Value Addition for Technology Start-Ups Through Physical Co-Location

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Abstract

Numerous economic theories, knowledge, social, and communication theories have extensively explored the phenomenon of 'physical co-location' in various contexts. However, limited scholarly attention has been given to co-location in emerging contexts such as co-working spaces, predominantly used by start-ups. One of the critical questions examined is how co-location adds value to technology start-ups in the early and growth stages of their development. We chose a premium coworking space in Bangalore, India's start-up capital, as the study's research setting during January – March 2020. The qualitative research employed semi-structured interviews to explore the phenomenon. Our findings revealed that start-ups actively used co-located resources to explore, experiment, and validate new business ideas in the early stage. As they transitioned into the growth phase, they exploited co-located industry networks to expand into new markets. They also learned vicariously from other co-located resources and used them to solve complex problems and refined their processes and routines. As start-ups begin to grow and expand, co-location infrastructure-related costs are not justifiable, operations are less secure, and the meta culture of the co-located environment is in conflict with the firm's operating culture. The results of this study have the potential to be significant for technology start-ups that are exploring new ways of working and addressing uncertainties during the early and growth stages of their development.

Keywords : **Co-location, start-up life cycle, value addition, vicarious learning, opportunity, coworking**

JEL Classification Codes : L26, M13, N75

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Physical co-location is a spatial intervention that brings diverse teams or organizations into one space and enables serendipity encounters (O'Mahony & Bechky, 2008) and knowledge exchange. Alfred Marshall (Edgeworth, 1895) and a few other scholars have drawn out the value addition emerging from agglomeration and linked it with performance (Rawley & Seamans, 2020). These scholars have suggested various

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performance-related benefits (Mathias et al., 2020) from the supply and demand side (McCann & Folta, 2009). Cooke argued that clusters offer a competitive advantage through increased productivity, untraded interdependencies, innovation-related opportunities, and facilitate new business formation through learning (Pollard, 2003). Similar benefits have been echoed in entrepreneurial ecosystems research, which aims at building a geographically proximate, inter-connected system of organizations that attracts start-ups (Nambisan & Baron, 2013).

Scholars have examined agglomeration in a wide variety of contexts and industries, including hotels (Kalnins & Chung, 2004), manufacturing (Beaudry & Swann, 2009), wineries (Wang et al., 2014), and biotechnology (Folta et al., 2006). However, there has been limited examination of how technology start-ups leverage the 'context of physical co-location' to ideate, validate, and execute their business models. To address this lacuna in the literature, we explore this emerging context of start-up co-location through an exploratory study that investigates and understands the benefits drawn by technology start-ups through physical co-location.

The study is critical in the current context because a start-up company attempts to shape a high-tech revolutionary product without any previous experience, operates under intense uncertainty, and tries to construct a proven and scalable business model (Sperindé & Nguyen-Duc, 2020). Against this backdrop, we hope to make a potential contribution by seeking insights on how technology start-ups leverage physical co-located environments to overcome the compelling challenges and uncertainties they face in their start-up journey.

We use a large, premier coworking space as our research setting. Coworking spaces are open-plan work environments where independent economic actors such as freelancers, entrepreneurs, start-ups, and incumbent firms (Bouncken et al., 2020) collaborate by renting desks or small offices (Spinuzzi, 2012).

These spaces reflect a start-up lifestyle (Moriset, 2017) and provide a convenient location for people to meet, explore, learn, share knowledge, and discuss digital technology-related topics (Bilandzic et al., 2013). It facilitates innovation among professionals through frequent face-to-face interactions, resource sharing, community building, and collaboration (Capdevila, 2014).

Unintended knowledge spillovers are possible during interactions in coworking spaces (Becerra et al., 2008). Such spillovers add value to early-stage start-ups by shaping innovative business models (Bouncken & Fredrich, 2016). Coworking spaces strengthen social ties by providing access to sophisticated networks (Hite & Hesterly, 2001) and provide opportunities for creativity and serendipity encounters (Graebner, 2004). Strong social ties and interaction facilitate co-creation, knowledge exchange, learning, and idea absorption from experienced co-workers, resulting in improved start-up performance (Capdevila, 2014).

Review of Literature

The localization of spatial clusters is defined as agglomeration. Similar or related businesses and industries congregate (concentrate, agglomerate, co-locate, cluster) in specific locations, resulting in information and knowledge exchange (Malmberg & Maskell, 2006). Agglomeration enables access to skilled labour pools, resource-related inputs, and technological spillovers (Dubé et al., 2016) and facilitates idea generation, experimentation, and discovery (Van Der Panne, 2004).

Geographic co-location has been elaborated in cluster-based theories in addition to economic theories. Clusters, according to Porter, are concentrations of interconnected businesses, suppliers, complementary service providers, firms in related industries, and institutions (Porter, 2000). Later, sociological network, knowledge, and ecosystem theories (Muegge, 2013) emerged, emphasizing the importance of connections and communication (Pfeffermann et al., 2013) as well as information flow through interpersonal networks (Burt, 2000). Geographic or physical co-location is a spatial intervention that brings together diverse teams or organization space, allowing for serendipitous encounters (O'Mahony & Bechky, 2008). Intra-firm geographic co-location occurs when different

business units of a company share plant and machinery as well as specialized capital, teams, and support services (Alcácer & Delgado, 2016). Co-location has recently emerged as an outside-in, non-equity model for collaboration between corporate firms and start-ups (Steiber, 2020). When entrepreneurs and teams from large corporations co-located, it paved the way for corporate coworking spaces to emerge (Bouncken et al., 2018). Co-location speeds up innovation and allows established firms to access new technologies at a lower cost (Wright & Drori, 2018). Enterprises of all sizes strive to implement new methods based on information technology solutions to strengthen their competitive position and increase productivity (Tomar, 2017).

As entrepreneurs shape their new ventures, they are naturally exposed to the risk of newness and smallness (Kor & Misangyi, 2008). An estimated 137,000 new businesses open their doors every day, but 90% fail within the first three years (Tajpour et al., 2021). Overcoming obstacles and making just enough money to stay afloat are two critical goals for businesses in their first few years (Chakraborty & Altekar, 2021). Start-ups can obtain funding at first, but their inability to generate a consistent cash flow causes them to become cash-strapped, resulting in their closure (Bajaj & Mehendale, 2016). Another issue that new businesses face is high operational costs (Bagla & Khan, 2017). The perfect environment for growth is created by institutional stimulus and human capital (Lokhande, 2017). Colo, or co-located office space, uses shared infrastructures, resulting in lower start-up operating costs.

Start-ups access external resources (Barwinski et al.,2020) in co-located environments to build their knowledge and financial, human, and social capital to overcome similar challenges and uncertainties and make appropriate decisions (Frese, 2009). Co-located start-ups seek information about potential customers and partners, tap into experienced entrepreneurs' knowledge, and learn vicariously by observing and learning from their experiences to help them cope with uncertainty (Venkat et al., 2021).

According to agglomeration theories, new firms co-locate to seek knowledge and information spillovers (Belderbos et al., 2011) to gain additional economic knowledge and generate new ideas (Aggarwal, 2019). Co-location facilitates the transfer of tacit know-how, which would otherwise be difficult and expensive, allowing for easy, continuous face-to-face interactions (Collins, 2010). Scholars contend that such knowledge flows in co-located environments help reduce the liabilities of newness and smallness that impact new firms by lowering the costs of accessing and obtaining knowledge (Pe'er et al., 2008).

Furthermore, co-location is preferred by start-ups to facilitate product innovation (Zhang & Li, 2010). Co-located start-ups have access to various training programs, shared infrastructure, complementary service providers and their networks, lower transaction costs, and gain legitimacy and improve their long-term sustainability, performance, and profitability (Cho, 2018). On the other hand, the benefits of co-location are expected to vary across economic activities with different degrees of knowledge intensity (Delgado, 2020).

Research Gap and Scope

Several theoretical perspectives have been developed to investigate the phenomenon of co-location. However, there is little discussion of how technology start-ups use the context of physical co-location. The new direction established by this qualitative study is focused on uncovering key insights relating to value addition derived from physical co-location by technology start-ups. We also investigate how the source of value addition, firm-related behaviors, and value-added mechanisms differ in the early and growth stages of the start-up life cycle. The findings of this study can be significant for numerous technology start-ups confronted with the risk of newness and smallness, thus evaluating new ways of working and addressing uncertainties.

Start-ups are companies whose business ideas are based on high-tech, cutting-edge technology solutions (Deeds et al., 2000). An early-stage start-up entrepreneur is concerned with identifying a business opportunity, creating a prototype, forming a team, and acquiring resources (Lichtenstein et al., 2006). During the growth stage,

the emphasis shifts to managing growth, increasing sales, and developing an efficient system (Scott & Bruce, 1987). This paper's scope is restricted to early and growth-stage technology start-ups that have embraced physical co-location. The purpose of this study is to determine whether and to what extent physical co-location adds value to technology start-ups during the early and growth stages of the start-up life cycle.

Research Methodology

This qualitative study used an inductive approach to examine and describe the value addition resulting from co-location through the eyes of start-up entrepreneurs. Qualitative studies often have a smaller sample population than conventional studies, whose focus is on the 'what, how, and why' of the research question (Dworkin, 2012). Since we wanted to explore respondents' experience with physical co-location, we adopted an interpretive approach that helped us study the meanings that survey participants assigned to them (Denzin & Lincoln, 1995). Hence, understanding the phenomena through the participants' eyes involved capturing and assessing start-up entrepreneurs' perceptions and sentiments.

In January – March 2020, we conducted the survey in an ample coworking space in Bangalore, India's start-up capital. The survey was conducted in two stages: The pilot phase was included in Phase 1. Interviews with four respondents were conducted during this phase. The questionnaire guide was restructured for Phase 2 after the questionnaire was tested during this phase. We realized that the questions needed to be more exploratory ; so, we came up with key themes to investigate. The key themes were: a) the type of resources sought, b) firm-related knowledge-seeking behaviors, c) channels used to seek external knowledge, and d) firm outcomes.

Since the study's scope is limited to start-up entrepreneurs, we used snowball sampling to identify likely respondents in Phases 1 and 2. Snowball sampling employs respondents, primarily from the researcher's peer group, to source additional respondents through a chain–referral system (Ghaljaie et al., 2017). We used a non-probability sampling technique and chose each respondent based on the sampling criteria. The constituents had to be early-stage and growth-stage start-ups developing and deploying technology solutions for various industries.

We interviewed 17 people from the identified group (refer to Table 1). Eight were early-stage start-ups that operated from 2018 – 2019, and nine were growth-stage start-ups that had been in operation since 2015. Because the interviews were exploratory, the triangulation method was used to confirm the findings' validity and examine the convergent nature of results from various sources.

In qualitative research, triangulation refers to multiple data sources to develop a comprehensive and detailed understanding of the phenomenon (Patton, 1999). The data were triangulated by interviewing growth-stage start-ups about the challenges they encountered early in their journey. In addition, we triangulated data collected from growth-stage start-ups by interviewing some of the more established start-ups that were on the verge of leaving the co-located environment.

Respondents were informed about the purpose of the study and assured of their anonymity before the interviews. The interviews lasted between 60 and 90 minutes on average. We used a semi-structured informal approach, keeping the conversation flowing with the help of an interview guide that identified key exploratory themes discussed previously. The questions attempted to probe and comprehend their perspectives on how co-location has added value during their start-up journey's early development and growth stages. All interviews with survey respondents were recorded using the voice recorder feature on the mobile phone. We used Otter.ai, an artificial intelligence tool to transcribe all the discussions that led to the detailed narratives and codes.

Using Microsoft Excel, we coded the data using open coding, to begin with, followed by abstracting the data using axial coding. Clustering respondents' views helped in recognizing patterns across the dataset. We finally arrived at selective coding when theoretical saturation was reached. As we coded and abstracted the data, we engaged in thematic analysis (TA) to draw insights from interviews.

Table 1. ***Profile of Tech Start-Ups***

	Start-Up Category*	Stage of Development	Nature of Work	Start of Coworking	Interviewee/s	Team Size
1	Digital Marketing	Early	Setting up online channels	2019	Cofounder	7
2	Ecommerce	Growth (shared experience on both stages)	E-commerce platforms	2015	Cofounder	9
3	Tech Art, Tech Labs	Growth	Art & technology integration	2015	Cofounder, staff member	11
4	Language Localisation	Growth	Language localisation	2015	Founder	8
5	Emergent Technologies	Growth	Offers IT services - AI, IoT, ML	2015	Founder	15
6	Traveltech, Fintech	Growth	Traveltech & fintech	2015	Founder	14
7	Cloud Computing Services	Growth	Google Cloud services	2015	Head of Sales	22
8	Automobile Spares, Service	Early	Aggregator	2019	Founder	1
9	HR	Early	HR recruitment	2019	Founder	3
10	Fintech	Growth(shared experienced on both stages)	Mutual fund	2016	Technical Head	9
11	Tech Services	Growth	Augmented reality	2017	Head of Operations	13
12	Digital Web and Mobile Solutions	Growth	Digital solutions	2016	Founder	6
13	Healthtech	Early	Artificial intelligence solutions	2018	Founder	4
14	Foodtech	Early	Restaurant discovery platform	2018	Founder	5
15	Data Analytics	Early	Data analytics	2019	Consultant	4
16	Tech for Wildlife Conservation	Early	Technology for wildlife conservation using AI	2019	Founder	5
17	Edtech	Early	Educational technology	2019	Founder	2

Note. *Anonymity of start-up company names has been maintained.

In the present study, the six-step approach described by Braun and Clarke is used (Braun & Clarke, 2019), which includes data familiarization, coding, extracting first-order themes, second-order themes, analysis of each theme, and contextual analysis with current sources of literature. The present study uses reflexive TA and approaches in an inductive manner (Braun & Clarke, 2021). The following coding and abstracting findings are categorized as first-order and second-order themes and aggregate theoretical dimensions based on the inductive method. We then analyze the results using the current source of academic literature.

Analysis and Results

The primary exploratory research question involved determining whether or not co-location adds value to technology start-ups' early and growth stages. Furthermore, we investigate how sources, behaviors, and mechanisms related to knowledge-seeking from co-located environments add value across different stages of the start-up life cycle. As reflected in Table 2 and Table 3, knowledge available among diverse actors in a co-located

Table 2. ***How Does Co-Location Add Value for Early-Stage Development of Tech Start-Ups?***

Value Addition:		
First-Order Categories (Knowledge-seeking from co-located resources)	**Second-Order Themes**	**Aggregate Theoretical Dimensions**
Knowledge Seeking : Type	**Exploration (New Knowledge)**	**Opportunity Creation**
Broad in scope, exploratory		
Search for opportunities		
Seeking feedback (ideation, validation, minimum viable product, product previews)		
Market knowledge		
Entrepreneurial knowledge		
Knowledge Seeking : Behaviour	**Experiential Learning : Feedback and Experimentation**	
Making sense of feedback		
Building social ties		
Learning by doing (Active experimentation with MVP)		
Adaptive to new opportunities		
Knowledge Seeking : Mechanisms/Channels	**Knowledge Spillovers (Networks/Product)**	
Interaction		
Serendipitous encounters		
Community events, Cofounders meet		
Knowledge spillovers: Connections/networks		
Knowledge spillovers: Product		
Technology alliances		
Outcomes :	**Product Innovation**	
Knowledge creation		
Product innovation		
Social capital		

environment is vital for value addition. This section presents the key themes identified for each category, along with a table that captures first-order categories, second-order themes, and aggregate theoretical dimensions. The final section also offers the selective experiences of interviewees in the form of quotes.

Start-Ups in the Early Development Stage

Twelve respondents stated that co-location initially aided them in exploring new ideas or seeking clarity on their proposed business idea. "Opportunity Creation" was the overarching goal for early-stage start-ups. Table 2 summarizes the findings concerning early-stage start-ups and how co-location contributed to value addition.

Some of the experiences shared are being reproduced here via quotes:

> You meet people from diverse backgrounds…and then you start exploring your ideas with them…I listen to what they have to say…this way, I know if my idea is going to work or not.

We attend many community events where we get to interact…there were also serendipitous interactions at the café or in the corridor.

This place is vibrant with young ideas, knowledge…you get to hear how people integrate technology into business.

That's for the MVP …So you create the smallest thing, put it out there, start building features one by one iteratively later.

Growth Stage Start-Up

To begin, five growth-stage start-up interviewees said that co-location helped them find quick solutions to problems. They observed or listened to their coworkers' experiences in similar situations. To address process-related issues, start-ups either hired experienced personnel or sought technical assistance from coworkers. They gained access to inter-and intra-industry knowledge pools to understand better how to expand and customize their products for different industries. As a result, the overall focus is "Opportunity Development" at this time. Table 3 summarizes the findings related to growth-stage start-ups and how they draw value from co-location.

Table 3. ***How Does Co-Location Add Value for Start-Ups in Their Growth Stage?***

Value Addition:		
First-Order Categories	**Second-Order Themes**	**Aggregate Theoretical Dimensions**
Knowledge Seeking : Type	**Exploitation (Problem Solving, Efficiency)**	**Opportunity Development**
Narrow in scope		
The exploitation of inter-and intra-industry knowledge pools		
Problem-solving		
Feedback on execution		
Process knowledge (know-how)		
Knowledge Seeking : Behaviour	**Vicarious Learning**	
Process building		
Ties with closed networks		
Learning: Vicarious, mutual interaction		
Customer focus, inter-industry sectors		
Knowledge Seeking : Mechanisms	**Knowledge Spillovers (Process, Industry Sector Knowledge)**	
Interaction (primarily external, planned)		
Spillovers (process/know-how) (industry sectors)		
Strategic collaboration		
Outcomes :	**Process Innovation, Market Expansion**	
Knowledge extension		
Process innovation		
Co-creation		
Product customization		

On the other hand, interviewees stated that such value addition occurred only in the early stages of their development. As the company grew in the latter half of the growth stage, the start-ups spent more time building networks outside the co-located environment. As the number of new hires increased, it became unprofitable to continue using the coworking space.

Clients expressed security-related concerns about the use of shared technology infrastructure. As the company expanded, it had only recently established a formal structure and new routines and operating principles. The start-up meta culture prevalent in a coworking space quickly clashed with its organizational norms, resulting in low productivity and employee dissatisfaction. To summarize, the value derived from the coworking environment was "depleting" as they expanded, forcing them to decide to leave the coworking space.

Some of the experiences shared are being reproduced here via quotes:

> We work with logistics. We are now working with healthcare, in education…we keep replicating these product ideas cross-industry…here in this hub, we get that knowledge about different sectors and how things happen.
>
> There was co-selling, co-branding, co-design, co-bidding that happened on larger inter-firm projects. We were part of a project where we helped with the design.

Some of the experiences shared are being reproduced here via quotes:

> We have 90 plus staff, and it is no longer economical to stay here.
>
> Our clients have raised security issues….Their ISO auditors have suggested we invest in independent servers.
>
> There is a start-up culture that doesn't match ours ...

Discussion

We created a two-by-two matrix (see Figure 1) to offer propositions and insights from the study. Our findings reveal that both early-stage and growth-stage tech start-ups sought value in co-location, albeit in very different ways. Tables 2, 3, and Figure 1 demonstrate that knowledge shared by diverse actors in a co-located environment is a critical source of value addition. The types of knowledge sought and the associated behaviors, mechanisms,

Figure 1. ***How Does Co-Location Add Value for Tech Start-Ups?***

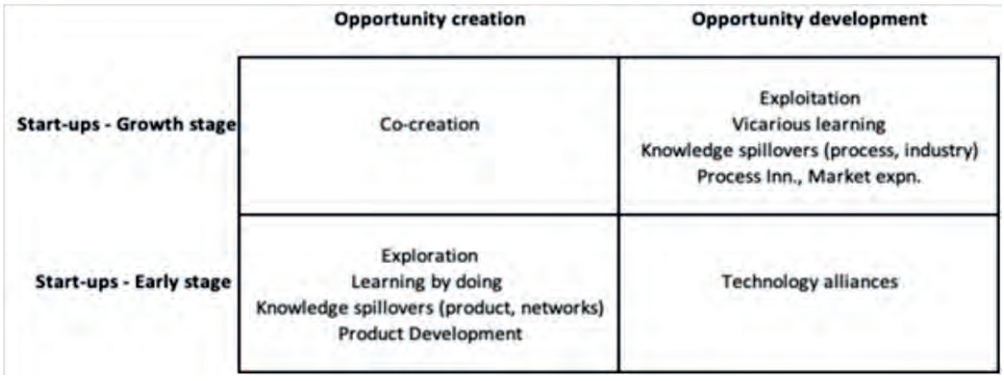

Table 4. ***How Does Co-Location Result in Depletion of Value for Start-Ups in Their Growth Stage?***

Value Depletion:		
First-Order Categories	**Second-Order Themes**	**Aggregate Theoretical Dimensions**
Rising leasing costs	Rising costs	**Value Depletion**
Security	Low security	
Less interaction		
The exit of experienced start-ups	Less interaction and learning	
Community distractions		
Free-flowing start-up culture	Conflicting culture	
Employee dissatisfaction	Low productivity	
Low staff compliance		

and outcomes for early and growth-stage start-ups were dichotomous and contrasting in nature.

The stage of the start-up's life cycle determines the type of knowledge sought. In addition, the theory confirms that organizations seek knowledge based on their "perceived need" (Shane, 2000). Regardless of the initial findings, one of the study's key findings is that as the start-up grew and expanded its operations, value addition gradually gave way to value depletion (refer to Table 4).

The two-by-two matrix highlights the following dimensions: 1a) Start-ups in the early stage, 1b) Start-ups in the growth stage, 2a) Opportunity creation, and 2b) Opportunity development. Co-location aided start-up entrepreneurs in the processes of 'Opportunity Creation' in the early stages of the start-up life cycle and 'Opportunity Development' in the growth stage.

When the interview data were analyzed, we discovered that both groups shared some value-add sources. Both stated that co-location allowed for a) geographic proximity to diverse sources of knowledge, prospective clients, and partners, b) building social ties, and c) a faster learning curve and problem-solving. Spatial clustering is associated with proximity and place, and it is distinguished by skilled labor, specialized services, face-to-face contact, and trust. Such characteristics enhance knowledge spillover, learning, and innovation (Malmberg et al., 1996).

Apart from commonalities, the value sought from co-location differed significantly. Co-location facilitated access to networks and product-related knowledge spillovers that aided in the identification of opportunities for early-stage start-ups. Learning occurred due to feedback and active experimentation via validation and the development of a minimum viable product (MVP). Growth stage start-ups relied on industry-related knowledge spillovers to tailor their existing offering for new markets and process-related knowledge spillovers to improve their current processes. They learned to solve problems vicariously through the experiences of others. They also gained knowledge through knowledge spillovers from strategic collaboration with parties both inside and outside the space.

However, as the growth cycle progressed, the value derived from co-located resources decreased significantly. As a company grew, its reliance on co-located resources decreased as it relied more on external networks. As teams grew, co-location infrastructure costs became prohibitive, and security concerns arose due to shared technology infrastructure. Growth-stage start-ups focused on building new routines, processes, and shaping operating principles. However, these new principles clashed with the clear, free-flowing start-up meta culture prevalent in co-located spaces. Such disagreements resulted in low employee productivity and satisfaction.

According to the study's findings, co-location begins with value addition in both the early and growth stages of a start-up's life cycle. However, towards the latter half of the start-up growth cycle, value depletion sets in, prompting start-ups to leave the co-located environment.

Development of Propositions

To begin, early-stage start-ups took advantage of co-located actors, networks, and community events to engage in the search for exploration of new opportunities. Exploration is associated with searching, discovering, experimenting, taking risks, developing new knowledge, innovating, and identifying business opportunities.

Start-ups in their growth stage, on the other hand, are focused on 'exploiting' their existing offerings to expand into new markets and drive operational efficiency through process streamlining. Respondents to the survey indicated that they used multidisciplinary and intra and inter-industry knowledge pools to glean sector-specific knowledge and tailor products accordingly. Exploitation is associated with knowledge refinement and extension and activities that improve efficiency, productivity, and performance. The exploration entails searching for new knowledge; whereas, exploitation refers to applying previously acquired knowledge (Levinthal & March, 1993). Hence, we propose:

Proposition 1

(1a) Co-location facilitates the exploration of new knowledge related to discovering new opportunities for start-ups in the early stage.

(1b) Co-location enables the exploitation of existing knowledge to develop opportunities in new markets for start-ups in the growth stage.

Start-ups engage in idea validation to reduce risk. This process entails learning a lot about a new idea and making changes to reduce its chances of failing. Respondents sought feedback from potential co-located clients, early adopters of technology, technology partners, and those engaged in active experimentation to build the minimum viable product iteratively (MVP).

Academic research confirms that early-stage start-ups use networks for knowledge exchange, learning, and feedback (Spinuzzi, 2012). Knowledge is transformed through reflective observation or active experimentation (Baker et al., 2012). Many growth-stage start-ups reported that an external search for solutions resulted in faster problem solving and avoided learning through trial and error. Organizational issues result in an external search for solutions that leads to vicarious learning (Posen & Chen, 2013). Learning that results from indirect experience gleaned from sources outside the firm (Levitt & March, 1988) is vicarious learning (Csaszar & Levinthal, 2016). Hence, we propose :

Proposition 2

(2a) Co-location facilitates experiential learning through feedback and experimentation in the early-stage product development.

(2b) During the growth stage, co-location facilitates vicarious learning that enables problem-solving and process enhancement.

When start-ups grew in size, the value-added from co-located resources appeared to decrease significantly — their reliance and interaction with co-located resources reduced as they relied more on external networks. As teams grew in size, co-location infrastructure costs became prohibitive. Because of the use of shared technology infrastructure, security concerns arose. Following the expansion of the business, new routines and processes were implemented. The unique culture of the start-up clashed with the lucid, free-flowing start-up meta

culture that existed in co-located environments. This conflict resulted in low employee productivity and dissatisfaction. Evidence from research conducted in the Saskatoon biotechnology sector in 2003 – 2004 suggested that when companies focused their efforts on product development, co-location became unimportant (Dorry, 2014). Our findings indicate that co-location begins with value addition in a start-up life cycle's early and growth stages. However, towards the latter half of the growth stage, value depletion sets in, prompting start-ups to leave the co-located environment. Hence, we propose :

Proposition 3 : The value drawn from co-location reduces considerably when start-up firms witness business expansion during the growth stage of their development.

Conclusion

Tech start-ups are shaping new business ideas, keeping in mind digital technology solutions that transform businesses. Tech start-ups, however, are constrained by resources, and this study explores how co-location adds value to early and growth-stage tech start-ups. The study reveals that co-location adds considerable value for start-ups in the early and growth stages of their development. However, value depletion is evident in the latter stage of the growth cycle. Early-stage tech start-ups are focused on exploratory actions that enable opportunity creation. In contrast, growth-stage tech start-ups are engaged in exploitative activities centered on process innovation and market expansion. As businesses expand, high infrastructure costs and conflicting cultures of co-located environments result in value depletion, forcing the start-ups to exit the co-located environment.

Implications, Limitations of the Study, and Directions for Future Research

The study's findings have important theoretical implications because they contribute to the existing body of knowledge on physical co-location by exploring a new context involving technology start-ups. The study describes the experiences of early and growth-stage start-ups and interprets the value addition that co-location brings to the start-up context. It emphasizes that the phenomenon of co-location adds significant value to start-ups at both the early and growth stages of their life cycle. Though the value - add nature differs at each stage, it addresses critical needs relevant to the start-up life cycle stage. However, value addition decreases significantly in the latter half of the growth stage, justifying the start-up's exit from the co-located environment.

The study has important practical implications as well. The environment in which resource-constrained start-ups operate is dynamic, complex, and unpredictable. In such a challenging environment, it is difficult for a) early-stage start-ups to identify opportunities and validate their ideas before full-fledged exploitation, and b) growth stage start-ups to build processes, drive efficiency, and develop new markets. Coworking spaces's ethos and community orientation provide many resources for tech start-ups to seek knowledge and explore new product and process-related opportunities.

Co-location enables access to potential clients and value chain partners to solicit feedback and validate business ideas. This feedback from nearby sources enables them to pivot or change their offerings, ensuring the scalability of their business model. Furthermore, it aids in the development of solid network ties to recognize opportunities in other industries, enables quick learning and problem solving through vicarious learning, and results in process improvements.

One of the study's limitations is that it was conducted before the COVID-19 pandemic. It will be interesting to see if such value addition continues for co-located start-ups after the pandemic. One of the suggested future research directions is to use a quantitative approach with a large sample size to validate the current qualitative study and its resulting propositions.

Authors' Contribution

Radhika Venkat led the study and was responsible for formulating the research idea and developing the research design. She engaged in reviewing the literature, identifying the research gaps, and taking the study forward by conducting interviews with the survey respondents. Dr. Amit Gupta helped shape the study with his guidance and extensive experience with start-ups. Dr. Jayanta Banerjee was responsible for the review of literature on start-ups, finalizing the questionnaire design, coding, and analysis. Mr. Ramesh helped identify the survey respondents, was engaged in interviewing a cross-section of interviewees, and was responsible for transcribing and coding.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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