used in an environment alongside other established products. Therefore, the process of developing these products requires a strategic partnership that may involve such activities as onsite testing with partners just like in the case described by the founder of Firm 7: “[We] collaborate with [other organizations] to test out [our] products to improve on them. [It is also] to get feedback from patients who are using them and from the clinicians who have worked with hundreds of patients over the years to make the best product.”
4.8 Conclusion

The characteristics of business incubators that influence collaboration among startup firms are corporate membership maintained by a business incubator, space configuration, informal and formal networking, incubator’s industry focus (whether single industry or general), information environment, and human and social capital. The expectation of startup firms regarding collaboration falls into three broad categories. The first sees collaboration as an essential process for growth; the second identified that risks are involved, and the third contends that collaboration requires a support structure. Collaboration among firms occurs on a continuum of contact, co-operation, co-ordination, and co-creation.

Information sharing by firms is informed by one of three perspectives: one of trust that places few or no limits on what is shared, one of self-protection that makes use of non-disclosure agreements, for example, and one that emphasized sharing only as necessary. There are nine collaboration types that include actual collaboration, division of labor, expanded insights, advising, information seeking, mutual optimism, mutual telling, one-way information transfer, and strategic partnership. In terms of demographics

In terms of demographics, 68% of founders are in the 20s to 40s age group, 75% are male, 67% identified as White, and 84% have graduate degrees. Education qualification of founders reflects the university affiliation of two of the incubators, with the startup firms located in them having faculty members and graduate students as founders. On average, firms are founded by two people (48%), and more than 50% of the firms employ between one to five people.
CHAPTER 5. DISCUSSION OF FINDINGS

5.1 Introduction

Collaboration creates a competitive advantage (Gloor, 2006). It is a viable way startup firms can acquire complementary resources and skills that reside in other companies (Dyer, Kale, and Singh, 2001). Studies examining the influence of business incubators on startup firms have largely focused on other variables influencing the growth of startup firms within an incubator space. Some have focused on services provided by incubators such as administrative and support services that include, office space, printing, mailing, and recruiting (Mian, 1997; Hansen, Chesbrough, Nohria, and Sull, 2000). In a recent study examining the influence of collaboration on startup firms, Alkalali and Malmqvist (2020) found that collaboration enables startup firms to validate ideas with help of feedback from partners, attain experience and knowledge of any given sector, receive help in defining problems to solve, receive economic funding when co-developing products, scale ideas faster, and gain credibility.

To extend the research in this field, this study examines how business incubators encourage and support collaboration among startup firms located in them. Primarily, the study's focus is on the characteristics of business incubators that promote collaboration among startup firms in the context of 44 firms in four business incubators. The research focus takes into consideration, the social, physical, and informational characteristics of a business incubator that promote collaboration among startup firms. Other focus includes the practice of collaboration, expectation of startup founders in a business incubator regarding collaboration, the continuum of collaboration among startup firms, and information sharing during collaboration. In each of the 44 firms, either of the founder, co-founder or a senior manager of the firm was interviewed. One incubator manager was interviewed per incubator. In addition to interviewing founders and managers, the study combined other qualitative methodologies such as observation and document analysis.

The research findings are divided into five categories. The first category focused on the social, physical, and informational characteristics of business incubators influencing collaboration among startup firms. For this category, the characteristics that emerged include corporate membership, space configuration, informal and formal networking, a single-industry
focus, information environment, and human and social capital. The second category is on the expectation of startup founders regarding collaboration. Three findings emerged from this category. These include collaboration being an essential process for growth, collaboration comes with risks such as competition and partner incompatibility, and collaboration requiring a support structure.

The third category of the research findings is on the continuum of collaboration. Collaboration was observed to occur in the following continuum: contact, co-operation, co-ordination, and co-creation. The fourth category of the findings is on information sharing during collaboration. Three strands of the results described information sharing. These are openness based on trust, protection through a non-disclosure agreement, and shared only as a need-to-know basis. The last category is on the observed collaboration types. Nine collaboration types that include actual collaboration, division of labor, expanded insights, advising, information seeking, mutual optimism, mutual telling, one-way information transfer, and strategic partnership emerged.

5.2 Incubator characteristics influencing collaboration

While a business incubator provides a space to work for a startup firm, this service of space provision is not unique to business incubators. There are organizations whose business model is to provide office space for organizations of all sizes. Therefore, business incubators are by nature expected to provide more than just a space for startup firms. Hence, the main findings from this study are focused on the social and physical characteristics of business incubators influencing collaboration among startup firms. Each of these characteristics as stated in the preceding section are explained subsequently.

Corporate membership. A business incubator’s corporate members are external, and often established organizations or entities that are connected to an incubator. These members have different objectives for joining an incubator. Objectives may include the provision of funding as investors, technology acquisition for corporate organizations looking to acquire certain technology or provision of support services like sponsorship of events organized by an incubator. Corporate membership is important for collaboration among startup firms because
these members are either potential collaborators or have in their networks, other entities through which startup firms can start a collaborative relationship.

A business incubator needs to devise a way to have as many corporate members as possible. More importantly, the selection or acceptance of corporate membership should also coincide with the focus or mission of a given incubator. For example, an incubator whose focus is on helping startup firms that are developing products to solve problems in the financial space will do well to connect with corporate members in this space. Not every corporate member will be appropriate to accept. Given that business incubators are in business primarily because of the startup firms, the acceptance criteria for corporate members should be driven by how such membership will benefit the startup firms.

Space configuration. Space configuration refers to the way the incubator space is organized. For companies or entities whose operating model is only to provide space services for organizations of all types, the way space will be configured can be analyzed from how it maximizes profit. For business incubators, however, space configuration is critical to interaction among firms. The design of incubator spaces should be with the intent of maximizing interactions among firms. Without thinking about space in this manner, an incubator will be nothing more than any other organization renting out office space. In this study, nearness between firms or what the literature referred to as proximity between firms has a positive relationship with collaboration.

An extensive discussion of proximity has been done in the literature (see Knoben & Oerlemans, 2006). Proximity has been discussed in terms of geographical proximity (Bradshaw, 2001), institutional proximity (Kirat and Lung, 1999), organizational proximity (Meisters and Werker, 2004), cultural proximity (Gill and Butler, 2003), social proximity (Bradshaw, 2001) and technological proximity (Greunz, 2003). Given these pluralities of occurrence of proximity, the current discussion more closely aligns with geographical proximity discussed in Bradshaw (2001). Bradshaw’s discussion of proximity relates to how closely located firms are within an incubator space. Geographical proximity was reported as the primary influence on communication among firms in a study conducted by Cooper et al. (2012). They noted that geographical proximity encourages communication because of its potential for allowing firms to cross paths naturally.
While this study identified proximity between firms as beneficial for collaboration and a potential way for business incubators to improve collaboration among resident firms, other studies have reported otherwise. McAdam and Marlow (2007) reported that some of the firms in their study noted proximity as a challenge. The proximity between firms was perceived by some participants in their study as a threat to privacy, intellectual property, and competitive strategies. Their study shows that this behavior towards proximity was prominent among more established startup firms who are at an advanced stage of product development. McAdam and Marlow’s study shows that as firms grew, they become more protective of their intellectual properties. Hence, space configuration that provides proximity between firms may no longer appeal to such firms.

Informal and formal networking. Opportunities for informal and formal networking are created through incubator-organized events and by founders who specifically seek them out. An incubator environment fosters collaboration through networking by providing access to resources (Pangarkar and Wu, 2013) and enabling founders to acquire needed knowledge. Networking events can be in the form of training programs or social events that are organized by an incubator. While founders within an incubator can decide to organize informal or formal networking programs by themselves, the real impact on collaboration among firms will come when such events are intentionally organized by an incubator and continuously.

Previous studies have noted that business incubators may not entirely determine whether new firms will be engaged in a networking relationship (Grilli and Murtinu, 2018). While this study measured informal or formal networking events using an incubator’s events calendar, previous studies considered other incubator attributes. The construction of an incubator space as well as a founder’s willingness to connect with others have been reported as major influences on networking among firms (Bøllingtoft & Ulhøi, 2005). To highlight the importance of networking, Hughes, Ireland, and Morgan (2007) noted that greater involvement in networking activities is related to better performance among firms.

Networking will require the efforts of founders as well as incubator management because firms’ destiny, according to Hughes et al., “lies in the hands of their combinations of strategic networking activities (p. 154).” The current study acknowledges the place of the founders and the incubators in creating and maintaining an incubator environment that supports and
encourages collaboration through networking. A business incubator management will need to take a deliberate approach that should include listening to and identifying the needs of startup firms to be informed about the type of networking events to organize. Founders need to be intentional about making connections that will benefit their firms.

A single-industry focus. A single industry focus means that a business incubator only admits startup firms whose products and services are geared towards a particular industry specified by the incubator. For example, in the case of Incubator D with a focus in the healthcare industry, all startup firms in residence have a product that is solving a health-related problem. It is surprising to observe that startup firms in this incubator are more likely to collaborate compared to startup firms in the three others. It is surprising because it is assumed that competition will be evident among these firms given that their focus is in the same industry.

However, what this study shows is that focusing on the same industry does not necessarily result in a competition. Founders in this incubator have specialized skills that require many years to acquire. Because of the amount of time it would take to build the required knowledge, firms are more open to collaborating with other firms with complementary skills and products compare to learning those skills themselves. Hence more collaboration is observed among firms in this industry-focused incubator.

According to previous research, depending on the industry and types of organization, both complementarity and similarity lead to collaboration (Rothaermel & Boeker, 2008). Prior studies have shown that firms with complementary skills or specialty were more likely to form collaborative relationships (Gulati, 1995). These studies have established that pooling complementary skills and resources together to create added value is a major driver of a collaborative relationship among firms in this category. An incubator focusing on a single industry has several startup firms with complementary assets and skills that provide the opportunity for a collaborative relationship among the firms and with established entities in the focus industry.

Human and social capital through mentorship. Incubators provide an opportunity for startup firms to have access to human and social capital through various mentorship programs. Mentors are accomplished professionals who have themselves built or successfully led other organizations. They may also be individuals who have certain knowledge that is useful to startup
firms by their industry experience. For mentors, it is a way to give back to the community, and for startup firms, it is a way to gain insights for growth.

Given the impact of mentors, business incubators should select and evaluate potential mentors for maximal impact on the startup firms. To do this, an incubator must constantly assess the needs of its startup firms and seek to attract mentors who will be most likely to help meet those needs. Mentorship is important for collaboration because by being connected to a mentor, a startup firm is indirectly connected to the network of such mentors. Firm 6 acknowledged this by stating that “there were one or two key interactions that helped the trajectory of the company. One of them was meeting one of our first advisors.”

**Information environment.** Startup firms, at any stage, have information needs. Examples of information needs can be how to apply for a grant, what grants are available, how to get the contact of the CEO of company X who can help test a product, and how to get the best deal on a proposed equipment purchase. For the purpose of this study, a major information need can be with whom to collaborate on a project and how to know if the collaboration is worth a try. Information science scholars have discussed the information behaviors of individual information users. Some of the principles have application for organizations. This study appraises Wilson’s (1999) information behavior to highlight theoretical perspectives on information sharing to enable a better understanding of the information practices observed among the firms and in the business incubators.

According to Wilson (1999), and as shown in Figure 6, information-seeking behavior arises from a need perceived by an information user. The seeking behavior cannot be explained in isolation. A need triggers the behavior. To satisfy the need, an information user makes a demand on formal and informal information sources or systems. This demand on formal or informal information sources or systems could be successful or could fail. In the context of business incubators and this research, the most important concepts from Wilson’s model are information systems or information sources. These two are central and determines business incubators’ information environment. Founders’ description of the incubators’ information environment shows that there are information systems that business incubators established for interactions among the firms. Through platforms like websites, founders could search and
contact other founders in the incubator. A communication platform like Slack also enables easy interactions among incubator members.

![Figure 6: Wilson’s model of information behavior](image)


However, a major part of Wilson’s model that needed to be examined critically in the context of this research is the user information-seeking behavior. As discussed previously, a co-founder of Firm 27 mentioned: “[With] Slack, I can reach out to any member.” This statement implies that when an incubator makes an information system such as Slack or a database of firms available, the individual founders, who are information seekers, in this case, must develop appropriate information-seeking behavior to be successful. In addition to having information systems in place, satisfying the information need of startup firms requires curating other information sources. Beyond business incubators, startup firms can also take a deliberate effort to achieve this. An example of a way founders used other information sources is what the founder of Firm 29 shared:
I read an article [about the company] and I looked up the name of the person at [the company] who was in that article and I just did a LinkedIn connect with him. And the gentleman was nice enough to say, I’m not the right person but you should talk to this person.

Business incubators’ other information sources include workshops, mentoring, and other programs that provide opportunities for the firms to gain information. While business incubators have structures in place to support both information systems and other information sources, founders cannot solely rely only on either of these. Either of them may not yield the kind of information sought per time. Wilson’s theory also suggests that users may not have an appropriate information behavior that would allow them to be successful at a search task.

Given what is known about collaboration among startup firms and with external entities, it is important to state that information underpins intentional sociality, discussed below. Also, business incubators and firms have different roles to play in shaping information seeking and sharing. Many types of information sharing appear in the library and information science literature. Li, Sikora, Shaw, and Woo Tan (2006) identified transactional, operational, and strategic levels of information sharing. The operational level of information sharing addresses the day-to-day performance of transactions. For business incubators and startup firms, the operational level includes daily routine activities and how information sharing features in those activities.

Talja (2002) describes strategic information sharing as a conscious strategy of maximizing efficiency in a group. Talja (2002) further shared three additional levels of information sharing that include paradigmatic sharing, directive sharing, and social sharing. Many aspects of information sharing among the firms, such as with mentors and other founders, are either directive or social sharing. Talja describes social information sharing as a relationship- and community-building activity. While some of the social sharing of information involves learning, some are also just a way of sharing about the journey with founders who themselves understand the process, including the highs and the lows.

Incubators share information to inform and to promote. Promotional information, as the name implies, shares the activities of the firms with an outside audience. For promotional information, the recipients include corporate members because they have an interest in the firms.
Other targeted recipients of promotional information are the funding entities or agencies providing financial support for the firms. Promotional information is also shared with incubators’ institutional funders to show them that the incubator is executing the tasks it was funded to execute. The primary recipient of information with the intent to inform are the incubators’ community members. These members include the startup firms and other registered users of the incubator.

Information sharing improves collaboration (Cricelli & Grimaldi, 2010). In a collaborative relationship, greater self-interest will reduce support for sharing and hence affect collaborative effectiveness (Constant et al., 1994). Understanding how incubators and firms can support information sharing is necessary. Past studies on knowledge-sharing relationships among startup firms found that the amount of information sharing between firms is affected by location (Allen, Gloor, Colladon, Werner, & Raz, 2016).

The closer firms are, the higher the possibility that they would share information. However, while physical proximity is necessary for information sharing, it is not enough to indicate high-frequency interactions and information sharing among startup firms (Allen et al., 2016). On the effect of information sharing on innovation among the firms, Allen et al. (2016) concluded that the intensity of interactions is a better prediction of information sharing. Information sharing is multifaceted, impacted by communication style and the social ties in context. A more dynamic communication style, and more diverse social ties impact information sharing and hence are beneficial to innovation.

Three core themes emerged in this study regarding information sharing among firms. These themes are founders are open to sharing based on their trust for members of a collaboration, founders will protect critical information through a non-disclosure agreement, and founders will share not more than is required to move a collaborative relationship forward. Founders agreed that the startup community, to a large extent, can be trusted. Their core ideology of information sharing during collaboration is built on this notion of trust.

An incubator environment with new firms trying to break into a specific market segment would be assumed as a place with little or no trust. This was not the case. It was surprising that many founders stated that they freely share information. There is a belief among research participants that not many startup founders are out looking to steal other founders’ ideas. Also,
some of the founders specifically noted that it would take many years of learning and effort for other founders to acquire the kind of knowledge needed to produce their types of innovation.

Mutual trust, as espoused by the participants in this study, has been reported in other research as an important requirement for a collaborative relationship among firms (Kale, Singh, & Perlmutter, 2000). Given that trust emerged as the anchor on which founders hinge their information-sharing efforts, it becomes evident that a business incubator must nurture a culture of trust. Trust must start with the business incubator before extending it to the resident firms as a form of fundamental principles of the incubator. In an inter-organizational relationship, trust is defined as the intentions of a partner towards a relationship, particularly in refraining from opportunism (Woolthuis, Hillebrand, & Nooteboom, 2005).

The framing of trust as a pre-condition for information sharing among founders fits into the categories identified by Woolthuis et al. (2005). These categories are competence trust and intentional trust. Some founders in this study believe that it would take other founders many years to learn the skills they currently have. Founders who have this kind of belief engage in trust-based information sharing because they have technical advantages that cannot be matched by others. These founders fall into the competence trust category. Founders who believe that others will not steal their ideas based on assumed pervasive integrity among other founders fall into the intentional trust category.

A business incubator should develop strategies to nurture both competence trust and intentional trust since they affect information sharing. However, the factors affecting intentional trust are better amenable to control as against competence trust. Hence, business incubators can institute specific ideas that will encourage intentional trust among startup firms since not all founders would have domain-specific knowledge that generally underlies competence trust.

Part of the strategic information-sharing decision that firms make in a collaborative relationship is to have a non-disclosure agreement in place. While the norm for information sharing seems to be dictated by trust, founders noted that some level of collaboration that involves detailed sharing of technology and inventions requires an introduction of a non-disclosure agreement. A non-disclosure agreement is a legal document signed by members of collaboration that prohibit sharing of any detail of a collaborative relationship beyond the members of such a relationship.
Protection through a non-disclosure agreement eliminates some of the concerns about trust. Trust as an impediment to information sharing was reported in the study by Cooper et al. (2012) where they noted that firms declared a lack of trust as an obstacle to networking among resident firms. While a non-disclosure agreement is a mechanism that is often devised by potential collaborating firms, business incubators can also find alternative ways of instituting structural changes and procedures that will lead to trusting relationships among resident firms.

Strategic decisions about information involve sharing information based on priority and also with those that only need to use such information to move a collaboration forward. This approach helps reduce oversharing and reduces the risk associated with unintended disclosures. For collaborative relationships where members do not sign a non-disclosure agreement, this form of information sharing can be adopted to help protect critical details from being mistakenly shared.

Finally, the discussion in this section highlights that business incubators can enhance collaboration among startup firms by making both information systems and other information sources available. Beyond this, however, other factors as to how these systems and sources are used will depend on the startup firms themselves.

5.3 Founders’ expectation of collaboration

Although previous literature had emphasized the value of collaboration, this study examines how founders perceive it and highlight their expectation for a collaborative relationship. Understanding the founders and the way they think about collaboration is essential for business incubators to implement required supporting structures.

*Collaboration is an essential process for growth.* Founders considered collaboration as an essential process for growth. This belief is on the premise that a startup firm can have access to resources and connections that can lead to growth through collaboration (Alkalali & Malmqvist, 2020). This is reflected in the response of the founder of Firm 29 who noted, “so, we don’t have any intellectual property [right now]. But to get started, [it] is faster to do it this way while we develop our platform in-house.” Collaboration can help startup firms take advantage of technologies or resources that would ordinarily take them several years to build or acquire.
This is particularly true because startup firms are resource-constraint in comparison to established firms. The majority of tools, technologies, and resources needed by startup firms are not affordable at the beginning of their startup journey. While some of these can be paid for, startup firms do not always have the financial resources needed to acquire these resources as well. Collaboration is a vital approach for startup firms to take advantage of these resources that are often available in other established or startup firms.

*Collaboration comes with risks.* Founders, although considered collaboration as an opportunity for growth, noted that collaborating with other entities comes with risks. Risks associated with collaboration include intellectual property theft and competition arising from collaborating with entities in the same line of business. Startup firms will have to assess all collaborative opportunities to identify potential threats that may come as a result of collaborating.

While founders noted the various risks connected with collaboration, it is surprising to see that regardless of the risks, some of the founders are willing to engage in a collaborative relationship because of its perceived benefit to the growth of their companies. The implication of this is that, rather than avoiding collaboration altogether, founders will need to find a way to mitigate any form of risks or threats to their firms that may arise as a result of collaborating. This is not only true for startup firms but many other forms of collaboration involving different entities. Working with other organizations will always present some form of risk. Therefore, it is important to have a structure in place to mitigate such risks.

*Collaboration requires a support structure.* Within the scope of a business incubator, a support structure for collaboration will capture specific guidance, rules of engagement, and program of action that are intentionally developed by the incubator to maximize the opportunity for collaboration. Given that founders recognize the need for collaboration, business incubators need to constantly engage the founders and the incubator community to identify any impediment to collaborative relationships and create action plans to overcome these impediments.

The concerns shared by the founders in this study about the need for business incubators to put structures in place to enhance collaboration have been shared by other entrepreneurs. In a similar study by Cooper et al. (2012), participants mentioned lacking information about other residents. This impedes collaboration as firms lack information about contacts of other residents,
knowledge of what they do, or the opportunity to seek out other organizations within the incubator. A participant in Cooper et al.’s study described this situation as being isolated within an incubator saying: “Part of it is, right now, we know generally what most of the companies are about, but we don’t necessarily know what they’re doing (Cooper et al., 2012, p. 447).” This sentiment is similarly shared by the participants in this current study. For example, the founder of Firm 23, referring to the management of the incubator noted: “You have the roster, you have the list of all the companies that work here, and you have the list of all the things they do. It should be very easy for you to point out, okay, these two can definitely benefit from meeting.”

5.4 The continuum of collaboration

The form of collaborative relationship described by founders fall under four continuum that includes contact, co-operation, co-ordination, and co-creation. This continuum taking together provides a holistic view of collaborative relationships among startup firms.

Contact. While contact forms the minimum or the least end of the continuum, its impact in a community of startup firms cannot be ignored. Those random discussions at a lunch table, group discussion during educational events, and occasionally scheduled meetings between founders will often help one or more of the founders involved to find solutions to certain problems. The design of the incubator space and the overall atmosphere will either encourage or discourage these forms of interaction between founders.

Some collaborations may start at this first stage and never extend beyond it, others may extend and lead to a deeper level on the continuum. Expectedly, a relationship that terminates at the point of contact will not produce as much impact on the members as those that extend beyond this first stage. Noting how the environment of an incubator supports this early form of collaboration, Pettersen, Aarstad, Høvig, and Tobiassen (2016) reported that firms in their study exchanged knowledge and experiences connected to the different stages of developing their firms. Founders in their study stated that sharing those experiences is valuable to their firms as it allows them to learn from other founders and provide moral support in the process.

Co-operation. This stage of collaboration includes an informal agreement between two or more entities that will produce small but tangible benefits. A business incubator environment with startup firms focusing on diverse areas provides an important setting for this form of
collaboration. For example, two firms can co-operate on sharing the cost for a tool that is needed by both or decide to share the cost of educational content. The benefit of this type of collaborative relationship is cost saving for the entities involved. Depending on the benefit sought, a co-operative relationship among firms can be diverse.

**Co-ordination and co-creation.** In both co-ordination and co-creation, formalized procedures are required to guide members. Unlike the earlier stages, collaboration members at the stage of co-ordination and co-creation expect tangible benefits from such relationships. In co-ordination, only one entity may be receiving the benefit. For example, a formalized relationship between a startup firm and an established company may involve the startup firm utilizing certain technology that belongs to the established firm. That the relationship is formalized does not imply all members are receiving equal benefits.

Firms with complementary assets get involved in co-creating. Complementarity of assets reduces the fear of intellectual property theft as each of the collaborating members have distinct skills and resources. In cases of co-creation, founders are observed to be highly skilled in a particular domain. It may take several years of education and practice combined to acquire the skills and knowledge of a collaborator in a co-creation relationship. This knowledge acquisition barrier introduces some level of safety and trust in a collaborative relationship resulting in co-creation.

5.5 Collaboration types and coopetition

1. Collaboration types. As presented in the findings section, nine different types of collaboration emerged from this study. These nine collaboration types are actual collaboration, division of labor, expanded insights, advising, information seeking, mutual optimism, mutual telling, one-way information transfer, and strategic partnership. The researcher began the study with an intrinsic expectation of widespread actual collaboration among the firms. Actual collaboration depicts a relationship in which two or more firms combine their knowledge and skills, based on a signed agreement, to create a new product or service. It was fascinating and somehow surprising to see that collaborations among firms took these nine shapes, with strategic partnership and mutual telling being the two most popular forms of collaborations. In this study,
a strategic partnership refers to a relationship between firms that require formalized rules of engagement on resource sharing or product integration.

It would be better to understand the resource requirement, limitations, and constraints faced by startup firms to explain why strategic partnerships emerged as the top collaboration type. For many of the firms, resource constraints meant that firms would engage in certain activities such as product testing and validation through collaboration with either established companies or other startup firms with a specialty in the area. The majority of the strategic partnerships fall into this category of either product testing or product integration. Product integration is a situation where a startup firm is developing a product that will only work in conjunction with another product or on another platform. This type of collaborative relationship helps startup firms to save on costs while providing access to opportunities for growth. Second to strategic partnership is mutual telling. The dominance of mutual telling also fits within the context of startup firms. Startup firms are at a stage where they are busy testing their product and unique selling proposition. The incubator environment provides an opportunity for interaction where founders share certain information. The need for continuous flow of ideas and information sharing among founders can explain the prevalence of mutual telling over one-way information transfer. Mutual sharing will often encourage more sharing compared to one-way information transfer.

2. Coopetition. The term coopetition is a portmanteau of the two terms cooperation and competition. Coopetition is a term used by scholars to describe the cooperation between competing companies through the formation of a strategic alliance that is designed to help both companies (Walley, 2007). While coopetition may be a conscious strategic move by two competing organizations, it is also a necessity for others as part of their business model.

Raza-Ullah, Bengtsson, and Kock (2014) discussed the paradoxical nature of coopetition. According to their study, it is a paradox for two companies who consider themselves competitors to consider cooperating at any point. However, for some companies, there could be a business need for a one-time or even an ongoing collaboration with competitors.

In the information technology domain, for example, large companies like Facebook and Google are both competing for advertising money from millions of online advertisers. However, to download the Facebook app, one would need to go to either Google Play Store or Apple Store.
While these three companies are competing for advertising money, coopetition occurs among them in this way – Google and Apple housing Facebook Apps for user downloads.

The Google, Apple, and Facebook examples may not represent a pure example of coopetition. The reason is that the focus of their products is relatively distinct. Google focuses on search, Facebook on social networking, and Apple on digital devices. However, their monetization strategy pitches them against each other as competitors. Luo (2007) presented a more accurate example of coopetition between Philips and Sony, two electronics corporations. According to Luo, these companies collaborate to develop and manufacture new DVD players while also competing arduously in other product groups.

An example of coopetition happened recently in the development of the COVID-19 vaccines. Johnson & Johnson (J&J) is collaborating with competitor Merck to mass-produce the vaccines. While some of the studies on coopetition centered on the need for product innovation (Estrada, Faems, & de Faria, 2016; Ritala & Hurmelinna-Laukkanen, 2009), the current relationship between J&J and Merck is centered on production capacity and reducing the time to get the vaccine to the people.

The decision, according to a press statement, is not just based on what is best for each of the companies but also on what is best for the country. The CEO of J&J wrote about this relationship thus: “our industry realized in the early days of the pandemic that vaccine development wasn’t a race against each other as competitors—it was a race against time to defeat a common enemy (Johnson & Johnson, 2021).”

While the J&J example described coopetition as a strategy to reduce time to market of the COVID-19 vaccines, coopetition has also been described as a natural route taking by firms desirous of product innovation (Bouncken, Clauß, & Fredrich, 2016). Zhang, Shu, Jiang, and Malter (2010) noted in their study that coopetition enhances knowledge acquisition and internal knowledge creation. Some of the sentiments shared by the founders in this study about the need for collaboration reflect the position of Zhang et al. (2010). For example, the founder of Firm 29 said about the current collaboration: “we don’t have any intellectual property [right now]. To get started, [it] is faster to [collaborate] while we develop our platform in-house.”

The founder of Firm 29 quoted above continued: “In a year or two, whenever we’re ready, we can roll it out and tell [our collaborators] we enjoyed working with you, but now we
have our intellectual property.” In the case of this founder and the startup firm, the need for collaboration results from the need for product innovation. For context, the startup firm was developing innovative technology to speed up the process of international and local shipping of perishable goods. The collaborator was a large shipping company, a potential competitor with more financial base and capacity to compete with the product the small startup firm is developing.

Given that the startup firms in this study have diverse product focus, coopetition does not firmly apply to most of the collaborative relationships observed. For startup firms in the three general-purpose incubators for example, there is a glaring difference in the focus of their products and their target consumers. In the cases where a startup firm is collaborating with a large company in the same industry, the relationship is such that the startup firm is either building something that could be integrated into the existing product of the large company (for example in the case of Firm 39) or acquire directly. The latter reflects the case of Firm 41, where a large insurance company was looking to acquire their product.

The only segment of the findings close to coopetition is the collaborative relationships between startup firms at the industry-focused incubator. Since this incubator admits startup firms developing products and services to solve problems in the healthcare domain, it is safe to assume that by the virtue of focusing on the same industry, coopetition could be observed. However, none of the discussions of collaboration among the founders reflect coopetition.

In an example shared by the founder of Firm 40 describing a collaboration involving seven companies, each of the seven companies brought unique skills and resources to the relationship. The founder of Firm 40 did not consider the six other companies as competitors but rather as collaborators without whom the project may not have been successful. Referring to a project executed together with collaborators, the founder of Firm 40 shared, “well, [my startup firm] only did part of that, but if we layered it with [other companies’] product, we could answer those needs.” This statement implies that without the collaborators, those needs could not have been answered.

Considering the findings from the study and the researcher’s understanding of the resource constraints of startup firms, it is in the researcher’s opinion that it would be unproductive and also unsustainable for startup firms to willingly engage in coopetition with
other startup firms. A coopetitive relationship with a large company, on the other hand, may offer advantages such as growth, access, and reputation for a startup firm (Hora, Gast, Kailer, Rey-Marti, & Mas-Tur, 2018). However, a start-up-to-start-up coopetitive relationship may harm one or both regarding intellectual property rights. It is assumed that in a startup-to-startup collaboration, especially for competitors, both will be running against time, and the first firm to obtain a significant advantage from such a relationship may become the winner in the product category. A coopetitive relationship with large companies will differ because these companies will be mindful of lawsuits and their reputation compare to most startup firms.

The conclusion is that a coopetitive strategy is more likely to benefit startup firms in a relationship that involves startup firms and large established organizations than in a relationship between startup-to-startup.

5.6 Research connection to previous studies

1. Affirming past research. The outcome of this study affirms the findings of previous research on factors that foster collaboration. Cook and Morgan (1998) reported that successful innovation in a firm is built on social interactions and associational capacity. Similarly, the current study established that proximity between startup firms and the membership maintained by incubators are essential to successful collaborative relationships. This study affirms Cook and Morgan (1998) by establishing a relationship between variables like corporate membership, informal and formal networking, and collaboration among firms. The connection between collaboration and innovation has been discussed earlier in this study using Rogers (2003). Therefore, given the connection between collaboration and innovation, the current study and Cook and Morgan (1998) agreed that the social environment of a business incubator is important for innovation among startup firms.

Another previous research, Mattessich, Murray-Close, and Monsey (2001), identified six categories of factors necessary for successful collaboration to happen. These include the environment, membership characteristics, process and structure, communication, purpose, and resources. Both the environment and membership characteristics aligned with this study’s findings on space configuration and incubators’ corporate membership respectively. This study has established that incubator characteristics such as corporate membership, space configuration,
informal and formal networking, industry focus, and human and social capitals influence collaboration among startup firms.

This study also affirmed some previous research on proximity. Scholars have studied proximity using different approaches. Bradshaw (2001) reported on the impact of geographical proximity, Kirat and Lung (1999) on institutional proximity, Meisters and Werker (2004) conducted their study on organizational proximity. Other research on proximity includes cultural proximity (Gill and Butler, 2003) and technological proximity (Greunz, 2003). The current study affirms previous research given that it examines proximity between firms. However, it differs in its examination of proximity. The current study examined proximity in the context of the design of the incubator space. While all the above studies on proximity, including the current study, reported a positive impact of proximity on firms, McAdam and Marlow (2007) reported that as startup firms begin to grow and acquire intellectual properties, open collaborative spaces begin to have lesser appeal to them.

Finally, regarding the link between this study and previous research, this study aligns with Sherman (1999) by showing that startup firms are receiving tangible benefits from the incubators as indicated by the number of them who still maintain membership with the incubators after renting office spaces elsewhere.

2. Contradicting past research. Schwartz (2013) reported that business incubators have no real impact on the long-term survival of new firms. This study suggests otherwise. The stories shared by founders point to the influence of incubators and their structures in the progress of the startup firms. For example, startup firms that have graduated from some of the business incubators still maintain membership. If a business incubator has no real impact, it will not be appealing for founders who now have office spaces outside the incubator to continue paying membership fees.

Another example of a contradiction observed is on homophily as used by scholars of network research. Homophily (McPherson et al., 2001), the idea that “birds of a feather flock together,” or in this context, startup firms with similar characteristics tend to form connections, is seen throughout the findings. Given the context of this study, we can explain homophily in multiple ways. We can explain it using space – firms sharing the same incubator space will develop an affinity for collaborations. We can explain it in the context of industry focus, where
firms in the study, located in an incubator with a single industry focus, tend to collaborate more than firms in other incubators.

However, this study contradicts the discussion of homophily by scholars because in the incubator with a single industry focus, firms are drawn toward other firms for collaboration, not because of similarities (homophily) between the firms, but because they have complementary ideas or products. For these firms, the complementary nature of their product is a stronger determinant of collaboration than being in an incubator with a focus on a single industry. The industry focus – similarity or homophily – only allows firms with complementary ideas or products to co-locate.

3. New findings. The really new finding here is that incubator membership has to include both the startup firms and the established corporations. Each type of member has to be selected, recruited, and attended to. Business incubators need to place equal emphasis on the selection process for firms and corporate members. Specifically, this study identified the importance of strategic corporate partners, and the maintenance of human and social capital through the selection of appropriate mentors for startup firms. Corporate partners and mentors stood out as sources of collaboration for startup firms. Mentors have resources in their networks that could be beneficial for the firms given their own entrepreneurial or professional experiences. Corporate members have financial and technical resources that could be leveraged by startup firms to overcome the inertia that comes with starting a new firm. No other study has examined the crucial role of corporations in incubators as in this study.

5.7 Implications for theory

1. Business incubator as a social system. The focus of the current research is on the enablers of collaboration among startup firms in a business incubator environment. The findings have shown that collaboration among startup firms is not only beneficial but also take many shapes. The study adapts theoretical perspectives from Rogers (2003) to understand the structure of the entities and relationships that encourage collaboration within business incubators. While Roger’s focus is on the diffusion of innovation, his perspectives are adaptable in understanding how collaboration can be initiated and sustained. This assumption is on the premise that collaboration among firms can potentially lead to innovation, what Rogers referred to as “an
idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p. 12).

But then, what part of Roger’s theoretical perspective is useful for theorizing about collaboration within a business incubator? Rogers (2003) itemized four elements that are responsible for the diffusion of innovation. These elements include the innovation itself, communication channels, time, and a social system. The crux of the findings from the current study points to the social aspect of an incubator as important attributes influencing collaboration among firms. This is because the characteristics of business incubators that impact collaboration among firms are, corporate membership, space configuration, informal and formal networking, industry focus, human and social capital, and trust. Many of these characteristics are social.

An incubator as a social system is therefore expected to connect all interrelated entities and structures that should enhance collaboration. The interrelated units of a business incubator work together to ensure that startup firms develop and advance their ideas. Rogers (2003) defined a social system as “a set of interrelated units engaged in joint problem solving to accomplish a common goal” (p. 23). An incubator is expected to have within it, structures that should enable its function. Rogers (2003) defined structures as “the patterned arrangements of the units in a system” (p. 24). Rogers (2003) indeed claimed that the nature of the social system affects individuals’ innovativeness (Sahin, 2006). For this study, the nature of a business incubator affects startup firms’ propensity to collaborate.

This study extended the contention of Rogers (2003) that a social system enables the diffusion of innovation. The study posits that a business incubator is a social system that enables collaboration among startup firms. A business incubator is a social system because, as per Rogers, it is a set of interrelated units engaged in joint problem solving to accomplish a common goal. This perspective equates a social system that enables the diffusion of innovation as the same that allows for collaboration to take place and extends that collaboration can enable innovation to happen. This conclusion is represented contextually in Figure 7 below.
A business incubator as an enabler of collaboration provides the opportunity for collaboration among startup firms, as well as with entities beyond the incubator. For a business incubator to enhance collaboration among its startup firms, it must devote resources to addressing its social structure.

2. Intentional sociality as a paradigm for promoting collaboration. This study introduces “intentional sociality” as an explanatory model for understanding how to promote collaboration among startup firms in business incubators. This model is based on the idea that the structures and attributes that support collaboration among startup firms, as evidenced in the findings, are largely social. Hence, to improve collaboration among firms, these structures and attributes must be intentionally managed. The theoretical clue for this explanatory model is from ‘network sociality’ as proposed by Wittel (2001). Per Wittel, network sociality is understood in contrast to community. This is because “community entails stability, coherence, embeddedness, and belonging. It involves strong and long-lasting ties, proximity, and a common history or narrative of the collective” (Wittel, 2001, p. 51). Building on Castells (1996) notion of “network society”, Wittel (2001) explains that in network sociality,

Social relations are not “narrational” but informational; they are not based on mutual experience or common history, but primarily on an exchange of data and on “catching up”. Narratives are characterized by duration, whereas information is defined by ephemerality. Network sociality consists of fleeting and transient, yet iterative social relations; of ephemeral but intense encounters (p. 51)
While Wittel's (2001) theoretical perspective provides the basis for understanding social interactions that have the potential for improving collaboration among firms, the nature of network sociality does not particularly encourage the type of sociality that should be nurtured among firms in business incubators. In network sociality, Wittel affirmed that interactions are fleeting, often having breadth but no depth. By inference, participants in network sociality are after the number of relationships formed rather than quality. However, intentional sociality will benefit from network sociality’s “intentional” process of organizing events resulting in these social interactions (Wittel, 2001). This art of organizing and curating these different events that result in the social interactions among members in a network sociality can be adapted in intentional sociality.

Intentionality as a concept represents the quality of a human’s mental state that is being directed towards some goal or thing (Jacob, 2003). To be intentional is, therefore, to be purposeful or mentally aware or to be deliberate about certain tasks, goals, or activity (Jacob, 2003). Intentionality demands due diligence and a presence of mind. Sociality represents the tendency to associate in or form social groups. While network sociality seeks fleeting but iterative social relations (Wittel, 2001), intentional sociality seeks purposeful or deliberate social relations that emphasize both breadth and depth but with more emphasis on depth.

This study identified three areas that business incubators could focus their attention to create intentional sociality that can enhance collaboration among resident firms. These areas are shown in Figure 8. Intentional sociality within the context of business incubators implies addressing each of these three areas not as a once and never-to-be-repeated thing but continuously.

1. Space. Intentional sociality takes into consideration the physical location of an incubator. The premise for this is that an incubator’s location will determine its access to human and material resources. Studies on economic geography where organizations are located near other organizations to take advantage of shared resources such as talents, distribution networks, suppliers, and market support this position (Bathelt & Glückler, 2003; Krugman, 1991). Intentional sociality also considers the design of the incubator space. The findings from this study show that the design of an incubator’s space affects interaction among firms. Space design will take into consideration the proximity between firms. The knowledge that all firms will differ
in their willingness to co-exist with others in the same open space should guide proximity decisions. McAdam and Marlow (2007) reported such a case where firms that were far along in their innovation journey prefer some level of privacy to protect their intellectual properties. Design an incubator’s physical space to accommodate firms in this category while still providing opportunities for firms that will cherish being near other firms.

**Space**
- Locate incubator to maximize firms’ visibility
- Arrange early-stage firms in immediate proximity
- Allow more privacy for growth stage firms

**Information environment**
- Publish updated lists of firms’ achievements
- Curate events to enhance networking and exposure
- Maintain multiple channels for firm interactions

**Focus**
- Hire staff with industry knowledge
- Host firms working across a single industry
- Recruit corporate members with strategic advantages

Figure 8. Three levels of attaining intentional sociality in a business incubator

2. **Information environment.** A business incubator assumes a social system given the definition of a social system by Rogers (2003). Intentional sociality involves a deliberate act of curating and implementing social events and structures that will maximize the opportunity for collaboration among firms. Intentional sociality includes deciding whom to accept as members
of the incubator community and understanding the reason for that choice. Other registered or miscellaneous members of an incubator’s community influence the social structure of the communities. When a business incubator is starting, it will most likely be guided by its vision and mission. This vision and mission will dictate what type of entrepreneurs or startup firms to admit. Hence, the decision for what type of startup firms to admit is made very early in the process.

Besides membership, business incubators must perform due diligence in deciding on the specific programs and events that have the potential for immediate and long-term impact on the firms. The immediate impact to founders may come in the form of knowledge gained that can be applied to building their growing firms. The long-term impact may come in the form of a collaborative relationship. By this reasoning, a business incubator’s social structure must address the necessity for both formal and informal networking events among the resident firms. An incubator’s administration should also focus on systems and structures that allow for seamless interaction between firms. Attention should be paid to various tools, media, and platforms that allow startup firms to not just connect with other firms in the incubator but with other entities outside of the incubator. The tools for interactions may include emailing, technologies for virtual meetings, messaging, and newsletter distribution. A business incubator’s administration may also conduct regular check-in with the founders and organizing mentoring relationships that can help propel firms in the right direction.

3. Focus. This study identified two types of business incubators based on the focus of the firms admitted. The first is a general-purpose or a generic incubator where firms can be developing products and services that will serve customers across different industries. The second is an industry-focused incubator that only admits firms developing products or services for a single industry. This study shows that recruiting firms working across a single industry increases the chances of synergies. Therefore, focusing on recruiting firms that are developing products or services for a single industry is an intentional act of maximizing specialized skills among the firms. The rigor that goes into vetting potential startup firms should also be applied to selecting miscellaneous members like corporate and individual members. This decision will be guided by the knowledge that any other incubator membership should be adding value to the incubator’s primary customers, the startup firms.
Furthermore, an effective incubator structure that will support intentional sociality must ensure adequate staffing. Other than adequate staffing, conscientious effort must be put in place to support startup firms’ desire to take advantage of opportunities within and outside the incubator. For example, having a curated list of firms and what each firm does will help guide firms in identifying potential collaborators. Past research associated an incubator’s administrative structure with providing basic support services for firms in the incubator (Mian, 1997). Incubators with support for intentional sociality must go beyond providing basic support services to identifying impediments to interactions among firms and finding lasting solutions to them. To better implement intentional sociality, a business incubator, while starting, should devise a means of putting resources in place to address these three areas.

5.8 Conclusion

This chapter provided some context and explanation that helps guide the reader through the research findings. The research findings discussed under four subsections addressed, first, the social and physical structures of business incubators influencing collaboration among resident firms. Some of these social characteristics include corporate membership, space configuration, and informal and formal networking. The second aspect of the findings identified what founders expect of a collaborative relationship while the third discussion placed collaboration observed among startup firms into a continuum.

The fourth piece of the research findings discussed in this chapter identified issues relating to information sharing when collaborating. Firms discussed sharing information based on trust, and in cases where trusting is not enough, a legal document is required, to ensure a non-disclosure among participating parties. Strategic partnership and mutual telling are two dominant collaboration types among the startup firms. Theoretical guidance for the study comes from Rogers (2003) and Wittel (2001). The study extends these theoretical perspectives by introducing “intentional sociality,” a conceptual model to explain how business incubators can better support collaboration among startup firms.
CHAPTER 6. CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

6.1 Introduction

This dissertation has identified the characteristics of business incubators that enable collaboration among the startup firms located in them. The study adapted Rogers (2003) to provide a theoretical explanation for why a business incubator doubles as a social system with the capability for promoting collaboration among firms. The study introduces “intentional sociality,” an explanatory model showing three key areas a business incubator can strategically focus its efforts on improving collaboration among resident firms. The remainder of this chapter takes up the following topics:

1. Implications for policy and practice: what does the research say to policy/practice?
2. Implications for method: how does the method used compare to the studies cited in chapter 2?
3. Further directions in research: what next research does this study suggest is needed?
4. Limitations of the study: what limitations were encountered and how can future research overcome them?

6.2 Implications for policy and practice

The following are twelve recommendations for business incubators that intend to create intentional sociality and thus collaboration among startup firms. These recommendations presented item by item descriptions of the three levels of intentional sociality represented in Figure 8.

1. The location of a business incubator should allow startup firms access to talents, markets, and other resources like venture capital funding.
2. Configure business incubator spaces to allow physical interactions among firms, especially for firms in their early stage. Collaborative workspaces serve this purpose best.
3. Space design should also accommodate firms that are more advanced in their journey. Some of them may prefer a private office within the incubator.
4. Incubators should make membership available to corporate organizations. Their presence gives legitimacy to the startup firms and leads to the formation of strategic relationships.
5. Programs and events are a potential conduit for collaboration. Business incubators should curate them with specific attention on the ones with the most impact on most firms.
6. An industry-focused incubator can better provide guidance and support for startup firms.
7. Industry-focused incubators can hire domain experts as staff members. These experts can provide tailored support to firms, unlike in generalist incubators.
8. Business incubators should provide mentoring relationships. Mentors help startup firms navigate complex issues on their journey.
9. Pair startup firms with mentors that have expertise in their area of business.
10. Incubators should build a culture of trust among startup firms by listening and acting on suggestions.
11. Business incubators should employ two approaches to information sharing. The first approach should be to inform, and the second approach is to promote.
12. Promotional information is information about the firms shared with external entities. Promotional information helps build external interest in the firms.

6.3 Implications for method

The methodological approach used in this research is reflective of previous studies. The number of incubators included in this study, four, is comparable to the number (five) investigated in Schwartz (2013). The primary difference between the samples of Schwartz (2013) and the current study is the age of the selected incubators. While the average age of incubators in the current study is 8 years, it is 13 years in Schwartz (2013).

In terms of the data collection process, this study used the approach employed by Schwartz (2013) where in-person interviews were conducted with incubator managers. However, the current study interviewed both incubator managers and founders of startup firms while Schwartz (2013) used incubator managers as sources for information about startup firms but did not conduct in-person interviews with representatives of the 371 firms that were included in the final analysis.

In terms of reaching the participants, the current study used an approach similar to that used by Schwartz and Hornyx (2010). Schwartz and Hornyx obtained information about startup firms by browsing through the websites of 26 incubators in Germany. In this study, the researcher did obtain contact information for the firms by browsing the websites of the
incubators. Many other studies (Link and Scott, 2005; Mian, 1996) used the interview as a method of data collection, with some employing surveys (e.g., Sherman, 1999) as additional data collection tools. The current study supplemented interview and documentary data with observation: the researcher was present in each of the incubators several hours a day, observing the environment and interactions among founders to provide an additional data point for the analysis.

Prolonged observation of the founders, as they work in the incubator environment, would yield more nuanced data about the daily activities of the different firms and inter-firm interactions. Hence, for future research, a methodological shift to an ethnographic approach may provide better insights about factors influencing collaboration among firms. An ethnographic study that would last a minimum of six months would provide a researcher with insights and some depths of understanding compare to this study’s current methodological approach. This is because the researcher would have the opportunity to spend more time with the founders and become a part of the incubator community. Other directions for future research are discussed below.

6.4 Further directions in research

This study examined collaboration among startup firms in four business incubators. Two of these incubators are owned by two separate universities and the remaining two are owned by non-profit organizations. The findings in the study were based on interviews conducted with 44 representatives of startup firms in four business incubators. Four additional interviews, one from each incubator, were conducted with incubator managers. The data were supplemented with observations and document analysis that include web-based resources from each incubator and the 44 firms. The following are specific ways future researchers can build on this study.

Consider a larger sample of startup firms. There were 519 potential startup firms across the four incubators that could have been included in this study. While this number may be too large for a study of this nature, a future study taking a similar approach may want to include more startup firms than 44.

Do a comparative study of business incubators across multiple states or regions. The current study focused on business incubators in the U.S. Midwest. Future research can expand
the study by looking at business incubators in two or more states or across multiple regions. A study of this nature may establish other elements that could be responsible for collaboration beyond the business incubators themselves.

*Utilize the survey method to gather quantitative data.* This study largely relied on the interview and observational methodologies in gathering data. Future research can utilize standardized instruments to gather survey data, which will enable the covering of a larger sample size and reduce the turnaround time for the required data.

*Compare industry-focused incubators with general incubators.* The one incubator in this study admitting startup firms whose products are focused in the healthcare industry outperformed other incubators in terms of collaboration. Future research may consider a comparative study of industry-focused and general-purpose incubators. Including a larger sample of industry-focused and broad-based incubators can help build on the findings of this study.

*Gather data using other unobtrusive means like patent filings.* Studies on how knowledge circulates among startup firms within a given economic region have utilized discreet methodologies in data gathering. An example of this is using invention or patent records. Future studies on the practice of collaboration could follow this established approach.

6.5 Limitations of the study

The current research did not study the performance of startup firms. Rather, the study focuses on collaboration among them or with other businesses as a step towards performance. Studies have shown that there is a relationship between collaboration and firm performance. Baum et al. (2000) established that collaboration can improve performance early in a firm’s journey. Performance is a concept that measures how well a startup firm is doing using criteria like the year of founding, revenue generated, and the number of employees. Lebas and Euske (2002) defined performance as financial and non-financial indicators that show how an organization accomplishes set objectives.

By the definition of Lebas and Euske (2002), we can explain the performance of a startup firm as the rate of growth of the firm. This rate of growth could be defined by the number of years it takes to begin generating net revenue. By this definition, we can regard a startup firm with 10X net revenue in a given year as performing better compared to one that generates 2X
revenue, assuming the two startup firms were founded in the same year and keeping other factors constant. The performance of startup firms has also been linked to the effectiveness of the business incubators those firms are located. Previous studies have used the long-term performance of startup firms to measure the performance of business incubators (Barbero et al., 2012).

Some of the past studies found a direct relationship between networking (one of the factors this study found to influence collaboration) and firm performance. Hughes et al. (2007) noted that more involvement in networking activities is related to better performance among firms. Rothenmel and Thursby (2005a), in their study, measured the ability of startup firms to be able to gain new knowledge that can be applied to a new product as a measure of performance. Measuring performance helps us to understand the growth of startup firms. However, the type of firm and the incubator they work from can influence the factors to consider in performance measurement. Given that this study did not measure performance, future work could measure both collaboration and performance. In such studies, measuring collaboration will highlight the influence of incubators, and measuring performance will provide better insights about the firms, thereby adding to the picture of what incubators practicing intentional sociality can do.

Another limitation of the study concerns the research time frame, which has two dimensions: first, the researcher collected the entire data within four months. Across the four incubators, the researcher depended on participants’ recollection of past and present experiences. The second is the expectation that participants would convey these experiences accurately under a limited time. This approach is limited because participants may not have presented past experiences as accurately as possible. An ethnographic study, which would require a longer time in the field, may yield deeper insights through extensive interactions and observation. Finally, the questions used to learn about information sharing during collaboration were specific. A better approach would be to incorporate the four W and H questions to learn about information sharing among the firms.

6.6 Implications for the researcher

I started this study by providing background information about myself, especially on the unemployment rate in my home country of Nigeria. The study will conclude with some insights about the current entrepreneurial activities happening in Nigeria, and why this research is
necessary. At the moment, there is a wave of entrepreneurial activities across major African countries. Startup founders in this region are already looking to the United States and other western countries for technical and financial help.

This study will use the stories of two Nigerian startup firms to illustrate how firms founded by Nigerians in Lagos are getting help from entrepreneurial institutions in the United States. Flutterwave is a firm that was founded in Lagos in 2014 by Olugbenga and Iyinoluwa. On March 10, 2021, Flutterwave announced that it raised $170 million in series C funding valuing the company at $1 Billion (Kene-Okafor, 2021). Paystack, another Nigerian company, was founded in 2015 by Shola and Ezra, Nigerian entrepreneurs. In October 2020, Stripe, a US-based payment company, acquired Paystack in a deal valued at $200 million (Lunden, 2020).

Both Flutterwave and Paystack are financial technology companies providing payment infrastructures that enable businesses in Africa to collect payments from local and international customers. Their platforms also help African customers to transact business with international merchants.

What is the common denominator between these two startup firms beyond operating in the same sector? They were both the first set of Nigerian startup firms admitted to Y Combinator (YC), a California-based startup accelerator program. Paystack passed through the program in 2015 and Flutterwave in 2016. YC was founded in 2005. As an accelerator program, it provides necessary resources for early-stage companies. YC helps startup firms avoid the majority of challenges faced early in their journey by providing funding and advisory services. According to its Wikipedia page, it has helped launch over 2,000 companies with a US$300 billion combined valuation as of January 2021 (Wikipedia, 2021). Some examples of companies that have passed through YC include Stripe, Airbnb, DoorDash, Instacart, and Dropbox.

For these two companies, we cannot discuss their success story without acknowledging the opportunities that came with passing through the YC program. One of the many opportunities that came with being an immediate cohort in the year they were admitted to YC was instant funding to the tune of $120,000. They also enjoy some continued benefits as ex YC companies. In an interview, the co-founder of Paystack mentioned that the best part of YC is a platform called Bookface (Y Combinator, 2018). On this platform, all companies that have been part of YC have the opportunity to network and share problems faced down the lines in their journey. It
is a community they would never have been a part of had they not participated in the YC program.

This study started with rather disheartening unemployment statistics about Nigeria. However, the entrepreneurial boom seems to be underway, given the stories of Flutterwave, Paystack, and many others. Hence, my job as a researcher is to begin examining local support structures that would in the future match the vast accumulated advantages that are available through the membership of Y Combinator. More importantly, following the recommendations in this research will help in establishing business incubators that can provide the growth environment required by startup firms.

6.7 Conclusion

This chapter presented twelve policy recommendations that will enhance the efficacy of a business incubator as an enabler of collaboration. Some of these recommendations addressed location and space design, membership selection, events and programs, and mentoring. Business incubator space should be designed to foster interactions among the startup firms. The criteria for member selection should inform the inclusion of corporate members, so they will have maximum impact on the growth of startup firms. The management of business incubators should curate programs and activities so that they address the specific interests of member firms. Focusing on a single industry helps promote complementary activities among firms. Finally, incubators should address diversity issues by providing opportunities for underrepresented groups to participate.

Future research should address similar issues by considering a larger sample, comparing incubators across states or regions, performing an ethnographic study that will give researchers more time in the field, or by comparing industry-focused incubators with general incubators.
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Notice of Approval: New Submission

October 17, 2018

Principal Investigator  Kate Williams
CC  Noah Oluwafemi Samuel
Protocol Title  Collaborative Innovation Among New Technology-Based Firms
Protocol Number  19241
Funding Source  Unfunded
Review Type  Exempt
Status  Active
Risk Determination  No more than minimal risk
Approval Date  October 17, 2018

This letter authorizes the use of human subjects in the above protocol. The University of Illinois at Urbana-Champaign Institutional Review Board (IRB) has reviewed and approved the research study as described.

Exempt protocols are approved for a five year period from their original approval date, after which they will be closed and archived. Researchers may contact our office if the study will continue past five years.

The Principal Investigator of this study is responsible for:

• Conducting research in a manner consistent with the requirements of the University and federal regulations found at 45 CFR 46.
• Requesting approval from the IRB prior to implementing modifications.
• Notifying OPRS of any problems involving human subjects, including unanticipated events, participant complaints, or protocol deviations.
• Notifying OPRS of the completion of the study.
Protocol Form

Initial New Protocol Application, date of submission: 10/08/2018
Revised New Protocol Application, date of submission: 10/14/18
IRB Number: 10241

Human Subjects Research – Protocol Form

Guidelines for completing this research protocol:

- Please submit typed applications via email. Handwritten forms and hard copy forms will not be accepted.
- For items and questions that do not apply to the research, indicate as “not applicable.”
- Provide information for all other items clearly and avoid using discipline specific jargon.
- Please only include text in the provided text boxes. The text boxes will expand as they are typed in to accommodate large amounts of text.

Before submitting this application, ensure that the following have been completed.

- IRB Application is complete.
- Relevant CITI modules have been completed for all members of the research team at www.citiprogram.org.
- Informed consent/assent/parental permission document(s) are provided.
- Relevant waivers and appendices are provided.
- Recruitment materials are provided.
- Research materials (e.g. surveys, interview guides, etc.) are provided.
- Any relevant letters of support are provided.

Instructions on the non-exempt review process and guidance to submitting applications, can be found on the OPRS website, https://oprs.research.illinois.edu/. You may also contact OPRS by email at irb@illinois.edu or phone at 217-333-2670.

Submit completed applications via email to: irb@illinois.edu.

University of Illinois at Urbana-Champaign
Institutional Review Board

Approved October 17, 2018
IRB #10241
APPENDIX B: MANAGER INTERVIEW GUIDE

Hello, thank you for talking with me. (Interviewer introduces himself and explain his roles at the university) I will talk with you and record your answers.

The first thing is to get your official consent to participate in this research. So, I’m going to give you this consent form and a few moments to read it. And then if you agree, please sign it.

Once they have signed it, give them a blank copy and take their signed copy.

OK, let’s start. This interview is for a study about collaborative innovation among new firms. (Place the definition of collaborative innovation on the table and point the attention of the interviewee to it). The questions here are about your role in this incubator, the role of the incubator in the life of the firms, and collaborative innovation. Let me know if you need me to repeat or go back. I want to be clear!

1. Please tell me a little about your role in this incubator.
2. What are the specific benefits to firms that are located here?
3. Can you give me some examples of collaborative innovation among firms in this incubator?
4. Would you say this incubator encourage collaborative innovation?
   a. If incubator encourages collaborative innovation, in what ways?
   b. Ask follow-up question about specific ways collaborative innovation is encouraged (e.g. tell me more about an initiative that encourages collaborative innovation)
   c. If collaborative innovation is not encouraged, why not?
5. Tell me about information resources that the incubator makes available to firm
6. May I get a floor plan of this incubator?