

Interorganizational Learning Between Knowledge-Based Entrepreneurial Ventures Responding to COVID-19

Abstract

Purpose: The COVID-19 crisis has significantly affected entrepreneurial ventures, where knowledge resources are limited and contextual uncertainty is heightened. This paper aims to identify if and how interorganizational learning (IOL) may assist entrepreneurial ventures adapt, survive and grow in a crisis.

Design/methodology/approach: The following research question is asked: How may responding to the adversity induced by the COVID-19 pandemic affect IOL between entrepreneurial ventures? Four hypotheses were developed to carry out a quantitative study of 228 knowledge-based entrepreneurial ventures in Norway.

Findings: The results illustrate how different combinations of adversity from COVID-19 and the active responses conducted by entrepreneurial ventures influence IOL. Four clusters representing different behaviors are developed accordingly: “Collaborators,” “Supporters,” “Responders,” and “Victims.” The findings provide empirical support for the importance of engaging in interactive and collaborative activities for IOL.

Research limitations/implications: The findings can help in understanding how COVID-19 influences IOL between entrepreneurial ventures. Policymakers may utilize these findings to promote organizational continuity in entrepreneurial ventures by creating and nurturing support systems that promote IOL during a crisis.

Originality: Studying a contemporary and critical situation—the COVID-19 pandemic—the present paper provides an empirical study of the antecedents to IOL, adding to the currently scarce body of research on IOL in and between entrepreneurial ventures.

Keywords: Interorganizational learning; COVID-19; coronavirus; startups; quantitative

Paper type: Research paper

Introduction

Learning is an essential process in any organization (Chou and Ramser, 2019), and the concept of organizational learning describes how organizations develop their activities, capabilities, and knowledge in a rapidly changing environment (Örtenblad, 2018). As Lane and Lubatkin (1998) stated, a firm's capabilities depend on interactive learning, and frameworks for how organizational learning occurs through interactions at the individual, team, organizational, and interorganizational levels have been developed over the last few decades (Anand *et al.*, 2020). Learning not only occurs within firms but also across firm boundaries via business networks (Eiriz *et al.*, 2017; Peronard and Brix, 2019) and partnerships (Choi *et al.*, 2019). The growing interest in *interorganizational learning* (IOL) has fueled a better understanding of how firms leverage and involve other organizations in their learning process and how knowledge is cocreated by interacting organizations (Anand *et al.*, 2020; Easterby-Smith *et al.*, 2008; Mariotti, 2012).

Whereas previous research on IOL has primarily focused on established and/or larger organizations (Brockman, 2013), all organizations were once new (Yang and Aldrich, 2017). There are particular learning processes unfolding during the emergence of nascent organizations, including *entrepreneurial ventures* (Brockman, 2013); these ventures face high uncertainty combined with knowledge and resource scarcity, making them highly dependent on learning with and from external actors to adapt, survive, and grow (Dutta and Crossan, 2005; Franco and Haase, 2009; Jones and Macpherson, 2006). Hence, studying entrepreneurial ventures' IOL is appropriate and relevant for advancing the IOL field.

Research on learning in entrepreneurial ventures has emphasized how entrepreneurs learn by responding to critical events through the process of developing and managing the venture (Cope, 2003; Haneberg, 2019). Although such events are indeed venture specific, events such as the lockdowns following the COVID-19 pandemic have likely affected entrepreneurial ventures globally (Kuckertz *et al.*, 2020). Entrepreneurship is certainly not business as usual during a major crisis (Doern *et al.*, 2019), and most entrepreneurial ventures do not have the knowledge, routines, resources, and bargaining power required to cope with adversity (Doern, 2016; Smallbone *et al.*, 2012). Rather, the crisis may amplify the dependence of entrepreneurial ventures to learn from and with external actors, for instance, customers, suppliers, and investors (Bruneel *et al.*, 2010). Here, IOL enables the transfer and cocreation of strategies to survive a crisis. Thus, responding to the COVID-19 pandemic is a highly important and interesting context in which to study this topic, leading to the following research question: *How may responding to the adversity induced by the COVID-19 pandemic affect IOL between entrepreneurial ventures?*

The present paper builds on previous research on IOL related to entrepreneurial ventures through networks and interactions (Bruneel *et al.*, 2010; Leung *et al.*, 2019; Peltier and Naidu, 2012), for example, as part of business incubators (Fang *et al.*, 2010; Wu *et al.*, 2020). The current paper also relates to entrepreneurial learning (Nogueira, 2019) and previous research on entrepreneurship in crises; it focuses on *knowledge-based* entrepreneurial ventures as a

particularly important type of entrepreneurship, representing the sources of innovation, economic development, and employment (Hayter, 2013).

The current paper contributes via an empirical study, hence adding to the scarce body of research on IOL in and between entrepreneurial ventures. Focusing on the critical situation that COVID-19 has imposed, the findings have utility for policymakers when it comes to understanding how the pandemic influences entrepreneurial ventures. The next section introduces the literature and develops four hypotheses. Thereafter, the methods section describes the quantitative empirical study of 228 knowledge-based entrepreneurial ventures in Norway. The results are then presented and discussed, followed by the conclusion.

Theoretical Background

Several recent contributions in the field of IOL have already provided overviews of this topic (Anand *et al.*, 2020; Manuj *et al.*, 2013; Rajala, 2018); thus, the focus here is to extend the established research on IOL to address IOL in entrepreneurial ventures.

Interorganizational Learning

Anand *et al.* (2020) provided a comprehensive review of research on IOL, pinpointing how scholarly interest in IOL has seen a surge in recent years. IOL can be defined as “*learning between organizations where there is (initially) a low degree of interdependency*” (Holmqvist, 2003, p. 102). According to Lane and Lubatkin (1998), IOL may develop through passive, active, and interactive processes. The former two are often considered through dyads of “student organizations” and “teacher organizations,” where the former learn from the latter, for instance, through observation and modeling (Huber, 1991). However, in interactive learning, roles are often more equal, where complex and tacit knowledge is cocreated by two or more collaborators (Peronard and Brix, 2019). Thus, IOL can be both learning *from* and learning *with* (collaboration, cocreation) other organizations (Larsson *et al.*, 1998). Although IOL is different from *intraorganizational* learning, an organization must be able to internally transform learning from or in collaboration with other organizations to benefit from IOL (Holmqvist, 2003; Jones and Macpherson, 2006).

The absorptive capacity of an organization (i.e., the ability to acquire, assimilate, and exploit knowledge, cf. Cohen and Levinthal (1990)) is essential for IOL (Lane and Lubatkin, 1998), as is exhibiting receptiveness and transparency toward another organization to complement existing knowledge with knowledge developed through IOL (Holmqvist, 2003; Jones and Macpherson, 2006; Larsson *et al.*, 1998). Beyond organizational abilities and characteristics as well as mutual dependence, formalization, and the joint learning capacity of partners and in alliances (Choi *et al.*, 2019; Janowicz-Panjaitan and Noorderhaven, 2008; Fredrich *et al.*, 2019), a fundamental aspect of IOL is that it depends on and facilitates the real activities and interactions by the involved parties (Eiriz *et al.*, 2017; Peronard and Brix, 2019). Through reinforcing the connection between organizational ambidexterity (cf. March, 1991) and organizational learning, Brix (2019) conceptualized how, for example, knowledge from the exploitative activities of an organization may facilitate the explorative learning of another

organization and vice versa. Hence, the abilities and characteristics of organizations (i.e., entrepreneurial ventures) and their collaborations (Fredrich *et al.*, 2019)—as well as the real activities and interactions taking place, influence eventual IOL processes.

The specific benefits and effects of IOL have been investigated (Anand *et al.*, 2020; Rajala, 2018), including organizations' capability to innovate (Olsson *et al.*, 2010), as well as different performance measures at the firm and collaboration levels (Kruckenberg, 2015; Manuj *et al.*, 2013; Pratono *et al.*, 2019; Seo, 2020). Importantly, given the focus of the present paper, IOL enables learning from the successes, failures, and everyday practices of other organizations (Leung *et al.*, 2019) with the aim, for example, of acquiring knowledge of new customers and markets (Bruneel *et al.*, 2010).

Interorganizational Learning in Entrepreneurial Ventures

There is only a small body of research referring explicitly to IOL and entrepreneurial ventures. However, learning does have a central role in entrepreneurship research; Cope (2005) stated that entrepreneurship *is* learning. The research field on *entrepreneurial learning* emerged to understand how entrepreneurs develop their ventures through learning (Deakins and Freel, 1998), and entrepreneurial learning can be considered organizational learning in the early stages of an organization (Haneberg, 2019). Scholars have increasingly acknowledged the influence of social interactions with other entrepreneurs (Nogueira, 2019) and the social context in which learning occurs (Davidsson and Honig, 2003; Karataş-Özkan, 2011; Taylor and Thorpe, 2004). As with IOL (cf. Jones and Macpherson, 2006), entrepreneurial learning occurs between the members within an entrepreneurial venture (El-Awad *et al.*, 2017) and across entrepreneurial ventures, for example, through social networks (Saunders *et al.*, 2014; Scarmozzino *et al.*, 2017), influencing the process of developing an entrepreneurial venture (Soetanto, 2017). Entrepreneurs learn from observing their peers (Miller, 2012) and others' experiences (Lévesque *et al.*, 2009), as well as through interactive collaboration (Seet *et al.*, 2018) and shared practices (Lefebvre *et al.*, 2015). Moreover, entrepreneurs are active in providing social support for other entrepreneurs as part of their learning process (Mansoori, 2017).

The studies that explicitly refer to IOL also emphasize the importance of entrepreneurs' networks and participation in network activities. Bruneel *et al.* (2010) showed how IOL that unfolds through interactions with key partners, such as customers, suppliers, and investors, can be a substitute for prior experiential learning when entrepreneurial ventures internationalize. Financial resources are often crucial, and Pina-Stranger and Lazega (2011) found how shared personal relationships with venture capital investors were important for IOL. Entrepreneurs' IOL practices can develop over time based on the changing needs of their ventures (Peltier and Naidu, 2012), and a few studies have also pointed to the formal structures that facilitate entrepreneurial ventures' IOL: Leung *et al.* (2019) studied industry peer networks as a specific way of facilitating entrepreneurial ventures' learning from others, illustrating how IOL occurs by combining cooperation and competition between firms in industry peer networks. Fang *et al.* (2010) and Wu *et al.* (2020) studied IOL facilitated by business incubators and how

arrangements in business incubators support IOL internally between tenants, as well as with external actors.

Entrepreneurship and Interorganizational Learning in Crises

A cornerstone of the present paper is how contexts of crisis, such as the COVID-19 pandemic, may induce adversity for entrepreneurial ventures and impact IOL. Building on existing insights, four hypotheses are formulated.

There are several definitions of crises (Herbane, 2010); Doern (2016) described them as low-probability events with severe consequences for individuals, organizations, and society. They can include economic and financial crises (Laskovaia *et al.*, 2019; Williams and Vorley, 2014), natural disasters (Corey and Deitch, 2011; Martinelli *et al.*, 2018), agricultural crises (Irvine and Anderson, 2004), and riots (Doern, 2016). Studies have stressed that entrepreneurial ventures often face more severe consequences compared with larger companies because they lack the resources and procedures to take deliberate action (Doern, 2016), making them more vulnerable (Corey and Deitch, 2011; Irvine and Anderson, 2004). Nevertheless, some entrepreneurial ventures are flexible and can adapt quickly to new situations (Doern *et al.*, 2016); hence, different ventures will be affected differently by the same crisis (Smallbone *et al.*, 2012). In that sense, the crisis-induced adversity will vary depending on the abilities, characteristics, and activities of the ventures. Research has shown how entrepreneurs leverage interactions in social networks as sources of important resources and knowledge to respond to crises (Kwong *et al.*, 2019; Muñoz *et al.*, 2019), in addition to knowledge already acquired through the venture's experiences (Smallbone *et al.*, 2012). Wu *et al.* (2020) found that the effect of social networks in business incubators was stronger in situations of dynamism and uncertainty, both of which a crisis represents. Hence, crises can perhaps motivate, or even force, organizations to choose to open up and be receptive to learning from and with other organizations (Peronard and Brix, 2019); this leads to the first hypothesis:

Hypothesis 1: Higher crisis-induced adversity positively affects IOL.

The literature on IOL pinpoints how activities and interactions, such as active responses to crisis, within and between organizations are essential for IOL to occur (Brix, 2019; Peronard and Brix, 2019) and for action and learning in entrepreneurial ventures generally (Haneberg, 2019; Lefebvre *et al.*, 2015). Thus, a second hypothesis is formulated:

Hypothesis 2: Higher degrees of active responses to crisis positively affect IOL.

Because the literature identifies that there are differences both in terms of how entrepreneurial ventures are affected by crisis and their eventual IOL processes, some nuances can be added to hypotheses 1 and 2, leading to a third hypothesis acknowledging that the relationship between crisis-induced adversity and active responses may be nonlinear:

Hypothesis 3: Different modes and combinations of crisis-induced adversity and active responses affect IOL differently.

The importance of social networks appears as a common line throughout the literature on IOL, entrepreneurial learning, and entrepreneurship in crises. A good number of studies has focused on the nature and value of resources that individuals and firms can access through social ties (cf. Granovetter, 1985; Krackhardt, 1992), and social networks have gained considerable emphasis in the entrepreneurship literature (Greve and Salaff, 2003; Soetanto, 2017). The different types of social relationships and degrees of social embeddedness may have different roles for the activities, interactions, and learning processes of entrepreneurial ventures. Interpersonal and less formal relations between ventures in knowledge-intensive industries have been shown to facilitate IOL (Pina-Stranger and Lazega, 2011), while social embeddedness and networks can also be facilitated through organized mechanisms, such as taking part in business incubators (Fang *et al.*, 2010; Wu *et al.*, 2020) or industry networks (Leung *et al.*, 2019). Because social networks may have a role in how entrepreneurial ventures develop effective strategies and tactics (Peltier and Naidu, 2012), it is relevant to account for how participation in different types of social networks can influence the relationship between crisis-induced adversity, active responses, and IOL. Hence, a fourth hypothesis is included:

Hypothesis 4: Participation in formal or informal social networks positively affects IOL.

Methodology

Research Context

The empirical part of the research was conducted in the late spring of 2020 in Norway. Norway is a small, open economy in northern Europe, and despite strong entrepreneurial activity, entrepreneurial ventures in Norway are less international and less privately financed compared with those in other Nordic countries (Acs *et al.*, 2015). Experiencing rapid increases in COVID-19 infections, the Norwegian society went into lockdown on March 13, 2020, resulting in an abrupt halt to many economic activities.

Sample and Data Collection

A total sample of 4,854 knowledge-based entrepreneurial ventures was retrieved from a database of registered firms in Norway. Although there is a lack of clear and standardized definitions of knowledge-based entrepreneurial ventures as such because definitions of, for example, “nascent firm,” varies depending on the industry, some attributes include being a recently established entity, applying knowledge or technology as a primary instrument for commercial activity, and being a small but growing firm in terms of the number of employees (Hayter, 2013; Storey and Tether, 1998). The data were limited to companies established between 2013 and 2017 that belonged to one of the following level-2 NACE codes¹ corresponding to knowledge-based products or services: “Computer programming, consultancy and related activities” (62), “Architectural and engineering activities; technical testing and analysis” (71), “Scientific research and development” (72), and “Other

¹ Statistical Classification of Economic Activities in the European Community, Rev. 2 (2008).

professional, scientific and technical activities” (74). Email addresses for the firms’ contact persons (the registered general manager and/or owner of the firm) were retrieved along with the registered number of employees, founding year, and financial records from the latest available year (2018 at the time of writing). The financial records enabled the exclusion of firms with no activity (e.g., in terms of costs, revenues, or employees), which increased the quality of the dataset. Among the 4,854 firms, 1,531 were registered with a valid email address, and they were sent an online questionnaire. Complete answers were received from 282 firms (18.4%) during a one-week period in mid-May. The questionnaire asked for the founding year and the number of employees to validate the initial sampling criteria; firms that reported as being less than three (to have access to financial records) or more than seven years old and/or those with more than 30 employees were excluded (to align with the overall notion of knowledge-based entrepreneurial ventures and relevant policy guidelines²). The final sample consisted of 228 knowledge-based entrepreneurial ventures; the sample was tested for representativeness of the total population of 4,854 firms in terms of the firms’ earnings before interests, taxes, depreciations and amortizations (EBITDA; as a measure of profitability), total salary costs (as a measure of activity), and level-2 NACE code (as a measure of business area), firm age, and employee number. The analysis only showed significant differences between the total population and final sample in firm age, where the mean in the final sample was about half a year older than that of the total population. This is well within the sampling criteria of firms three to seven years old and does not conflict with the focus on entrepreneurial ventures. Although a higher response rate would indeed increase the statistical power, the response rate is deemed sufficient in studies of entrepreneurial ventures (Rutherford *et al.*, 2017), and the representativeness tests further suggest that the response rate is acceptable.

Measures

The questionnaire items were developed based on the literature background and collected the three following groups of independent variables: crisis-induced adversity, active responses, and social networks. Crisis-induced adversity was measured using five items asking the following: “*In which way has the firm been influenced by the corona situation regarding ... (1) the development of products and services, (2) marketing and sales to existing customers, (3) marketing and sales to new customers, (4) financial situation, and (5) development of the organization through employees and competence?*” A 7-point Likert scale was used (1=very negatively, 7=very positively). In the operationalization of the variable, the scale was flipped so that an increasing value corresponded to an increase in crisis-induced adversity. Strong correlation between items (2) and (3) were found and the two were merged. Active responses were measured using four items outlining the different types of intra- and interorganizational activities (cf. Mariotti, 2012). The questionnaire asked respondents to evaluate the following statements: (1) “*The firm is doing/planning responses based on prior experiences,*” (2) “*The firm is doing/planning responses based on observations and/or experiences of other firms’ responses,*” (3) “*The firm is doing/planning responses in collaboration with other firms,*” and (4) “*The firm supports other firms in their responses.*” A 7-point Likert scale was used (1=strongly disagree, 7=strongly agree). Social networks were measured through six yes/no

² Norwegian governmental instrument for innovation: <http://www.innovasjon Norge.no/en/start-page/>

questions asking the following: “The firm is part of ... (1) an incubator or accelerator, (2) a formal industry cluster, (3) a local industry network.” Further items were as follows: “The firm (or central employees in the firm) ... (4) is part of niche-region- or industry-specific interest organizations, (5) has a close relationship with one or several private investors, (6) interacts socially with central employees in similar firms.” The questions were developed based on previous studies relating to IOL in entrepreneurial ventures, as introduced in the previous section (Fang *et al.*, 2010; Leung *et al.*, 2019; Pina-Stranger and Lazega, 2011). Aggregated “Formal social networks” variables were created based on a “yes” answer to any of the first three items and “Informal social networks” based on a “yes” answer to any of the last three items. The questionnaire also included items for the operationalization of the control variables. The primary type of customer for the firm was measured through a three-option choice between “Consumers,” “Businesses,” and “Public”.

Table 1: Descriptive statistics for the independent and control variables.

Independent and control variables	Mean	Std. dev.	Min	Max
<i>Crisis-induced adversity (calculated average)</i>	4.878	0.964	1.875	7
Product/service	4.640	1.390	1	7
Marketing & sales (merged average of two items)	5.228	1.211	1	7
Financial	5.232	1.225	1	7
Employees & competence	4.412	1.186	1	7
<i>Active responses (calculated average)</i>	3.851	1.183	1	7
Prior experiences	4.579	1.542	1	7
Observations of others	4.237	1.483	1	7
Collaboration with others	3.474	1.883	1	7
Supporting others	3.114	1.809	1	7
Formal social networks (yes = 1)	0.180	0.385	0	1
Informal social networks (yes = 1)	0.614	0.488	0	1
Business customers (yes = 1)	0.610	0.489	0	1
Public customers (yes = 1)	0.149	0.357	0	1
Firm age (years)	5.232	1.348	3	7
Number of employees	3.412	4.473	1	30

To develop a variable for the different modes of combining crisis-induced adversity and degree of active responses, a k-means clustering approach was chosen (Eltibi, 2011). Given the variations between firms in the adversity they faced and how they responded to the crisis, four theoretical clusters ($k = 4$) and four initialization points for the clustering were defined (Cao *et al.*, 2009). Applying Makles’ (2012) approach, the number of clusters was confirmed by empirical observations because four clusters represented a kink in the within sum of squares output. The clustering procedure was performed five times to ensure consistent results. Figure 1 presents a plot of the variables “Crisis-induced adversity” and “Active responses,” as well as

how the means of the four calculated clusters are positioned in relation to the overall sample means and the empirical data available.

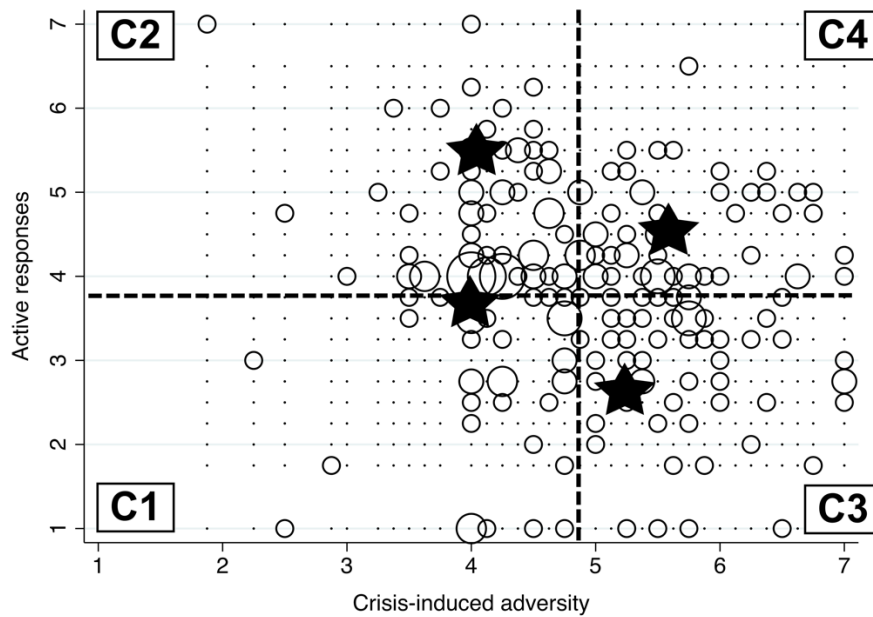


Figure 1: Adversity-response clusters C1–C4, indicating the four cluster means (black stars) and sample means (bold dotted lines) from Table 1. The weighted empirical data from the questionnaire are indicated by hollow circles.

The first cluster, *Cluster 1* (C1), includes 55 firms that are neither negatively nor positively affected by the crisis and show a slightly lower than average degree of active responses. The major type of active response is collaboration with other firms or supporting other firms. Hence, Cluster 1 is termed “Supporters.” *Cluster 2* (C2) includes 34 firms that are also neither negatively nor positively affected by the crisis but that nevertheless show a high degree of active responses, which is what primarily distinguishes them from the firms in C1. Their major type of active response is collaboration with other firms. Hence, C2 is termed “Collaborators.” *Cluster 3* (C3) includes 72 firms that are severely negatively affected by the crisis and show low degrees of active responses. Any responses taken are mostly based on their prior experiences and, to some degree, the observation of other firms. Because the firms in C3 are severely affected but comparably passive, the cluster is termed “Victims.” Finally, *Cluster 4* (C4) includes 67 firms that are significantly negatively affected by the crisis and that show a high degree of active responses. Given how the firms in C4 are strongly affected by the crisis yet show a high degree of active responses, C4 is termed “Responders.” The major type of active response taken by these firms is collaboration with other firms and supporting other firms although they score higher than average on all four types of active responses. Eventual differences between the clusters in terms of other variables were analyzed, and no significant differences were found. The four clusters were used as labels for the four different modes of combining crisis-induced adversity and degree of active responses in testing hypothesis 3.

To measure IOL, a scale containing three statement items was used. The first two statements were based on Bruneel *et al.* (2010) and led to the following items: (1) “The firm has acquired

new or important knowledge (e.g., about products, services, customers, markets, strategies, or financing) from other firms to handle the situation and/or to develop the firm accordingly” and (2) *“Other firms have contributed to us by building our knowledge and capabilities to handle the situation and/or develop accordingly.”* The scale was extended by an additional question for validating the viewpoint of the respondents: (3) *“Right now, I consider knowledge from or knowledge created in collaboration with other companies as more important than our experiences.”* All three items were measured using a 7-point Likert scale (1=do not agree, 7=completely agree), and the resulting three items for IOL had a Cronbach’s alpha of 0.85, which is considered very good; this allowed for averaging the three items comprising the dependent variable, “Interorganizational learning.”

Data Analysis

The complete set of responses from the questionnaire ($N=282$) was imported into Microsoft Excel, controlled for consistency, and further curated to prepare the analysis. The dataset was imported into STATA/MP 15 for statistical analysis. The responses on dependent variable was skewed since a number of firms, as expected, reported no IOL (i.e. 1=do not agree on all three items). This was addressed by logarithmic transformation of the dependent variable to fulfill the normality assumption. Because the transformed dependent variable followingly contained many “baseline-level” values, a left-censored Tobit regression was chosen for two models (Wooldridge, 2015). Tobit regression is a linear model accounting for zero-inflation and results for above-zero observation could hence be interpreted similar to ordinary least squares regression. The first model appends “Crisis-induced adversity” and “Active responses” as separate variables to test hypotheses 1, 2, and 4, while the second appends the adversity-response clusters to test hypotheses 3 and 4. The homoscedasticity assumption was found to hold for the two models.

Analysis Results

The results from the two regression models are presented in Table 2. The results show a significant yet opposite relationship to what was expected: an increase in crisis-induced adversity *decreased* IOL between entrepreneurial ventures. Thus, hypothesis 1 is rejected ($p<0.01$). Hypothesis 2 is supported ($p<0.01$) by the empirical results because a significant positive relationship was found between the degree of active responses to the crisis taken by the entrepreneurial venture and IOL. The second regression model included the four adversity-response clusters. As shown in Table 2, belonging to any of the clusters represented significant changes in IOL compared with the baseline cluster. The same was true when altering which cluster was set as the baseline. Hence, hypothesis 3 is supported ($p<0.01$). Both regression models address hypothesis 4 regarding the effect of formal and informal social networks. Significant relationships were not found in any of the models, and thus, a conclusion cannot be made on hypothesis 4. No significant influence from the control variables was found.

Table 2: Results from the Tobit regression. Standard deviations are included in parentheses, $**p<0.01$.

Independent and control variables	log(IOL) (model 1)	log(IOL) (model 2)
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Crisis-induced adversity	−0.106** (0.0393)	–
Active responses	0.294** (0.0339)	–
<i>Adversity-response clusters (baseline = C3):</i>		
C1 (“Supporters”)	–	0.623** (0.106)
C2 (“Collaborators”)	–	0.910** (0.124)
C4 (“Responders”)	–	0.600** (0.104)
Formal social networks	0.0239 (0.103)	0.0386 (0.109)
Informal social networks	0.0624 (0.0802)	0.0796 (0.0835)
Business customers	0.128 (0.089)	0.0568 (0.0941)
Public customers	0.0670 (0.122)	0.0143 (0.129)
<i>Firm age (baseline = 7 years):</i>		
3 years	0.183 (0.131)	0.222 (0.137)
4 years	0.106 (0.113)	0.0932 (0.119)
5 years	−0.0611 (0.106)	−0.115 (0.111)
6 years	0.0852 (0.112)	0.0246 (0.116)
<i>Number of employees (baseline = more than 3):</i>		
1 employee	−0.103 (0.088)	−0.0977 (0.092)
2–3 employees	−0.0461 (0.0949)	−0.0727 (0.0993)
Observations	228	228

Discussion

The results support the hypothesis that IOL occurs in entrepreneurial ventures and is affected by adversity from the COVID-19 crisis and the activities conducted by the ventures. However, there is a significant negative relationship between adversity and IOL, which is the opposite of what was outlined in hypothesis 1. Although the crisis-induced adversity from COVID-19 was expected to be an “enabling condition” for IOL (Anand *et al.*, 2020), firms are perhaps so severely affected by the crisis that there are insufficient abilities, resources, or willingness to engage in activities and interactions facilitating IOL (Eiriz *et al.*, 2017; Peronard and Brix, 2019). Moreover, the lockdown following the COVID-19 pandemic may have abruptly inhibited established routes of interorganizational interaction and collaboration, such as attending trade fairs or physically meeting collaborators. Hence, the negative relationship between adversity and IOL could be unique to the COVID-19 pandemic. An additional factor could be that there is a time lag in the economic effects of COVID-19 (Kuckertz *et al.*, 2020; Smallbone *et al.*, 2012), and responses by entrepreneurial ventures may not have fully been enacted yet. Therefore, further studies of IOL in later phases of COVID-19 and its aftermath would be interesting, recalling that the close relationship between carrying out interactive activities and IOL in the literature (Anand *et al.*, 2020; Brix, 2019; Janowicz-Panjaitan and Noorderhaven, 2008; Peronard and Brix, 2019) is empirically supported by the present paper.

The four clusters add nuance to the study and bring about insights into how a lack of a linear relationship between adversity and responses may be represented by the clusters as distinct

groups. The clusters reinforce previous research by showing how certain activities and interactions affect IOL (Peronard and Brix, 2019) and how different types of activities affect IOL differently. It is interesting how “Responders” differ from “Victims”; the former group shows considerably higher levels of active responses and IOL with similar crisis-induced adversity. Although crisis-induced adversity likely offers the ventures less of a choice to act, there may still be differences in realizing the value of IOL—as well as firms’ abilities to engage in IOL—among the entrepreneurial ventures (Peronard and Brix, 2019). Some entrepreneurial ventures were slightly positively affected by the crisis, and “Collaborators” were found to engage in active responses despite being less affected by the crisis. In addition, the “Supporters” are comparably unaffected by the crisis yet engage in supporting others. Collaborative activities by “Collaborators” and “Supporters” could be either preventive measures to avoid the mistakes of others (Leung *et al.*, 2019; Lévesque *et al.*, 2009) or a source of new opportunities, for example, to learn about new potential markets (Bruneel *et al.*, 2010). The COVID-19 pandemic represents a situation about which the entrepreneurial ventures have little experiential knowledge, and the present paper shows how some ventures engage in interactive and collaborative activities. In relation to the existing literature on IOL (Anand *et al.*, 2020), the present paper offers a novel contribution by empirically showing how the combination of adversity faced by firms *and* their involvement in interactive and collaborative activities affect IOL. There were no indications found that measured variables such as age, number of employees, or social networks led to firms belonging to specific clusters. Because the present paper shows that the differences in how crises are responded to affects IOL processes, an avenue for further research would be performing qualitative or mixed method studies to go deeper into the varieties of crisis consequences and responses addressing *how* and *why* firms respond accordingly.

Given the strong emphasis on social networks (Kwong *et al.*, 2019; Leung *et al.*, 2019; Peltier and Naidu, 2012; Soetanto, 2017), it is puzzling that the results do not show any significant relationships between formal or informal social networks and IOL. Referring to Table 1, a considerable share of the entrepreneurial ventures were part of formal institutions, such as incubators and accelerators, and more informal networks, such as interest organizations and having relationships with investors. That said, the present paper does not—and cannot—dismiss the importance of different types of social networks for IOL, whereas what the analysis *does* show is that researching the relationship between participation in formal and informal social networks would require more detailed and advanced measures. Further quantitative research on the subject could apply measures that build on a social network analysis (cf. Greve and Salaff, 2003) or apply in-depth qualitative studies. Because the strong importance of social networks for IOL found in previous research was not supported in the analysis, an implication of COVID-19 could indeed be that the effects of participation in social networks are inhibited during lockdowns, referring to the discussion on hypothesis 1 above. For example, could incubators, formalized industry networks, and the organizers of social events not be prepared to uphold a sufficient level of interaction between participants compared with when before the pandemic struck? It is important to consider the social context within which IOL occurs (cf. Rejeb-Khachlouf *et al.*, 2011), and further qualitative research could address how a crisis changes the social context and conditions for social networks and IOL.

When evaluating the results in relation to other studies of IOL, the particularities of learning processes in entrepreneurial ventures should be considered (Brockman, 2013; Yang and Aldrich, 2017). Entrepreneurial ventures may not only be *open* to but also fully *depend* on outside knowledge; there are likely few pre-existing organizational routines in the ventures, and taking deliberate action during a crisis—through exploration—is a challenge of cocreation rather than integration of knowledge. The COVID-19 pandemic may establish or increase the mutual dependence between firms in the same situation, where resources are scarce or appropriate tactics are crucial (Fredrich *et al.*, 2019). Although the firms may not share the same type of customers (Peronard and Brix, 2019), they could have similar challenges, particularly when most firms are facing challenges from the COVID-19 pandemic (Kuckertz *et al.*, 2020), creating a case of “parallel peers” (Leung *et al.*, 2019). However, as discussed above, some entrepreneurial ventures may not be able to partly or fully engage in the activities, interactions, and collaborations that facilitate IOL.

Conclusions

The present paper aimed to address IOL in entrepreneurial ventures, asking how responding to the COVID-19 pandemic may affect this. Four hypotheses were developed based on a theoretical background in IOL, entrepreneurial learning, and entrepreneurship in crises. The results both support and reject the hypotheses, empirically demonstrating that although increasing adversity from COVID-19 corresponds to less IOL, firms engaged more in interactive and collaborative activities—here as their responses to the crisis—show significantly higher IOL. Hence, the current paper contributes to the field of IOL by providing empirical support for the importance of engaging in interactive and collaborative activities for IOL (Brix, 2019; Eiriz *et al.*, 2017; Peronard and Brix, 2019). The results also show that different combinations of adversity from the COVID-19 crisis and active responses from the ventures influence IOL differently. The present paper adds to the scarce body of research on IOL in and between entrepreneurial ventures, strengthening the link between entrepreneurial learning and IOL by conceptually and empirically highlighting the role of the interorganizational level (Jones and Macpherson, 2006), as well as interorganizational interaction and collaboration (Lane and Lubatkin, 1998), in the context of nascent organizations. Hence, the present paper complements the dominant focus on established organizations (Brockman, 2013; Yang and Aldrich, 2017) and experiential and *intraorganizational* learning in entrepreneurial ventures (cf. Haneberg, 2019; Nogueira, 2019). Moreover, the present paper addresses the need for more empirical papers on IOL and its antecedents (cf. Anand *et al.*, 2020), in this case, how a global crisis induced by a pandemic affects IOL in knowledge-based entrepreneurial ventures.

Beyond contributing to the research on IOL, the present paper contributes to policy and practice by creating knowledge about the highly contemporary, critical situation that the COVID-19 pandemic imposes on the global economy. The pandemic may have abruptly changed opportunities for interorganizational interaction, collaboration, and learning in and between entrepreneurial ventures. The present paper should motivate entrepreneurial ventures to

become involved in proactive and interactive activities and motivate policymakers to create and nurture support systems that promote IOL during a crisis. Ensuring that entrepreneurial ventures stay able and willing to engage in IOL could positively influence the long-term survival and growth of entrepreneurial ventures through the development of effective strategies and tactics both during and after the pandemic.

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