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Going online: Peer entrepreneur networks in a startup accelerator before and during the COVID-19 pandemic

Kai Becker[a,*], Joris J. Ebbers[b,c], Yuval Engel[c]

[a] Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV, Amsterdam, the Netherlands
[b] Luiss Business School, Via Nomentana 216, 00162, Roma, the Netherlands
[c] University of Amsterdam, Amsterdam Business School, Plantage Muidergracht 12, 1018 TV, Amsterdam, the Netherlands

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ABSTRACT

A key value proposition of startup accelerators is the creation of social networks among participating entrepreneurs. The formation of these so-called "peer entrepreneur networks" is assumed to be strengthened by physical proximity within the accelerator, which facilitates the creation of trust and opportunities for informal, and often serendipitous, interactions. However, in response to the global spread of COVID-19, accelerators abruptly shifted their programs online, thereby allowing a rare opportunity to test the veracity of the assumption that physical proximity drives social connectivity. To understand how this shift affected peer entrepreneur networks, we compare longitudinal network data of two consecutive cohorts of the same accelerator: one offline-before, and one online-during, the COVID-19 pandemic. Drawing from the literature on physical proximity and interaction ritual theory, we show that in the online (compared to the offline) program, peer entrepreneur networks became less dense, entrepreneurs reached fewer peers via indirect connections, and clustering increased. We discuss contributions to theory on peer entrepreneur networks and startup accelerators.

1. Introduction

Startup accelerators – fixed-term, cohort-based entrepreneurship program(s) – aim to support entrepreneurial activity by creating the "social capital surrounding entrepreneurial efforts" (Hochberg, 2016, p. 33). Besides creating network ties with actors outside the accelerator – such as customers, suppliers, investors, and service providers – (e.g., Del Sarto et al., 2022), accelerators aim to create social connection among participating (peer) entrepreneurs more specifically (e.g., Chatterji et al., 2019; Cohen et al., 2019; Hasan and Koning, 2019). To that end, accelerators embed peer entrepreneurs into cohorts and invest significant resources into an array of formal and informal social activities such as weekly dinners or guest speakers where attending entrepreneurs can connect in person (Cohen and Hochberg, 2014). In fact, virtually all accelerators emphasize on their landing pages how they engineer social events such as in-person retreats to give "founders the opportunity to get to know each other" (e.g., Y Combinator)[1] and ensure "countless moments where you {entrepreneurs} can learn from your {their} peers" (e.g., Techstars).[2]

Whereas practitioners have long emphasized the value of peer interactions in these settings, research is now beginning to corroborate their insights. Peers are found to offer invaluable advice pertaining to people management, enabling inexperienced entrepreneurs to avoid costly trial-and-error learning (e.g., Chatterji et al., 2019). Similarly, peers are also the primary source of technical advice for entrepreneurs because they have encountered similar problems in the past (e.g., Hallen et al., 2020). In making introductions to other entrepreneurs, peers do not only facilitate contracting activity (e.g., Ebbers, 2014) but also serve to reaffirm entrepreneurial identity, provide emotional support, and encourage exploration of otherwise unattended to solutions for common problems (e.g., Cohen et al., 2019; Krishnan et al., 2022; Spigel, 2021). In sum, much of the benefits attributed to startup accelerators in general accrue via within-cohort "social connections of entrepreneurs to other entrepreneurs" (Hallen et al., 2020, p. 397).

However, with the onset of the COVID-19 pandemic and its associated public health and safety measures, most non-essential social activities, including activities pertaining to startup accelerator programs, abruptly shifted from face-to-face interactions to a digital environment.

* Corresponding author.
E-mail addresses: k.becker@vu.nl (K. Becker), joris.ebbers@luissbusinessschool.nl (J.J. Ebbers), y.engel@uva.nl (Y. Engel).

[1] https://www.ycombinator.com/about.
[2] https://www.techstars.com/accelerator-hub.

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This move has also prompted a critical reevaluation of social dynamics within accelerators, exposing long held assumptions about how accelerator design choices might shape peer networks. Indeed, the literature emerging around interest in the impact of the COVID-19 pandemic on entrepreneurship as well as the broader literature on digital work highlight the potential for both negative and positive outcomes associated with a transition to online social interaction (e.g., Chan et al., 2022; Scheidgen et al., 2021; von Briel et al., 2018). By moving online, accelerators can recruit from a broader audience while peer entrepreneurs can connect and collaborate more easily using new digital tools, promising frictionless, quicker, and broader tie formation (e.g., Nambisan, 2017; Smith et al., 2017; Zahra et al., 2022). In addition, online acceleration might prevent competitive cohort dynamics as entrepreneurs may no longer eschew peers who are "not valuable" and can stop "being wary of start-ups that could pivot into their technological space" (Krishnan et al., 2022, p. 678). On the other hand, networking online constrains serendipity (Busch and Barkema, 2020; Spigel, 2021); introduces problems surrounding 'zoom fatigue' because electronic communication carries fewer non-verbal cues and introduces technical hurdles (Ratan et al., 2022; Shoshan and Wehrt, 2021); and therefore generally "requires developed social skills and being psychologically comfortable with such interactions to prevent this from increasing existing stress levels and anxiety" (Giones et al., 2020, p. 5). Thus, we are still in the dark about how online networking truly affects peer entrepreneur networks in accelerators (Caccamo and Beckman, 2022; Chan et al., 2022).

In this paper, we therefore study the effects of switching from an offline to an online accelerator program on the development of peer entrepreneur networks. The sudden and complete shift from offline to online cohorts under COVID-19, which is akin to a quasi-natural experiment (e.g., Bergenholtz et al., 2021), represents a rare and unique opportunity to test this prediction. Despite the promises of new digital communication and collaboration tools, we predict that online (compared to offline) accelerator programs exhibit weaker social connectivity and higher clustering among participating entrepreneurs. To support our arguments, we particularly draw from the literature on physical proximity (e.g., Festinger et al., 1950) and interaction ritual theory (e.g., Collins, 2004; Goffman, 1967), which predict that social connectivity will be hampered in the online environment due to the limitations for physical interactions and building trust-based relations (Rivera et al., 2010).

To empirically test these ideas, we structurally compare social connectivity (e.g., density, reach) and clustering of these networks using social network analysis (Borgatti et al., 2013). In total, we draw on four waves of network data –from enrollment to demoday– collected from a cohort of 89 entrepreneurs participating in the offline cohort and four waves of network data from a cohort of 72 entrepreneurs participating in the online cohort. We find that, despite no significant differences at the start of each cohort, peer entrepreneur networks become less connected in the online (compared to the offline) cohort as the accelerator program unfolds. This is reflected by three fundamental measures of social network connectivity: Lower density, lower reach, and higher clustering. To illustrate, in the offline cohort, before the COVID-19 pandemic, the average entrepreneur at the end of the program regularly interacted with about five peers. These peers, in turn, enabled focal entrepreneurs to reach 45 percent of the cohort network by three or fewer degrees of separation. One year later, amid the COVID-19 pandemic and the shift to an online accelerator, the average entrepreneur regularly interacted with only three peers and could reach only 19 percent of the cohort in three steps. Moreover, these connections were predominantly clustered within one's own venture team.

Our study makes two core theoretical contributions. First, we add to the burgeoning literature on accelerator programs (e.g., Bergman and McMullen, 2021; Del Sarto et al., 2022; Hochberg, 2016) by introducing a structural social capital perspective (Adler and Kwon, 2002; Nahapiet and Ghoshal, 1998). Despite the accepted practice of co-locating entrepreneurs within accelerators (Cohen and Hochberg, 2014), in this literature, quantitative empirical studies using a social network analysis approach are almost entirely absent. We address this by employing a longitudinal survey design to collect data about social network ties among peer entrepreneurs in the same cohort at several moments in time during the accelerator program. In doing so, we do not only answer calls for more longitudinal studies of the social relations between peer entrepreneurs in accelerators directly (Bergman and McMullen, 2021), but more generally also inform future investigations of peer effects and learning in these programs (Caccamo and Beckman, 2022; Hasan and Koning, 2019; Moritz et al., 2022).

Second, we advance literature on digital entrepreneurship programs (e.g., Felzensztein et al., 2010; Grimaldi and Grandi, 2005; Morse et al., 2007; von Zedtwitz and Grimaldi, 2006; von Zedtwitz, 2003) by accounting for the online context as a boundary condition to the development of social capital in accelerators (e.g., Adler and Kwon, 2002; Elfring and Hulsink, 2003; Slotte–Kock and Coviello, 2010; Vissa, 2012). While we know that online accelerators are more cost effective due to the elimination of travel, real estate, and associated coordination expenses (Chan et al., 2022; von Zedtwitz and Grimaldi, 2006) and can more easily reach geographically or socially constrained participants (Kuhn and Galloway, 2015; Lall et al., 2023) as well as experts and mentors which might be scarce in local startup ecosystems (Bliemel et al., 2019; Schou et al., 2021), existing research lacks clarity on how the online setting impacts entrepreneur peer networks in accelerators. Our study quantifies the extent to which social connectivity is affected in an online compared to an offline accelerator. As such we not only advance theory about the advantages of physical proximity, in-person events, serendipitous encounters, and social interactions for network formation and resource exchange within entrepreneurship programs (e.g., Busch & Barkema; Hallen et al., 2020; Hasan and Koning, 2019; Roche et al., 2022), but also enable accelerators to more consciously and accurately weigh the different costs and benefits of using digital innovations involved in the decision to go online (Smith et al., 2017; Zahra et al., 2022).

2. Theory and hypotheses

2.1. Peer entrepreneur networks in startup accelerators

Having a solid peer network is one of the key factors influencing the emergence and successful development of nascent ventures (Cai and Szeidl, 2018; Zuckerman and Sgourev, 2006). Ties to other entrepreneurs are conduits for the transmission of private information, advice, as well as influence, and gateway to resources that may otherwise be unobtainable or only at an inflated cost (Coleman, 1988). Accordingly, social capital theory describes an entrepreneur's social capital as the "sum of the actual and potential resources embedded within, available through, and derived from the network of relationships" (Nahapiet and Ghoshal, 1998, p. 243). On the one hand, social capital entails a 'who you know' (Coleman, 1988) and is often equated with the structure of an entrepreneur's social network (Adler and Kwon, 2002; Galunic et al., 2012). On the other hand, social capital also entails a relational dimension that captures 'how' entrepreneurs are connected to others. Here, investments in social relations generate goodwill available to entrepreneurs that can be mobilized to achieve certain goals (Adler and Kwon, 2002) and include the specific set of norms and expectations embedded within a social network (Nahapiet and Ghoshal, 1998).

Accelerators, having recognized the value of ties among participating peer entrepreneurs as a source of knowledge, advice, referrals, and emotional support (Cohen et al., 2019; Moritz et al., 2022), actively foster the internal development of social capital and communities of practice (Brown and Duguid, 1991; Nahapiet and Ghoshal, 1998). To that end, accelerators can use a myriad of activities and events to facilitate the formation and development of peer entrepreneur networks, especially within specific program cohorts. Some of these activities are formal (e.g., guest talks), while others are more informal in nature (e.g., parties and other opportunities for exchange and serendipities encounters) (Caccamo and Beckman, 2022). There are two key mechanisms that are well-known to be important for tie formation: physical proximity and interaction rituals (e.g., Busch and Barkema, 2020; Krishnan et al., 2022; Roche et al., 2022).

First, accelerators' cohort structure means that entrepreneurs engage in their venturing process in the proximity of peers (Cohen and Hochberg, 2014). Co-located entrepreneurs that work alongside their peers are likely to develop social network ties because they have more opportunities to interact (Roche et al., 2022). Mere physical proximity affects relationship formation because frequent face-to-face encounters provide more opportunities to observe and evaluate non-verbal communication thereby offering a clearer judgment of a person's trustworthiness and cooperative attitude (e.g., Festinger et al., 1950; Preciado et al., 2012; Storper and Venables, 2004). Especially unplanned, serendipitous encounters at the workplace (e.g., at the coffee machine) are important for inspiration and creativity (Nijssen and van der Borgh, 2017). Prior studies indeed confirm that entrepreneurs co-located 'under the same roof' are more likely to collaborate (e.g., Bøllingtoft, 2012), an effect that becomes stronger with the length of residency (Ebbers, 2014) and proximity in the co-working space (McAdam and McAdam, 2006).

Second, it is the objective of accelerators to design and facilitate rituals that foster social interaction across the cohort to leverage the benefits of entrepreneurial peer networks. To do so, accelerators not only orchestrate unplanned interactions through office designs and seating arrangements but especially through planned social events (Cohen et al., 2019). Public events such as orientation weeks and icebreaker games include bonding rituals and are ideal to shape peer interactions because entrepreneurs are often unfamiliar with each other coming into these programs (Krishnan et al., 2022). According to interaction rituals theory, repeated face-to-face interactions across these formal events lead entrepreneurs to uncover their identity (Gur and Mathias, 2021) and build an affective understanding for their shared situation, thereby laying the foundation for ongoing resource exchange and norms of reciprocity (Goffman, 1967; Molm et al., 2007). In addition, identification contributes to the formation of social capital because members adopt the values and standards of the group as reference point (Tajfel, 1982). This enhances the concern for collective processes and outcomes which increases the chances that the opportunity for resource exchange will be recognized and performed (Gedajlovic et al., 2013). For instance, Cai and Szeidl (2018) show that monthly meetings make peer entrepreneurs become more trusting and ultimately willing to share private business contacts to critical customers and suppliers.

Taken together, concerted efforts from accelerator management, the shared experience of participation in these programs, as well as mere serendipitous face-to-face encounters due the co-location of entrepreneurs all seem to be sources for peer interaction as well as associated social capital.

2.2. Startup accelerators in times of COVID-19 and social connectivity restrictions

Since its rapid onset in December 2019, COVID-19 has spread to every corner of the globe, with over 753 million confirmed cases and more than 9.5 million deaths as of July 2023 (WHO, 2023). To flatten the infection and hospitalization curves and ease the burden on healthcare systems, governments often mandated a range of policy measures such as travel bans, social distancing or work-from-home policies that transformed our globally connected world into stay-at-home economies almost overnight (Nummela et al., 2020). Accelerators responded by moving their programs online (Mascarenhas, 2020; Migicovsky and Friedman, 2020). To ensure networking and collaboration, while supporting dislocated entrepreneurs as well as more international and larger cohorts, accelerators employed digital technologies (Giones et al., 2020; Zahra et al., 2022). Digital technologies have the potential to amplify peer networking by removing constraints of physical location and lowering the amount of time and resources to contact network ties (Nambisan, 2017; Smith et al., 2017). For example, communication and collaboration platforms such as WhatsApp or Slack enable entrepreneurs to request support from peers any time and any place, while videoconferencing tools such as Zoom are designed to replace in-person meetings and thus reduce communication and coordination costs (Rippa and Secundo, 2019; Soluk et al., 2021).

However, despite immense technical aptitude and innovative approaches by all involved actors, as well as entrepreneurs' notorious flexibility in times of crises (Schumpeter, 1950; von Briel et al., 2018), there is reason to believe that social network connectivity among peers declines when accelerator programs move online.

First, holding activities such as workshops online, as opposed to offline, negatively impacts social connectivity as the change in design hinders face-to-face interaction, a vital aspect of networking behavior (Gibson, 2020). Research on learning via social networks suggests that the probability of seeking information from others hinges not only on knowing and valuing what others know, but also on being able to gain access to that information at a reasonable cost (Borgatti and Cross, 2003). Because working digitally and remotely via means such as videoconferencing software adversely affects message interpretation, leading to heightened cognitive effort, greater ambiguity, and diminished physiological arousal (Lewandowski et al., 2011), it is perceived as more strenuous and ultimately more costly (Giones et al., 2020; Shoshan and Wehrt, 2021).

Second, by removing co-location, a core tenet of accelerator programs (Cohen and Hochberg, 2014), entrepreneurs should have fewer opportunity to connect. A plethora of research confirms that individuals who work in close physical proximity are more likely to share a bond (e.g., Festinger et al., 1950; McAdam and McAdam, 2006; Roche et al., 2022) because they are more likely to be exposed to, and interact with, one another which can help to establish emotional closeness, intimacy, and trust (Granovetter, 1973). For example, Roche et al. (2022) show that while startups co-located in co-working spaces are likely to adopt technologies from peers, this effect strongly decreases when the physical distance between their offices exceeds 20 m. Similarly, research shows that entrepreneurs collaborate more frequently when accelerators employ "designs that emphasize peer interaction" (e.g., through open office space but also publicly held pitches and progress reports) over designs that "foster privacy" (Cohen et al., 2019, p. 829). Hence, in online accelerators, due to the absence of a co-working space and physical proximity, entrepreneurs cannot 'bump into someone' at the coffee machine or share a car ride home after a day at work (Busch and Barkema, 2020; Krishnan et al., 2022).

Third, the online environment should be more disruptive to ritual chains that are formed as entrepreneurs move from one peer encounter to the next. These include formal events, such as meetings, as well as informal events, such as dinners that provide a sense of belonging and act as a source of high emotional energy (Collins, 2004). According to interaction rituals theory, a shared mutual goal, such as founding and running a new business, can generate identification and draw entrepreneurs to social interactions with peers (Krishnan et al., 2022; Weininger and Lizardo, 2019). However, these collective sentiments rely on observing others engaged in the same set of activities and will be reduced to memory unless they are constantly renewed in subsequent interactions (Goffman, 1967; Collins, 2004). As online accelerators lack a physical meeting space, there should be less potential to observe and interact with peer entrepreneurs and thereby renew and strengthen ritual chains. Taken together, we hypothesize:

Hypothesis 1. **(H1).** Network connectivity will be lower within the online cohort than within the offline cohort of a startup accelerator program.

Finally, we expect that entrepreneurs in the online cohort form more clusters –tightly knit sub-groups that are more densely connected to each other compared to the rest of the cohort. That is because going online changes the opportunity structure for serendipitous encounters and removes large, boundary spanning events (Busch and Barkema, 2020; Weeden and Cornwell, 2020). Social network theory maintains that boundary spanning across organizational clusters is important for knowledge recombination, creativity, and innovation (e.g., Argote and Miron-Spektor, 2011; McEvily and Zaheer, 1999; Stam and Elfring, 2008). Given the uncertainty inherit in early-stage entrepreneurship (Engel et al., 2017), events constitute a fruitful environment for actors to span such boundaries and serendipitously connect with others without a priori knowing the potential value (Busch and Barkema, 2020). For example, Stam (2010) shows that participation in industry conferences enable entrepreneurs to become brokers within their industry's social network. However, if entrepreneurs work from home, they tend to fall back on existing connections instead of making new ones. Yang et al. (2022) show that remote work increases the tendency for employees to interact with their existing network, which highlights the significance of in-person office days for building and strengthening weaker connections. Finally, in empirically elaborating on this idea, Weeden and Cornwell (2020) show that when Cornell university shifted to a hybrid model to curb COVID-19 (i.e., alternating offline and online attendance) and removed large major-spanning classes, student networks became sparser and more clustered because students mostly formed ties with peers in the same field of specialization. By these arguments, we hypothesize:

Hypothesis 2. (H2). Network clustering will be higher within the online cohort than within the offline cohort of a startup accelerator program.

3. Methods and data

3.1. Research setting

We test our prediction within the context of an early-stage university-based accelerator (Kaandorp et al., 2020; Souitaris et al., 2007) that mirrors private accelerators with several months of heavy workloads spread across practical workshops, lectures, mentor sessions, and the general demand of founding and running a new venture. As this specific program has existed for over a decade, those who sign up to join are usually well aware of what is expected of them. Program alumni include a social networking and mentoring platform for retired professionals, expense management software, social networking applications for co-working spaces, IT solutions for musicians to track evolution of their songs, and b2b software to monitor carbon footprint.

Whereas the cohort of 2019–2020 was offered offline, the cohort of 2020–2021 was offered completely online due to the COVID-19 pandemic. This quasi-natural experiment setting provides a unique opportunity to observe differences in peer entrepreneur networks and isolate their source because both cohorts had similar selection criteria and target participant populations, and both kept an identical design with a series of fixed pedagogical elements. The primary distinction between these accelerators was the move from an offline to an online accelerator cohort (see section 3.3 for details).[3]

3.2. Data

Our data are from two different cohorts (offline vs. online cohort) of the same accelerator. Whereas the offline cohort was held in-person and originally used to show how social network ties to cohort peers can facilitate the transfer of entrepreneurial passion (Becker et al., 2023)[4], the online cohort was originally intended to enlarge the original data pool but had to be shifted to an online format due to the COVID-19 pandemic. Each cohort contains four measurement waves taken in six-week intervals. We followed an interactionist approach to generate social network data by instructing entrepreneurs to select cohort members they interacted with across informal social activities[5] (Kleinbaum et al., 2015). In each (undirected) network we coded a tie if either entrepreneur within a dyad mentioned the other entrepreneur as a tie (Stam and Elfring, 2008; Wasserman and Faust, 1994). In line with other social network studies, we used a maximum of 10 names per entrepreneur to report on, with the aim to avoid respondent fatigue (Brace, 2018). The data cover all entrepreneurs who enlisted into the accelerator program and responded to at least two measurement waves[6] (Ployhart and Vandenberg, 2010). The final sample consisted of 161 entrepreneurs in total, of which 89 participated in the 2019/2020 offline cohort and 72 participated in the 2022/2021 online cohort.

3.3. Structural differences between offline and online cohort

Unlike earlier abrupt changes of accelerator programs early in the COVID-19 pandemic (e.g., Ford, 2020; Friedman, 2020), the second accelerator cohort we gathered data from took place several months into the COVID-19 pandemic from September 2020 to January 2021. Additional interviews held with the program managers confirmed that the online accelerator cohort followed the general structure of the offline cohort yet occurred during –and included design changes in response to– the COVID-19 pandemic. While program elements such as participant selection and enrollment remained unaltered, several other design features including the introductory ice breaker event, guest speaker attendance, as well as the demoday were moved online. Finally, given fewer opportunities for direct oversight, the program managers decided to adapt educational elements to ensure entrepreneurs stay on track. Whereas educational content in the offline cohort was delivered across voluntary topic-specific seminars and workshops, in the online cohort content was delivered across weekly coaching sessions to which attendance was mandatory (see Online Appendix A for more details).

3.4. Measures

To offer an overview on network topology, we report the number of entrepreneurs who are part of the *main component*, *network diameter*, and *average geodesic distance*. First, the *main component* describes the maximal set of entrepreneurs in which every entrepreneur can reach every other entrepreneur via any path. Second, *network diameter* represents the shortest distance between the two most distant, yet still (indirectly) connected, entrepreneurs. Third, we calculate the *average geodesic distance* which is the distance between any two random entrepreneurs in the cohort that are directly or indirectly connected (Borgatti

[3] We acknowledge that other pandemic-related factors than the move online might have impacted the patterns of social interactions between people regardless of how accelerators structured their programs. We return to these alternative sources of variation when we discuss the limitations of our approach.

[4] The data collection involving the offline cohort was originally designed for another study (see Becker et al., 2023) that dealt with a different research question, a different set of variables, and different analytical methods. In contrast, the online cohort data is unique to this study and has not been previously published.

[5] Specifically, we collected social network data at each wave by asking with whom in the program participants spent their free time with. Answers were reported with a dropdown menu populated with names from participation records provided by program management.

[6] Across both cohorts, we excluded 22 participants who did not meet this requirement. To test for non-response bias, we compared these 22 cases with the final sample based on demographics measured at Wave 1 (i.e., *sex*, *age*, *education*, and *entrepreneurial experience)*. There were no significant differences between respondents and non-respondents for all measures at enrollment.

et al., 2013). We consider and average only the lengths of existing paths because geodesic distance is technically undefined for unconnected entrepreneurs (i.e., infinite or treated as diameter + 1).

To test for differences in social connectivity (H1) at the level of the network, we follow prior network studies to focus on measures of *network density* and *reach* (e.g., Ahuja, 2000; Hoang and Antoncic, 2003; McEvily and Zaheer, 1999). First, *density* is a measure of connectedness that describes the proportion of potential connections that are actual connections. Second, *reach* delineates the proportion of the cohort that is reachable within a certain number of steps. This statistic is to be interpreted as degrees of separation with $k = 1$ step being a direct connection, $k = 2$ steps a connection of a direct connection and so on (Borgatti et al., 2013). Insofar as reachable network proportions are only descriptive observations, we calculate geodesic k-path centrality scores for each entrepreneur and average these individual scores at the network level for each cohort at each wave (Everett and Borgatti, 1999).[7]

We also measure *clustering* (H2), which represents the number of ties connecting the focal entrepreneur's neighbors divided by the total number of possible ties between these neighbors. A coefficient close to 0 indicates that the relative number of transitive relations involving that entrepreneur is low. A clustering coefficient of 1 indicates that this entrepreneur is involved in all possible transitive relations. We measure the overall level of clustering in the respective cohort networks as the average of clustering coefficients across all entrepreneurs. A network that is highly clustered means that entrepreneurs have a stronger tendency to form cliques or dense local neighborhoods, and therefore have fewer boundary spanning ties (Watts and Strogatz, 1998). For an overview of all demographic and network connectivity measures, we refer to Online Appendix B.

3.5. Analytical approach

Our aim is to estimate the effects of moving to online acceleration across the program duration on network connectivity and clustering. To test our hypotheses, we draw on a series of independent samples *t*-tests to establish differences with regards to network level statistics at each wave and demographics at baseline, respectively.

4. Results

Table 1 captures both accelerator cohorts at enrollment and provides descriptive statistics with regards to the network topology and participants' demographics (upper half) as well as comparative network statistics (lower half). The networks across all four waves – from enrollment to demoday – are depicted in Fig. 1. The red squares in the top panel of Fig. 1 represent entrepreneurs in the offline cohort, the blue circles in the bottom panel represent entrepreneurs in the online cohort. Finally, Online Appendix C shows descriptives (Table C1) and correlations (Table C2) for all variables used in this study.

4.1. Baseline comparison at enrollment

Wave 1, which is based on enrollment data, is different to other studies that compare network dynamics over time (e.g., Assenova, 2020; Uy et al., 2020) in that this baseline data was gathered *after* individual participants signed up but *before* the program started. This is crucial as Wave 1 captures enrollment networks not only as benchmarks within each program (i.e., longitudinal) but also across the offline and online cohorts. That is, because enrollment occurred digitally and in identical fashion for both cohorts, we can safely assume that it is not affected by later program design choices. Further supporting our assumptions about similarities between the programs at Wave 1, the data indicates no cohort-differences along all observable demographic and network measures (Table 1). Both programs seem to have initially attracted comparable sets of entrepreneurs, thus greatly diminishing the risks involved in isolating the effects of differences in the accelerator design choices (offline vs. online) as those came in to play only from Wave 2 onwards.

4.2. Between program comparison

Waves 2–4 data capture the actual accelerator program stretching over 18 weeks.

Several interesting patterns emerge when looking at the network topology for Waves 2–4 (Tables 1 and 2). First, both the offline and online cohort show a spike in connectivity when the program begins (moving from Wave 1 to Wave 2) as indicated by an increase in the numbers of ties, decrease in the number of distinct components, larger proportion of entrepreneurs being connected to the main component, shorter network diameters, and shorter average geodesic distances. Second, while the trend towards increased connectivity strengthens throughout the duration of the offline cohort, it generally declines for the online cohort. Third, these trends are also reflected at the team level. Teams at the onset of both programs were comparably connected, but by the end of the program there is a sharp decline in connectivity for online cohort teams such that, on average, each of these teams was connected to just one other team (in contrast to the offline teams that connected to more than two other teams on average).

With that descriptive pattern as our backdrop, we now turn to formally test network connectivity between programs using measures for density, *k*-step reachability, as well as clustering. These measures appear consistently in extant network research and allow for formal comparison across networks based on statistical inference (e.g., Borgatti et al., 2013; Burg et al., 2021; Snijders and Borgatti, 1999).

4.2.1. Density

The percentage of pairs of entrepreneurs who are connected in one-step (i.e., $k = 1$) is a measure of *network density* (Table 2). That is, entrepreneurs one-step away are directly adjacent and density is defined as the number of observed ties (i.e., adjacent entrepreneurs) divided by the number of possible ties ($n - 1$) across all n entrepreneurs in the network. Entrepreneurs in both the offline as well as the online cohort could reach about five percent of their peers within one step on average, suggesting that direct ties are at first somewhat robust to program design differences. However, in support of Hypothesis 1, we find a decline in connectivity towards the end of the online cohort of the accelerator program at Wave 4. At that point, the offline cohort was denser as compared to the online cohort ($t(158.55) = 2.47$, $p = .007$, $d = 0.380$).[8] This means that at demoday (i.e., Wave 4), the offline cohort connected 5.3% of all entrepreneurs whereas in the online program only 4.2% of connections were realized. While there are no studies measuring network densities of accelerator programs, single-digit densities are a common observation in larger networks such as university -, film school, or software industry networks (e.g., Batjargal, 2010; Ebbers and Wijnberg, 2019; Weeden and Cornwell, 2020).

4.2.2. Reach

As to indirect connections – an indicator of reachability, we find that entrepreneurs in the online cohort could reach fewer of their peers

[7] Note that density and reachability in one step (i.e., $k = 1$ step reachability) are mathematically equivalent because, entrepreneurs one-step away are directly adjacent and density is defined as the number of observed ties (i.e., adjacent entrepreneurs) divided by the number of possible ties averaged across all entrepreneurs in the network.

[8] Alternative testing based on 10.000 non-parametric artificial samples from the observed cohort networks that draws and replaces entrepreneurs at random while keeping the network structure intact (Snijders and Borgatti, 1999) mirrors our results: i.e., Wave 4 t(bootstrap) = 2.48; $p = .016$.

Table 1
Comparison accelerator cohorts at enrollment (Wave 1).

Measures:	Offline		Online		Comparison		
Network Topology							
Number of entrepreneurs	89	72					
Number of ties	94	75					
Components	34	18					
Entrepreneurs in largest component	52.8%	68.1%					
Diameter	12	14					
Geodesic distance	4.043	5.676					
Demographics	*M*	*SD*	*M*	*SD*	*t*(159)	*p*	*d*
Sex	0.74	0.44	0.68	0.47	0.85	.397	0.135
Age (in years)	20.99	1.15	21.15	1.27	−0.86	.393	0.136
Education	0.73	0.45	0.65	0.48	1.06	.291	0.168
Entrepreneurial experience	0.22	0.42	0.24	0.43	−0.19	.853	0.030
H1 *Network Connectivity*	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
Reach							
$k = 1$ (Density)	0.024	0.026	0.029	0.028	$t(159) = -1.23$	.221	0.195
$k = 2$	0.069	0.085	0.075	0.058	$t(155.24) = -0.51$	.609	0.078
$k = 3$	0.127	0.144	0.117	0.091	$t(151.23) = 0.53$	.600	0.078
$k = 4$	0.175	0.184	0.163	0.131	$t(156.61) = 0.47$	.636	0.073
$k = 5$	0.212	0.211	0.231	0.180	$t(158.56) = -0.64$	.525	0.099
H2 Clustering	0.434	0.358	0.382	0.404	$t(77) = 0.60$	.547	0.137

Note: p refers to the p-value obtained from a two-tailed *t*-test*; d* refers to the effect size of the difference (Cohen's *d)*. Given network size differences between the cohorts ($n_{\text{offline}} = 89$ vs. $n_{\text{online}} = 72$), we normalized network measures to ensure comparability (Snijders and Borgatti, 1999; Wasserman and Faust, 1994). For more measurement information on all network and demographic variables, we refer to Online Appendix B.

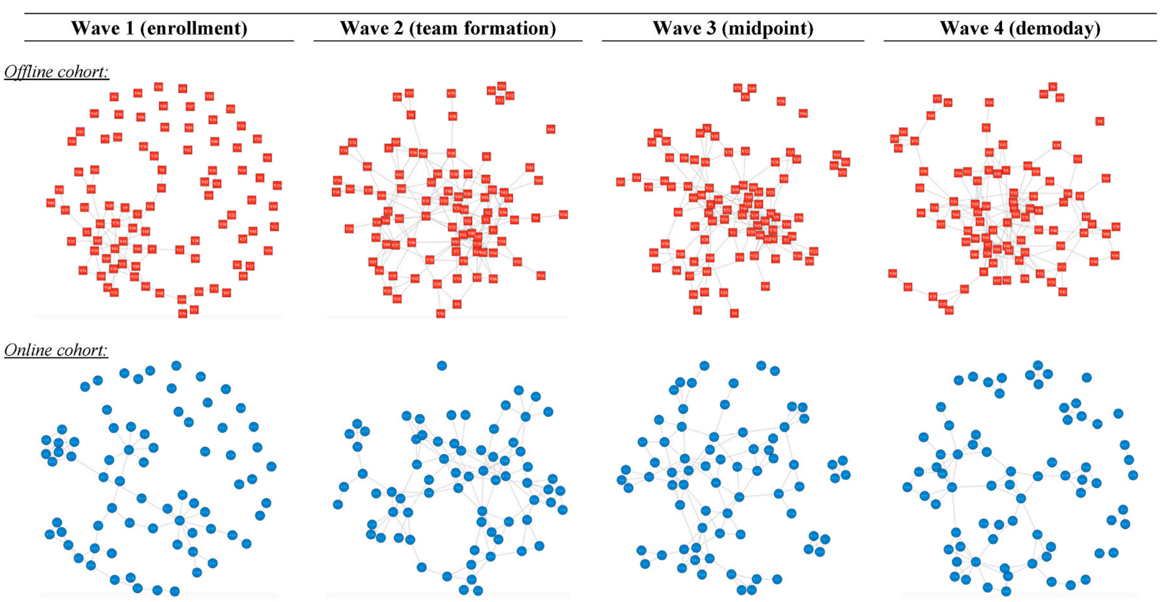

Fig. 1. Peer entrepreneur networks from enrollment to demoday
Note: All nodes (entrepreneurs) are arranged using the Fruchterman-Reingold algorithm in *R v4.0.3* (R Core Team, 2020) utilizing the *igraph v1.2.6* (Csárdi and Nepusz, 2006).

across all waves (see Table 2). This further supports Hypothesis 1. For example, entrepreneurs in the offline cohort could reach 65.5% of their peers within four steps (Wave 4) but entrepreneurs in the online cohort could reach only 27.9% of their peers with the same number of steps ($t(159) = 10.54$, $p < .001$, $d = 1.634$). In other words, when comparing the offline to the online cohort, network reachability was cut in half. With a Cohen's *d* of 1.6, around 95% of entrepreneurs in the offline cohort will be above the mean of the online cohort in terms of indirect connections. Further, there is an 87.5% chance that an entrepreneur picked at random from the offline cohort will have more indirect connections than an entrepreneur picked at random from the online cohort at demoday (Magnusson, 2021). Taken together, entrepreneurs in the offline cohort at Wave 4 can reach out (and obtain resources from) a significantly larger share of their peers by leveraging direct ties and the connections of these direct ties (Kim and Aldrich, 2005).

Table 2
Results offline versus online accelerator cohort (Waves 2–4).

Measures:	Wave 2				Wave 3				Wave 4			
	Offline	Online	Comparison		Offline	Online	Comparison		Offline	Online	Comparison	
Network topology												
Number of entrepreneurs	89	72			89	72			89	72		
Number of ties	211	139			215	129			209	109		
Components	3	2			5	4			3	9		
Entrepreneurs in largest component	94.4%	98.6%			89.9%	86.1%			95.5%	66.7%		
Diameter	8	9			8	9			11	10		
Geodesic distance	3.423	4.110			3.460	3.926			3.735	3.970		
H1 *Network connectivity*	Offline	Online	*p*	*d*	Offline	Online	*p*	*d*	Offline	Online	*p*	*d*
Reach												
$k = 1$ (Density)	0.053	0.054	.528	0.011	0.054	0.050	.152	0.158	0.053	0.042	**.007**	0.380
$k = 2$	0.204	0.171	**.031**	0.286	0.192	0.137	**.001**	0.478	0.202	0.103	**< .001**	0.910
$k = 3$	0.475	0.366	**< .001**	0.526	0.421	0.302	**< .001**	0.563	0.452	0.187	**< .001**	1.372
$k = 4$	0.713	0.592	**< .001**	0.541	0.627	0.478	**< .001**	0.598	0.655	0.279	**< .001**	1.634
$k = 5$	0.836	0.760	**.009**	0.371	0.750	0.613	**< .001**	0.525	0.772	0.356	**< .001**	1.738
H2 *Clustering*	0.481	0.451	.710	0.093	0.555	0.606	.185	0.148	0.501	0.610	**.031**	0.315
Team network	Offline	Online	*p*	*d*	Offline	Online	*p*	*d*	Offline	Online	*p*	*d*
Number of teams	33	21			33	21			33	21		
Average team degree	2.788	2.238	.204	0.233	2.485	1.619	.059	0.445	2.546	1.00	**< .001**	0.986

Note: p refers to the *p*-value obtained from a one-tailed *t*-test; *d* refers to the effect size of the difference (Cohen's *d*). Bold indicates significance at $p \leq .05$. For more measurement information on all network and demographic variables, we refer to Online Appendix B. Please see Tables D.1 – D.2 in Online Appendix D for full results including test statistics and robustness tests including two-tailed *t*-tests, respectively.

4.2.3. Clustering

We find no significant differences in clustering between the offline and the online cohort at Wave 2 ($t(142) = 0.553$, $p = .710$, $d = 0.093$) and Wave 3 ($t(147) = -0.90$, $p = .185$, $d = 0.148$). However, at Wave 4, in partial support of Hypothesis 2, the online cohort appears significantly more clustered than the offline cohort $t(143) = -1.87$, $p = .031$, $d = 0.315$. In other words, while we determined clustering for the online and offline cohort at enrollment as [$M = 0.43$ ($SD = 0.36$) and $M = 0.38$ ($SD = 0.40$)], respectively, suggesting a moderate tendency toward concentration of ties, clustering in the offline cohort increased by 16.3 percent to [$M = 0.50$ ($SD = 0.34$)] at Wave 4, whereas there was a substantial decrease in the proportion of connections spanning clusters in the online cohort as indicated by a 60.5 percent increase of the clustering coefficient to [$M = 0.61$ ($SD = 0.36$)]. More clustering at Wave 4 indicates that in the online cohort, entrepreneurs are exposed to a higher share of redundant information as the network exhibits more structural holes and less network closure as compared to the offline cohort (Burt, 1995; Granovetter, 1973).

4.3. Robustness testing

We have undertaken several steps to further examine the robustness of our analytical approach.[9] First, we added several covariates to our model: sex, age, education, and entrepreneurial experience, controlling for their effects statistically at each wave using regressions (see Tables D.3 – D.6 in Online Appendix D). Second, to further mitigate potential biases related to the selection process between the offline (control) and online (treatment) cohorts of the accelerator, we employed coarsened exact matching (Iacus et al., 2012). Leveraging our extensive array of pre-treatment confounders and a local sample of entrepreneurs (Brown et al., 2023), we matched entrepreneurs based on sex, educational background, entrepreneurial experience, and age) (e.g., Hallen et al., 2020; Pahnke et al., 2015). In total, we identified 55 entrepreneurs in the offline cohort that matched 55 entrepreneurs in the online cohort exactly, yielding a final sample size of 110 entrepreneurs. Results of follow-up regressions using this matched sample, are reported in Table D.7 and Figure D1 of Online Appendix D. Third, we applied panel regressions estimating the interaction between cohort (offline vs. online) and wave (see Table D.8 in Online Appendix D). Across all these specifications, our results are largely consistent with our main findings, providing more support for our conclusions.

Finally, we also evaluated network connectivity at the team level by determining team degree as the number of other teams connected to a focal team (Freeman, 1978). We coded a tie between teams when we observed at least one connection between at least two entrepreneurs on their respective teams. We find no significant differences between offline and online at Wave 2 ($t(52) = 0.83$, $p = .204$, $d = 0.233$). At Wave 3 differences become clearer but not yet statistically significant at the 5% level ($t(52) = 1.59$, $p = .059$, $d = 0.445$). However, at Wave 4, teams in the online cohort had significantly fewer ties to other startup teams [$M = 1.00$ ($SD = 1.05$)], compared to teams in the offline cohort [$M = 2.55$ ($SD = 1.95$); $t(50.86) = 3.77$, $p < .001$, $d = 0.986$]. Together, these results –which are also robust to the larger team network size in the offline cohort (e.g., Wave 4: $t(52) = 1.83$, $p = .037$, $d = 0.510$) (see lower section of Table 2)– point in the same direction as our main anaylsis.

5. Discussion

In this study, we compared peer entrepreneur networks within an acceleration program before and during the COVID-19 pandemic, which necessitated a design shift from offline to online acceleration. Despite suggestions in the literature that (new) digital communication and collaboration tools may facilitate networking activity (Zahra et al., 2022; Chan et al., 2022; Caccamo and Beckman, 2022), we argued that online (compared to offline) accelerator programs hamper the development of peer entrepreneur networks due to the lack of physical proximity (Roche et al., 2022) and weaker interaction rituals (Krishnan

[9] We thank an anonymous reviewer for suggesting this approach.

et al., 2022).

Consistent with our hypotheses, we found that social connectivity decreased and network clustering increased within an online cohort, in comparison to its offline counterpart. For instance, entrepreneurs within the offline cohort exhibited social connections with peers across twice as many startups compared to their counterparts in the online cohort—-even after adjusting for differences in cohort sizes (see lower panel of Table 2). Based on our results, the chance that an entrepreneur picked at random from the offline cohort will be better connected in two steps than the average entrepreneur participating in the online cohort is 74%.[10] Notably, despite no significant differences at enrollment, this connectivity deficit became more pronounced as the accelerator program progressed over time. Thus, we found that entrepreneurs in the online cohort formed significantly more clustered network structures compared to entrepreneurs in the offline cohort, with a 21.76% increase in clustering observed at Wave 4. The drop in network density we documented at Wave 4 also meant that entrepreneurs in the online cohort had about 21% fewer connections than those in offline cohort (i. e., a drop from 5.3% to 4.2% at Wave 4).

So what? Why is it important to know more about factors associated with peer network connectivity in accelerators? These results matter first and foremost because intra-cohort tie formation is a sought-after outcome of accelerator design (e.g., Chatterji et al., 2019; Del Sarto et al., 2022; Hasan and Koning, 2019) and since scholars wildly agree that resources accessed via peer entrepreneur networks in accelerators (e.g., knowledge, advice, feedback, referrals, and emotional support) are key to unlocking faster learning and development, and ultimately, venture performance (Cohen et al., 2019; Hallen et al., 2020). Indeed, prior research has firmly established that peers in entrepreneurship program are indispensable for entrepreneurial learning (e.g., Cohen et al., 2019), social support (e.g., Krishnan et al., 2022), and contracting (e.g., Ebbers, 2014). Building on these studies of the relationships between peer networks and relevant firm-level outcomes, our study delves deeper into the antecedents of peer networks in accelerators, specifically examining the timely question of how switching from offline to online acclerator design affects patterns of intra-cohort tie formation. Below, we further unpack several theoretical and practical contributions, discuss the limitations of our work, and outline opportunities for future research.

5.1. Theoretical contributions

We make contributions to the burgeoning literature on startup accelerators (e.g., Cohen and Hochberg, 2014; Del Sarto et al., 2022; Woolley and MacGregor, 2021). We first add to this research by investigating the structural social capital embedded in these programs longitudinally (Bergman and McMullen, 2021). Especially within research on peer effects within accelerators, social networks are typically mentioned but not empirically measured (e.g., Cohen et al., 2019; Hallen et al., 2020; Han and Eesley, 2023). Unlike studies that highlight “network constructs rather than the theories underpinning network-based research” (Hoang and Antoncic, 2003, p. 172), we regard the (peer) network as a dependent variable (Slotte–Kock and Coviello, 2010). Our findings indicate that both types of accelerator programs –offline (in-person) and online (digital)– facilitate the development of peer entrepreneur networks at first. Given that many of the benefits attributed to accelerators accrue via within-cohort connections among peer entrepreneurs (e.g., Avnimelech et al., 2021; Hallen et al., 2020), our approach illuminates how such networks develop and to what extent they develop differently when the program operates offline or online.

Second, by showing that social connections between cohort entrepreneurs are an expression of how the design of an accelerator program gives opportunity to form social connections, we contribute to the strand of literature on virtual entrepreneurship programs more specifically (e.g., Felzensztein et al., 2010; Grimaldi and Grandi, 2005; von Zedtwitz and Grimaldi, 2006). Programs such as incubators, and more recently accelerators, have begun to incorporate online modes of operation (Ford, 2020; Nowak and Grantham, 2000), a trend that accentuated under COVID-19 (Giones et al., 2020) and is likely to remain relevant well beyond the pandemic (Mascarenhas, 2020; Shepherd, 2020). To be conducive to development of social capital, entrepreneurship programs must facilitate social interaction among peer entrepreneurs (Krishnan et al., 2022; van Rijnsoever, 2020). Digital innovations (e.g., online education, online mentoring) have been heralded for creating a form of digital closeness and remote social connection (Nambisan, 2017; Scheidgen et al., 2021; von Briel et al., 2018) because underlying digital technologies can facilitate peer networking by removing physical constraints, lowering communication costs, and creating ‘virtual embeddedness’ (Rippa and Secundo, 2019; Morse et al., 2007). Our study identifies a boundary condition to these ‘rosy’ expectations as we found a less dense and more clustered network configuration in the online compared to the offline cohort. As such, a spatially remote way of acceleration does not seem to deliver all the benefits of in-person accelerators. At least in terms of social capital, online accelerators also have a ‘dark side’ that is not sufficiently mitigated by digital innovation and has yet to capture enough scholarly attention (Caccamo and Beckman, 2022; Chan et al., 2022).

In addition, by removing co-location and moving planned social events (e.g., introduction week, icebreakers, and social mixers) online, accelerators offer lower chances for cohort members to “recognize their common fate as entrepreneurs” (Krishnan et al., 2022, p. 43). Because new connections involve uncertainties that may only be resolved after repeated interactions (Nahapiet and Ghoshal, 1998), fewer opportunities to interact with peers, undermine bonding rituals and associated identification processes that rely on constant renewal through observation (Collins, 2004). By contrast, when entrepreneurs have ample opportunity to observe and interpret each other’s behavior and gauge non-verbal communication, particularly about emotions, cooperation, and trustworthiness, they ultimately strengthen their relationships (Podolny, 1994; Storper and Venables, 2004). More frequent encounters in offline accelerators, in that sense, act as the spark that lights the fire of reciprocity (Engel et al., 2017). Research on incubators and accelerators, consistently shows that the closer entrepreneurs are situated in space, the higher the likelihood of tie formation because closeness increases the chance of (often serendipitous) social interaction (e.g., Busch and Barkema, 2020; Nijssen and van der Borgh, 2017; Roche et al., 2022).

5.2. Practical implications

Our findings have practical implications for entrepreneurship support programs such as accelerators or incubators (Bergman and McMullen, 2021) and the entrepreneurs who are participating in them (Woolley and MacGregor, 2021). While no one is questioning whether accelerators can operate online, there are many questions about how they may do so more effectively. Our findings point to the need for accelerators to find solutions to buffer against the negative effects of online programs on peer entrepreneur networks.

First, although our empirical findings show that at the start of the program network connectivity in the offline and online accelerator cohort were similar, in the online cohort network connectivity declined significantly over time. At the start of the program, serious effort around digital social activities and breakout rooms (see Online Appendix A) had entrepreneurs in the online cohort form new connections to an extent that was comparable with new connections in the offline cohort. However, as network connections between peer entrepreneurs in online accelerators decline faster, as the program unfolds, program managers may need to dedicate more time and effort to facilitate the maintenance

[10] Based on the mean difference of reach in 2-steps observed at Wave 4 corresponding to a Cohen’s d of 0.910 (see Magnusson, 2021 for formulas and calculations).

or re-activation of ties between participating entrepreneurs. For example, by organizing additional (online) social events after initial icebreakers, or by establishing a cohort-based community for sharing news and updates about the startup's activities throughout the program (e.g., Cohen et al., 2019).

Second, over time, the online cohort became more clustered. Therefore, accelerator managers should consider how to make the knowledge embedded in disconnected clusters available to the broader cohort. For instance, by recognizing the value of random encounters and how online interaction might limit them, accelerators can try to create boundary spanning events (e.g., Burt, 2004; Busch and Barkema, 2020) by either going hybrid (i.e., offer selected social events in person) or implement technological applications such as Coffee Roulette (https://coffee-roulette.com) to randomly connect peer entrepreneurs and create shorter paths within the cohort. In addition, by closely examining the social networks of entrepreneurs embedded in their programs, accelerators could play a more proactive role as network brokers by connecting entrepreneurs who they believe might benefit from each other (Obstfeld, 2005) or by introducing particularly well-connected entrepreneurs to clusters of unconnected peers (Weeden and Cornwell, 2020). Perhaps these, or comparable tools and strategies, can be drawn upon to offset some of the strain online designs have put on peer entrepreneur networks.

Finally, our study also has implications for entrepreneurs who have to decide between a plethora of support programs including organized peer networks (e.g., Ho and Pollack, 2014), incubators (e.g., van Rijnsoever, 2020), accelerators (e.g., Cohen et al., 2019) as well as their digital imitators (Carayannis and von Zedtwitz, 2005; von Zedtwitz and Grimaldi, 2006). In selecting between these alternatives, entrepreneurs compare the expected value each of these programs offers (Hallen et al., 2020; Schwartz, 2013). Using a network lens might help to delineate between different programs and therefore aid a more optimal selection considering one's background, goal and ambitions. For instance, given our findings that offline acceleration offers stronger peer entrepreneur networks, entrepreneurs with underdeveloped networks (e.g., nascent vs. experienced/serial entrepreneurs) may be better advised to opt for offline programs than online programs (Hallen, 2008).

5.3. Limitations and future research

This study has some limitations as well as suggestions for future research. First, we set out to empirically study differences in peer network structures between offline and online accelerator programs in depth and over time, from enrollment to demoday. With the data we collected for that purpose we cannot assess how differences in network connectivity affect individual entrepreneurial performance or startup performance. Mitigating these concerns would require not only a sufficient breadth of performance metrics given that entrepreneur's ambitions and startups' industries varied considerably (Eveleens et al., 2017; Wiklund and Shepherd, 2003) but also more extensive longitudinal data that follows startups for several years post-acceleration (Yu, 2020). Although evidence in prior studies points to the performance benefits of better-connected entrepreneurial peer networks within entrepreneurship programs that include learning, resource exchange, and startup survival (e.g., Bøllingtoft, 2012; Cohen et al., 2019; Hasan and Koning, 2019), future studies could contrast matched samples of startups that participated in online versus offline accelerators on networks- and performance data at fixed intervals after graduation.

Second, there are limitations related to how we generated social networks in this study. In line with other network studies, we followed a binary approach by assessing if a connection between peer entrepreneurs was present (e.g., Kleinbaum et al., 2015; Stam and Elfring, 2008). However, considering specific services and activities provided by the accelerator (Cohen et al., 2019), a more nuanced approach might also capture the modality of the networks that transpire (e.g., whether the relationship included explicit contracting, exchange of feedback, emotional support). For example, it might be that informal gatherings are better suited to facilitate friendship formation whereas formal events might be more conducive to the formation of collaboration networks. Moreover, next to lower network connectivity, entrepreneurs may have also connected differently due to the artificial character and technical challenges associated with contact via digital means alone (Lewandowski et al., 2011). Instead of measuring *if* the shift to online accelerators affects social networks, future research could therefore qualitatively assess *how* online networks are different, and *how* potential negative effects might be mitigated.

Finally, the COVID-19 pandemic has undoubtedly disrupted many aspects of entrepreneur's social, emotional, and economic lives that it might have impacted peer entrepreneur networks beyond the specific accelerator design change from an offline to an online cohort. For example, entrepreneurs experienced financial pressure from reduced sales, but also uncertainty related to managing staff and relationships to key partners and investors who are equally engaged in adopting to COVID-19 (e.g., Kuckertz et al., 2020). Therefore, we cannot exclude the possibility that resulting uncertainty and anxiety extended into the accelerator setting and affected networking either independently or in conjunction with the effect of moving the accelerator online. However, considering the well-documented constraints on peer-to-peer interaction in educational online environments even prior to the pandemic (e.g., Shu and Gu, 2018), as well as the consistent findings emerging from recent research that distinguishes the impact of remote work from other pandemic-related factors on employees' collaboration networks (e.g., Yang et al., 2022), we assert that the transition to an online accelerator, as a deliberate design change rather than solely driven by the pandemic, is the main factor influencing the observed effects on network connectivity.

6. Conclusion

In response to the COVID-19 pandemic, startup accelerators shifted their programs online. We studied how this move has impacted peer entrepreneur networks by comparing longitudinal network data of two consecutive cohorts of the same startup accelerator. We find lower connectivity and higher clustering in the online (compared to the offline) program. This highlights the negative impact of "going online" on the formation and growth of these valuable peer networks, which rely on physical proximity, in-person events, serendipitous encounters, and social interactions for network formation and resource exchange.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.technovation.2023.102917.

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