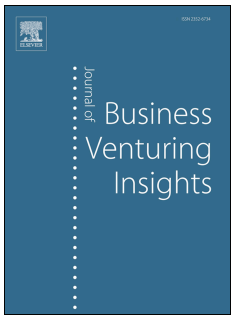

Startups in times of crisis – A rapid response to the COVID-19 pandemic

Andreas Kuckertz, Leif Brändle, Anja Gaudig, Sebastian Hinderer, Carlos Arturo Morales Reyes, Alicia Prochotta, Kathrin Steinbrink, Elisabeth S.C. Berger

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Startups in times of crisis – a rapid response to the COVID-19 pandemic

Andreas Kuckertz[a)b)], Leif Brändle[a)], Anja Gaudig[a)], Sebastian Hinderer[a)], Carlos Arturo Morales Reyes[a)], Alicia Prochotta[a)], Kathrin Steinbrink[a)], Elisabeth S.C. Berger[a)]

a) University of Hohenheim

b) Corresponding author: University of Hohenheim | Institute of Marketing & Management | Entrepreneurship Research Group (570c) | Wollgrasweg 49 | D-70599 Stuttgart, Germany | Email: andreas.kuckertz@uni-hohenheim.de | Phone: 0049 711 459 24821

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Startups in times of crisis – a rapid response to the COVID-19 pandemic

Abstract

***Research summary*:** The discovery of the coronavirus (SARS-CoV-2) and the spread of COVID-19 have led many governments to take drastic measures. The lockdown of large parts of society and economic life has come as an exogenous shock to many economic actors, not least innovative startups. This rapid response research combines a qualitative research design informed by entrepreneurial ecosystem actors with an analysis of policy measures called for, announced, and reportedly implemented in the international press. Interviews from an entrepreneurial ecosystem offer a first-hand account of the adversity startups face during a crisis and how by utilizing bricolage responses they cope, and the analysis of policy measures can serve as an inspiration to design support initiatives to protect startups from the consequences of the current lockdown and to alleviate the effects of future crises.

***Managerial summary*:** The lockdown measures as a response to the spread of the new coronavirus threaten the existence of many innovative startups. Our rapid response research first illustrates the challenges entrepreneurs face as a consequence of the crisis. Second, we illustrate how entrepreneurs are dealing with the effects of the crisis and what they are doing to protect their ventures. Finally, we present measures that could be utilized by policymakers to assist entrepreneurs facing challenges. The research conducted suggests that while startups are successfully leveraging their available resources as a first response to the crisis, their growth and innovation potential are at risk. Therefore, policy measures should not only provide first aid to startups by alleviating the pressure caused by constrained cashflow, but also involve long-term measures embedded in and supported by the wider entrepreneurial ecosystem to ensure rapid recovery and growth.

Keywords

Bricolage; coronavirus; COVID-19; crisis; entrepreneurship; policy

1. Introduction

With the discovery of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in late 2019 (Zhu et al., 2020) and very recently with the subsequent pandemic of COVID-19 (JHCRC, 2020), society and economies worldwide are experiencing an unprecedented exogenous shock (GDA, 2020). Although the occurrence of a pandemic caused by a new virus is unsurprising for virologists, the infection control measures such as social distancing (Glass et al., 2006) taken to slow the spread of COVID-19 exert tremendous pressure on large parts of a nation's economy. Most actors central to shaping the economy would admit to the current pandemic being a metaphorical black swan event, that is, a surprising, unpredictable event of great significance and severe consequences that dramatically changes the political and economic environment (Winston, 2020). While such events could be interpreted as opportunities, the unprecedented lockdown of large parts of society arising from the COVID-19 crisis marks the current situation out as an acute crisis. SARS-CoV-2 triggered a twofold crisis: The COVID-19 pandemic has placed an unprecedented burden on many health systems worldwide, and the infection control measures have caused an economic crisis by bringing a vast amount of economic activity to an abrupt halt. Moreover, while many other past crises have hit humanity at a specific point in time and regionally (e.g., hurricanes like Katrina in 2005) or developed over a longer period of time with global effects (e.g., the 2008 financial crisis), the COVID-19 pandemic has developed globally and the necessary countermeasures put in place have hurt economies suddenly.

The present rapid response paper therefore seeks to direct attention to a specific type of actor that is largely neglected in current public debate: innovative startups. Most policy initiatives taken to

protect economies during the COVID-19 crisis seem to target established corporations, existing industry sectors, and economies as such, and in doing so those measures aim to protect employment and the continuation of necessary economic activity. Currently, the focus is on protecting the present while the future of economic activity receives less attention. However, innovative startups that will shape that future economic activity are one of the most vulnerable actors in any economy (Walsh & Cunningham, 2016). Even in calmer times innovative startups face liabilities of newness and smallness (Stinchcombe, 1968) that threaten their continued existence. This situation is likely to worsen in times of crisis and the spread of COVID-19 thus threatens to curtail a tremendous potential for innovation that has been accumulated in recent years and was meant to generate economic and potentially societal and ecological value in the near future.

We interviewed individuals involved with an entrepreneurial ecosystem in Germany to determine their reaction to the crisis and opinion on the measures put in place to mitigate its economic effect. At the time of writing, measures supported by the German government intended to protect companies and startups affected by the COVID-19 crisis include taxation support, state support for short-hour working, improved measures at guarantee banks, as well as loans and special programs provided by KfW, a state-owned development bank. In addition to these loans (PWC, 2020), KfW offers other specific support programs for startups, such as growth loans and co-investment schemes, which were not explicitly developed to address the COVID-19 crisis, but may still prove useful. Moreover, a central measure is the nationwide COVID-19 aid package for large companies, sole-traders, and entrepreneurs. However, many of these measures, such as the KfW loans, are not available to startups as they (especially at an early stage) simply do not meet the traditional criteria for obtaining loans (BVDS, 2020a; PWC, 2020). Equally, not every startup can rely on investors who apply to co-investment schemes. Many programs require appli-

cant firms to be bankable, in that they can be expected to be profitable within a reasonable timeframe. The profit criterion is one an innovative startup cannot usually meet soon after inception. Innovative startups are thus clearly under pressure (German Startups Association 2020a; 2020b).

The COVID-19 pandemic and the many lockdowns in economies worldwide combine to create a unique situation that has no documented equivalent in the entrepreneurship literature. Nevertheless there is a body of research on entrepreneurship and crisis management (e.g., Williams & Vorley, 2015; Smallbone et al., 2012; Cowling et al., 2012; Parker et al., 2012) that offers two research streams in particular that could be informative in relation to the COVID-19 pandemic. The first could be labeled entrepreneurial crisis management and deals with how businesses respond to a crisis. Much of the research in this stream is concerned with resilience (Doern, 2016; Doern et al., 2019). The second stream suggests which policies could nurture a firm's survival during a crisis (Alesch et al., 2001; Dahlhamer & Tierney, 1998) and what barriers exist (Runyan, 2006); that second stream could thus support policymakers in developing appropriate interventions.

Against this background, starting on March 23, 2020 and finishing data collection on March 31, 2020, we conducted a rapid response research project intended to produce evidence in a timely manner rather than to explain the crisis and its effects after the event. Rapid response research lends itself to quick developments and has, for instance, been utilized to support rapid policy responses to riots (Alexander, 2010) or earthquakes (Powell et al., 2011). The current rapid response research intends to shed light on three pressing research questions that are linked to entrepreneurial crisis management on the micro level and to policy initiatives on the macro level. First, we are interested in determining the forms of adversity facing innovative startups in light

of an immediate lockdown (RQ1). Second, we aim to understand what coping strategies startups employ in the course of crisis management (RQ2). Third, we want to identify specific policy measures designed to protect startups during the COVID-19 crisis, be they called for or actioned (RQ3).

Having reviewed prior research on crisis and entrepreneurship, we provide answers to these questions for our specific context through a mixed-methods design (Johnson & Onwuegbuzie 2004). The methods involved are a qualitative analysis of interviews with 16 participants in various roles in a German entrepreneurial ecosystem (i.e., entrepreneurial actors, resource providers, and connectors, see Brown & Mason, 2017) and an analysis of the international public press coverage. Following recommendations by Khan et al. (2014), we streamlined data collection to permit rapid analysis. In doing so, we contribute to research at the interface of the entrepreneurship and crisis fields by providing a unique view just as the situation unfolds rather than after the event.

2. Challenges for innovative startups created by the COVID-19 lockdown

2.1 Prior research on challenges facing startups in a crisis scenario

Beyond the humanitarian tragedy of the COVID-19 pandemic, the virus is also having a growing impact on local economies and the global economy. Fears surrounding the unforeseeable effects of COVID-19 have already significantly influenced the world's top economies and many economists are now forecasting recession (GDA, 2020). A crisis such as the COVID-19 pandemic threatens the functioning and performance of a business (Boin, 2009; Comfort, 2002; Quarantelli, 1988; Williams et al., 2017). Turbulence affecting a business might arise from disturbed structures, routines, and capabilities (Williams et al. 2017). Unfortunately, to manage a crisis well, preparation is essential, and few startups would have been prepared for a crisis of the magnitude

of the COVID-19 pandemic. The limited number of studies on resilience in the context of entrepreneurship and crises mainly focus on the pre-crisis period and on the skills or resources that entrepreneurs and organizations build up to resist or adapt to crisis events (Bullough et al., 2014; Doern et al., 2019; Korber & McNaughton, 2017). Generally, the specific characteristics of innovative startups should enable them to be better prepared to cope with the COVID-19 crisis than other types of firms. Being innovative is a precondition of being resilient, as innovative businesses tend to constantly and continuously anticipate and adjust to a broad range of crises (Hamel & Valikangas, 2003; Linneluecke, 2017). However, businesses do not always recognize the actual threat that a potential crisis event entails (Muñoz et al., 2019) and the majority of startups will not have been prepared for the events of the last four months. We know from research on the effects of hurricane Katrina and its aftermath that a failure to prepare can have dramatic consequences, particularly for small businesses that are vulnerable to interrupted cash flows, lack of access to capital for recovery, and face problems accessing federal assistance and also serious infrastructure problems (Runyan, 2006).

2.2 Challenges of the COVID-19 lockdown in Germany for its innovative startups

Given that data on the immediate effects of the COVID-19 crisis and the subsequent lockdown in many economies are not available, we resort to a qualitative research design to answer RQ1 on the adversity facing innovative startups during lockdown (see Appendix 1 for our methodological approach, Appendix 2 for our sample, and Appendix 3 for representative quotes). Our results (see Figure 1) show that startups face immediate and tangible consequences of the COVID-19 outbreak especially in the form of reduced sales while fixed costs remain; a combination that threatens startups' liquidity and long-term survival.

Figure 1 about here

Additionally, startup founders reported the economic climate is currently unfavorable for innovation. Key partners, customers, and investors are themselves fully engaged in responding to the crisis and the uncertainty as to how the crisis will develop discourages any experimentation. When markets are gridlocked, startups are forced into what is known as "plateau patterned growth" (Bush et al., 2009, p. 489), which in combination with barriers to accessing funding can adversely affect their onward growth trajectories. The interviewees were aware that adversity arising from crisis can generate both opportunities and threats because it creates an external pressure to adapt (Deb et al., 2019). Startups reported being forced to take alternative action and adopt alternative behavior, i.e., some exhibit behavioral capabilities (Williams et al. 2017). The interviewees also reported that their firms were having to abruptly adjust their organizational infrastructure since value generation processes are on hold and supply chains are affected by the crisis. At the same time, some founders reported that their enterprises were not (unduly) affected by the COVID-19 crisis either because their businesses continue to be relevant despite the crisis or owing to the firms having measures in place since before the crisis that bolster their durability (Williams et al., 2017) and mean they remain resilient, albeit such resilience will most likely be time limited.

3. Entrepreneurial crisis management as a response to the COVID-19 lockdown

3.1 Prior research on entrepreneurial crisis management

Resilience is an essential concept in entrepreneurial crisis management (Doern et al., 2019); it not only describes an organization's ability to continue functioning throughout a disruptive event but the conceptual aspect of the term also considers which resources were accumulated prior to a crisis and then deployed throughout it and during the aftermath (Williams et al., 2017). Crisis management is employed to foster resilience and will be of utmost importance during the

COVID-19 crisis. Crisis management is employed to minimize the impacts of a crisis (Spillan & Hough, 2003) and, if done well, can quickly restore functionality to organizations suffering from the effects of disrupted or weakened systems (Williams et al., 2017). The few studies on crisis management in entrepreneurship research predominantly assess the actions that entrepreneurs or organizations take to mitigate the potential negative consequences of a crisis (Doern et al., 2019), among which are changes in sales, marketing, and employment practices. Small businesses in particular tend to excel at adaptability and flexibility (Smallbone et al., 2012) and we should expect them to demonstrate that in response to the COVID-19 crisis. Crisis management in the entrepreneurial context is thus closely related to the concept of bricolage (Mallak, 1998), and rather than suggesting rigid processes to address the challenges presented by COVID-19, it seems more appropriate for innovative startups to embrace iterative and flexible approaches such as effectual logic (Sarasvathy, 2001). Findings from research on the 2012 Emilia earthquakes in Italy (Martinelli et al., 2018) illustrate this point: The resilient entrepreneurs were those who created change and opportunities with the resources available at the time, thus clearly following one important effectual principle.

3.2 Entrepreneurial crisis management of innovative startups during COVID-19 in Germany

Our qualitative research (see Appendix 1) also answers RQ2 asking how innovative startups cope. To face the COVID-19 crisis, startups reported relying heavily on what are termed relational capabilities (Williams et al., 2017). Accordingly, their response to adversity has first and foremost been based on purposeful bricolage (Williams et al., 2017; Gilbert-Saad et al., 2018) through combining available internal resources and calling upon external resources from their network (Baker & Nelson, 2005), which would include the goodwill of partners, mutual support

in the startup community, and access to social capital through brokers. Moreover, founders reported trying to boost their firms' financial capabilities (Williams et al., 2017) by gathering capital through internal measures and applying for government support. However, with regard to government support, founders reported a perceived mismatch between the support services offered by government policy and their organizations' characteristics, in that, startups are being excluded from policy measures because for example they are not bankable, or the support programs are beset by bureaucratic hurdles that outweigh the benefits. Consequently, the startups' first response to the crisis was not founded on obtaining immediate governmental support. Finally, founders reported that they are very cognizant of their customers' shifting needs due to the COVID-19 crisis. Given the above conditions, startups applied their bricolage crisis response to solve new problems, in that they identified and pursued new entrepreneurial opportunities and established new directions for their firms.

4. Economic policy responses to the COVID-19 lockdown

4.1 Prior research on economic policy responses to crises

While crisis management on the micro level is largely the task of entrepreneurs themselves, policymakers are called upon to support entrepreneurs in their endeavors to deal with crises such as COVID-19, meaning that policymakers conduct crisis management on the macro level as they aim to strengthen the resilience of businesses, including startups, and to support their individual crisis management actions. Interestingly, research has shown that regions that exhibit a high level of entrepreneurship pre-crisis are well positioned to deal with exogenous shocks (Williams & Vorley, 2015; Bishop, 2019). An entrepreneurial region is characterized by the resilience of its enterprises and entrepreneurial activity can contribute to restructuring and adaptation in the aftermath of the crisis. Fieldwork by Grube and Storr (2018) conducted following hurricane Katri-

na and the tornadoes in Tuscaloosa, Alabama, and Joplin, Missouri, illustrates how post-disaster entrepreneurs contribute to recovery through actions such as supplying necessary resources to disaster victims while leveraging social capital to navigate extreme uncertainty. Such people are motivated by high place attachment, and address both commercial and societal goals. It is very likely that in the aftermath of the COVID-19 crisis we will see regions coping differently with the consequences of drastic lockdown measures, and some will benefit from their entrepreneurial potential. Whether this becomes possible depends on how innovative entrepreneurs can be. From a policymakers' perspective, it would however be unwise to rely solely on entrepreneurial initiative to fix the economic damage triggered by lockdown measures; instead, it should be a key priority of policymakers in the short-term during the COVID-19 crisis to guarantee that innovative startups can call on sufficient resources. New legislation, however, might not be the method of choice. Drawing on in-depth interviews with Greek entrepreneurs, Williams and Vorley (2015) suggest that changes to institutions have constrained entrepreneurial activity rather than enhanced it, and that effect was more pronounced in the midst of crisis. In any case, external assistance for affected regions prior to, during, and in the aftermath (e.g. McEntire & Myers, 2004) of the COVID-19 lockdown will be essential.

4.2 International policy responses to the COVID-19 pandemic

To answer RQ 3, we conducted a quantitative analysis of the international media discourse (see Appendix 4 for our methodological approach). The international media reports in English we identified cover policy measures being called for or implemented to support SMEs and startups in 40 countries. Among them are countries such as Namibia or Nepal, which at the point of data collection reported fewer than 100 cases of COVID-19. We differentiate between those measures called for by stakeholders such as entrepreneurs, scholars, or lobbyists (40.98% of all coded

measures) and policy measures announced by government or central banks (59.02%). Interestingly, the latter outweigh the former, which suggests most governments reacted promptly and in a resolute manner to the COVID-19 crisis. We find a plethora of immediate responses to the COVID-19 crisis specifically to support SMEs addressing the current threats around decreasing revenues, mounting costs, and illiquidity. Figure 3 provides an overview of the number of countries announcing the various measures to protect SMEs and startups. Overall, most measures represent short-term aid; the most popular policy measure announced or implemented by governments worldwide is to enhance a firm's financial capital by reducing loan interest rates or improving loan availability.

Figure 2 about here

The rapidity of the outbreak and spread of the Covid-19 pandemic meant that most countries (87.80%) looked for measures to provide immediate relief and few have progressed beyond that stage. Nevertheless, the first calls for long-term measures resolving more fundamental system-imminent problems are emerging (in 17.07% of the countries). An example is the Chinese call to generally secure the accessibility of financial capital for innovative startups. Among the measures being called for, some US opinion leaders advocate not losing sight of sustainable development goals and thus suggest economic government aid be tied to adherence to measures to ameliorate climate change (Kaufmann, 2020). If governments succeed in providing immediate relief to entrepreneurs under pressure, in a way that remains in line with the long-term objectives of "promoting health, equity, and environmental protection" (Wyns, 2020), the COVID-19 crisis may even contribute to a better future. Across all countries, we observe that the policy measures discussed or announced are usually available to businesses in general (82.93% of the countries). In 63.41% of the countries we find measures designed to specifically meet the re-

quirements of SMEs. However, countries announcing policy measures explicitly addressing startups are the exception (26.83%).

5. What entrepreneurs and governments can do

Human life is unquestionably more valuable than economic activity, and this research should not be read as a criticism of the measures taken to control the spread of COVID-19. We have illustrated how the economic crisis caused by infection control measures—and in particular the lockdown of much economic activity—affects innovative startups and the measures that could be taken to protect them. Unlike, for instance, the crisis caused by the dotcom boom and bust (Ofek & Richardson, 2003), the COVID-19 crisis threatens potential for innovation that could have proven viable in normal times. With respect to the fall of internet stock prices at the turn of the millennium, it could be argued that this was a shake-out during which unviable business models were eliminated. The COVID-19 crisis seems different; and the situation is not only about state intervention and protection of innovative startups. Table 1 translates our findings into actionable measures for both entrepreneurs and policymakers.

Table 1 about here

In particular the qualitative part of this rapid response research suggests that some businesspeople in the entrepreneurial ecosystem already perceive entrepreneurial opportunity in a positive sense, that is, they see an opportunity to address current issues by employing entrepreneurial measures. We identified seven factors related to adversity and coping strategies, which, however, only constitutes a first step to understanding startups' reactions to crises in general and to the COVID-19 crisis in particular. Future research will have to identify just how those factors interact, and it will be particularly interesting to determine how adverse situations can be managed to produce positive consequences. Our key dynamics model (Figure 3) suggests entrepreneurs re-

sponding to the COVID-19 crisis are employing a bricolage approach as part of their initial response to turn crisis induced adversity into resilience.

Figure 3 about here

The quality of an organization's response to a crisis is typically associated with resilience and "depends on the capacity to enhance improvisation, coordination, flexibility, and endurance …" (Boin et al., 2010, p. 11). These are qualities that are closer to routine behavior among innovative startups than they are among larger more-established firms. Furthermore, smaller businesses are often more creative than large firms, and this creativity might help to ensure that those businesses remain viable in the face of adversity (Williams et al., 2017). Many entrepreneurs adopt the bricoleur role as they attempt to spur change and create opportunities with the resources available (Martinelli et al., 2018). Bricoleurs demonstrate that crises can nurture the development of new opportunities (Brünjes & Revilla-Diez, 2013), innovation, and alternative products/services (Brem et al., 2020; Irvine & Anderson, 2004). As crises can also encourage the exploitation of new opportunities (Brünjes & Revilla-Diez, 2013), they can prompt innovation and the development of alternative products and services (Brem et al., 2020; Irvine & Anderson, 2004). In the short-term, there will be opportunities arising from the COVID-19 crisis, particularly for life-science ventures. The long-term consequences of the COVID-19 pandemic are, however, not yet foreseeable, but it seems inevitable that broader opportunities will arise. The literature suggests that for entrepreneurs, dealing with uncertainty and failure is a normal part of business (Ucbasaran et al., 2013; Mandl et al., 2016), even when the uncertainty is caused by a crisis like the COVID-19 pandemic. Accordingly, entrepreneurs can be expected to demonstrate flexibility and adapt their business models in response to a crisis. This would suggest startups are better prepared for crises than any other economic actor. Some commentators will no doubt suggest that

startups' flexibility and the relatively low numbers they employ mean that excluding them from governmental aid programs will not have a critical impact on the economy, but letting startups go to the wall potentially jeopardizes a state's future innovativeness. Therefore, mid-, or long-term policy measures targeting future innovativeness, while unlikely to be the first responses to such a crisis, nonetheless seem essential. This finding is in line with prior research suggesting entrepreneurial responsiveness to crises is determined by factors such as entrepreneurial culture and knowledge diversity (Bishop 2019; Bishop and Shilcof 2017), which cannot be addressed by short-term measures, but are the result of consistent policies fostering entrepreneurship. Just as the resilience of different state's health systems (Wyns, 2020) is currently proving central to their ability to respond to the COVID-19 pandemic, countries that have established resilient entrepreneurial ecosystems will be able to resume their pre-crisis level of activity more quickly than those that have not. The interviews conducted in support of this research show that startups will rely heavily on the support of their entrepreneurial ecosystem to manage the crisis. Policy measures are thus only likely to be successful if they are complemented by the wider attributes of an entrepreneurial ecosystem (Spigel, 2017). Incentivizing investors to provide growth capital despite the crisis—as called for by venture capitalists in Great Britain (M2 PressWIRE, 2020)—could be a suitable way to combine both providing short-term liquidity to pay wages and bills while laying the foundations for future recovery.

The international press analysis, for instance, has illustrated the many opportunities to protect the innovation potential of startups. While it remains unclear what specific measures will be most effective, it seems evident that programs specifically targeting innovative startups should be mandatory. Assuming measures targeting SMEs will benefit innovative startups too would be an error policymakers must avoid. Unlike many other crises, the COVID-19 crisis has not hit every

country at the same time. At least in healthcare, many European countries were able to learn from the experiences of China and Italy and to react proactively. While the time-lag of the economic crisis hitting countries might disappear in the long run, policy makers can nevertheless observe how measures taken to protect startups are unfolding and adopt or discard them as appropriate to improve the knowledge derived from crisis situations (Boin, 2009). Future research should thus not only evaluate the effectiveness of the different policy measures on the entrepreneurial activity in various countries but could also aim to understand the effect of short response times to economic crises. It will be important to follow up on the effects of the measures taken during the COVID-19 crisis to prepare for future comparable events.

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Figure 1. Data Structure

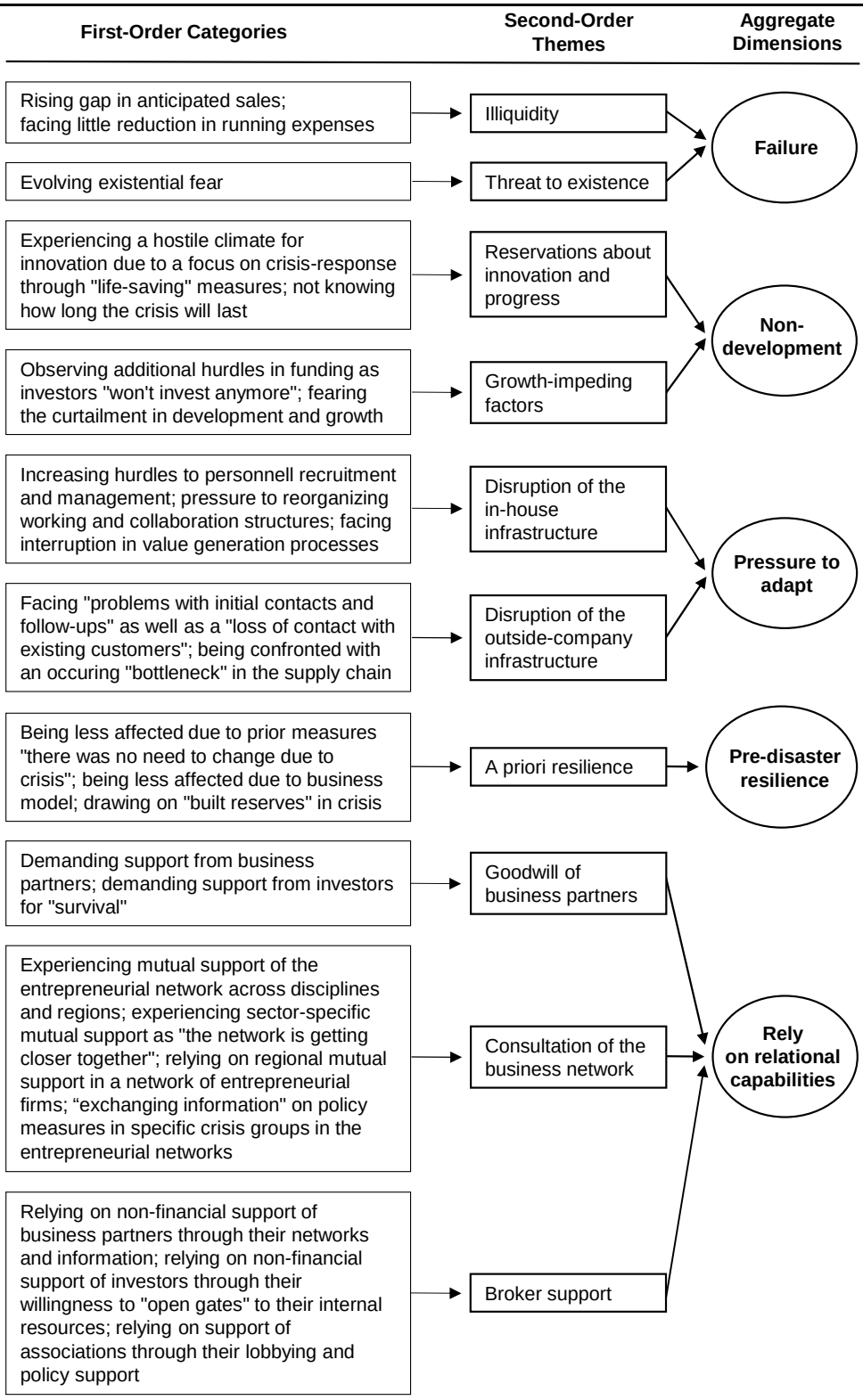

Figure 1. Data Structure (continued)

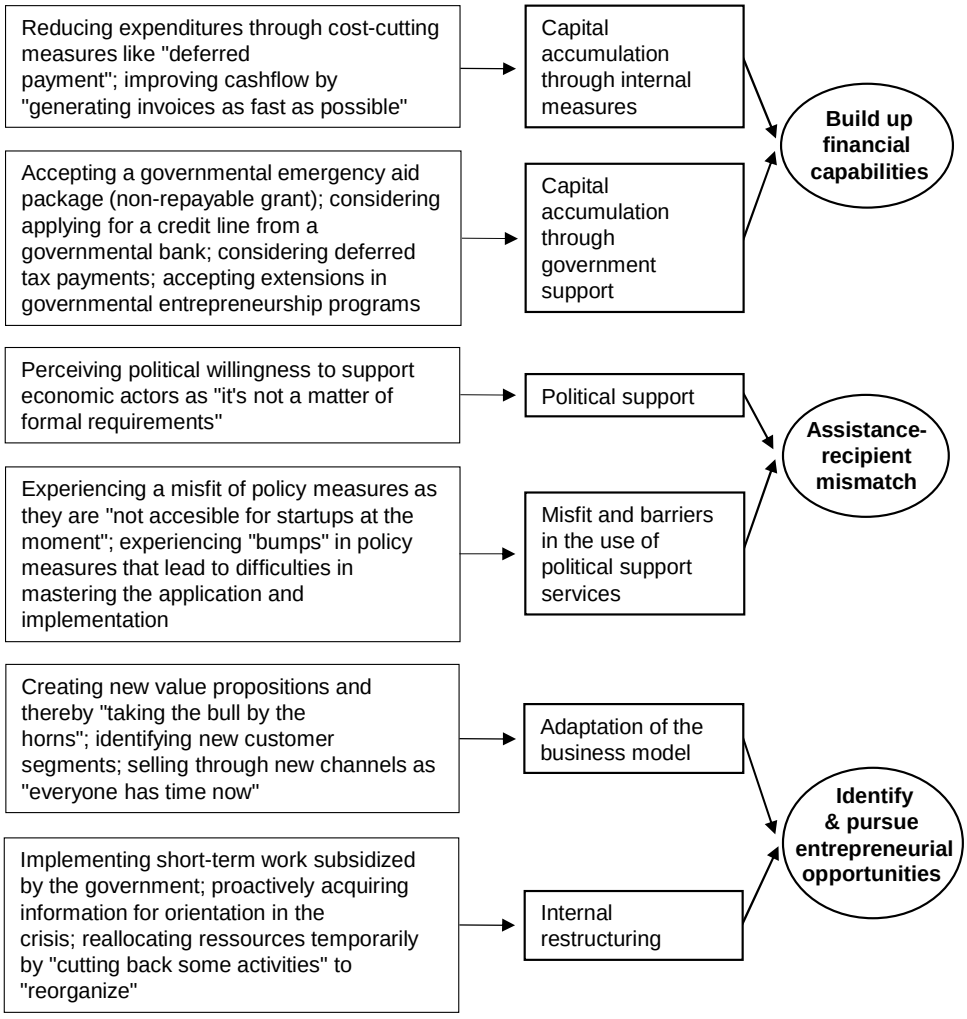
Reducing expenditures through cost-cutting measures like "deferred payment"; improving cashflow by "generating invoices as fast as possible"
Capital accumulation through internal measures
Accepting a governmental emergency aid package (non-repayable grant); considering applying for a credit line from a governmental bank; considering deferred tax payments; accepting extensions in governmental entrepreneurship programs
Capital accumulation through government support
Build up financial capabilities
Perceiving political willingness to support economic actors as "it's not a matter of formal requirements"
Political support
Experiencing a misfit of policy measures as they are "not accesible for startups at the moment"; experiencing "bumps" in policy measures that lead to difficulties in mastering the application and implementation
Misfit and barriers in the use of political support services
Assistance-recipient mismatch
Creating new value propositions and thereby "taking the bull by the horns"; identifying new customer segments; selling through new channels as "everyone has time now"
Adaptation of the business model
Implementing short-term work subsidized by the government; proactively acquiring information for orientation in the crisis; reallocating ressources temporarily by "cutting back some activities" to "reorganize"
Internal restructuring
Identify & pursue entrepreneurial opportunities

Figure 2. Number of countries where the identified policy measure was announced by the government

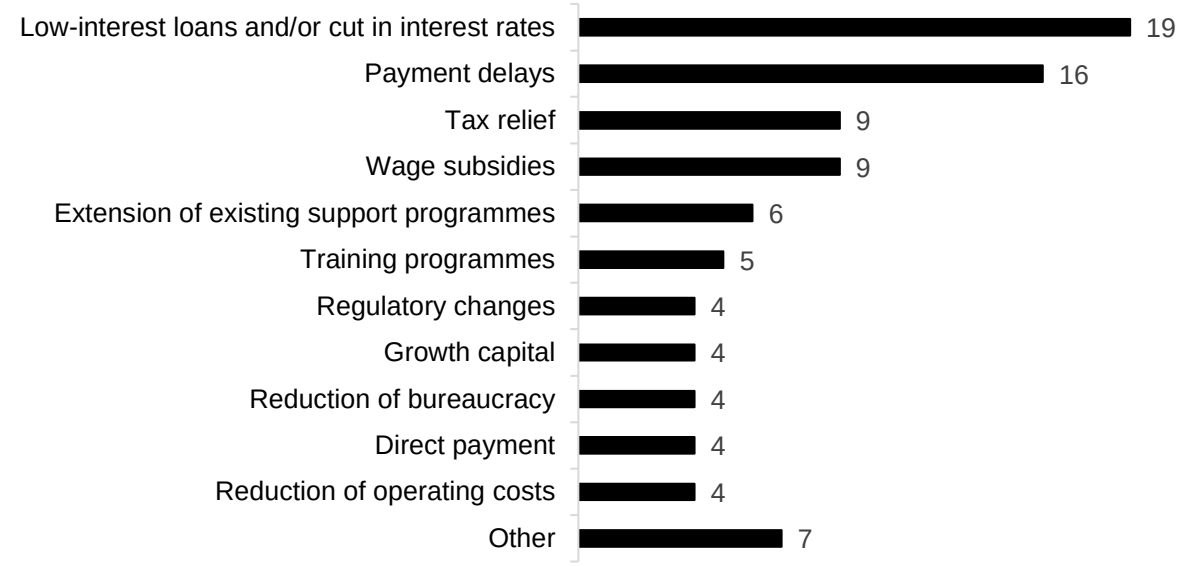

Figure 3. Key Dynamics Model

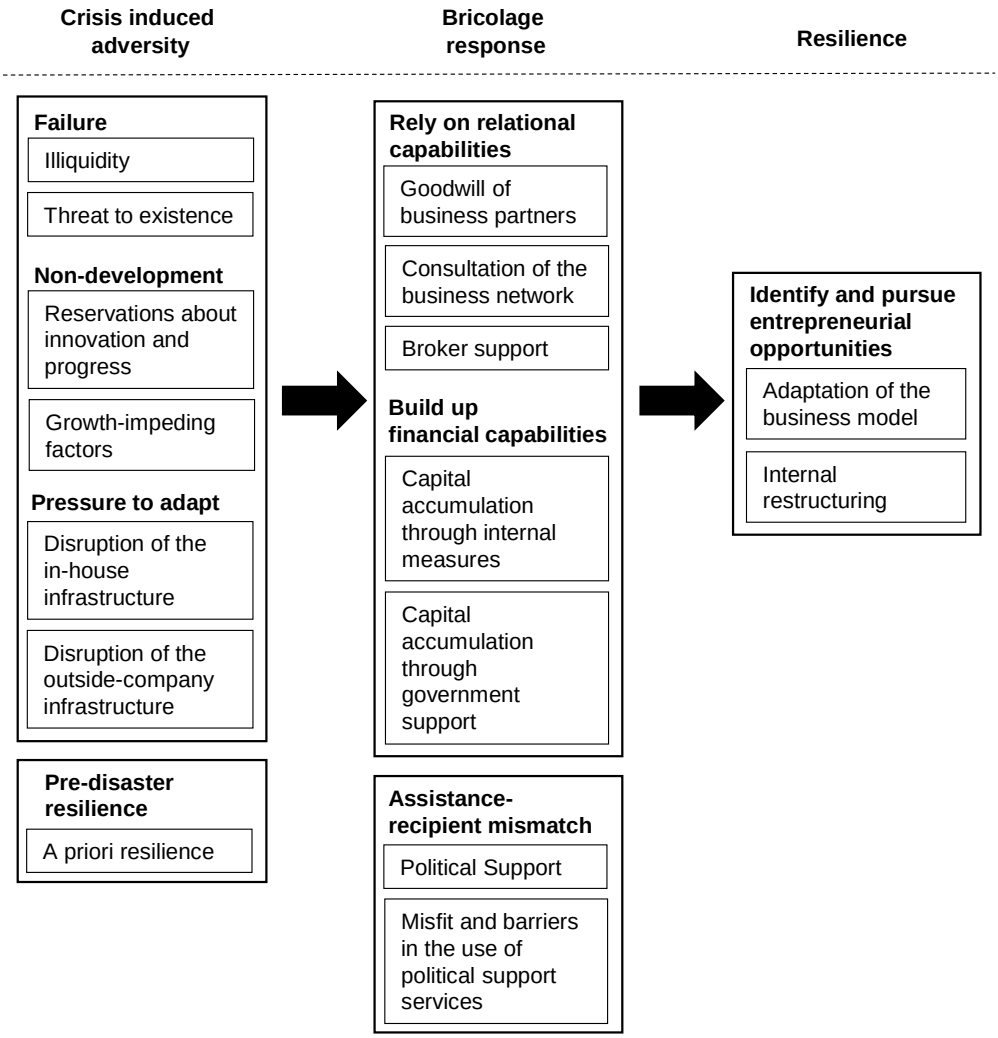

Table 1. Actionable measures for startups and policymakers

Challenges	Startup options	Policy options
Avoid immediate startup failure Drop in sales and mounting operating costs drive illiquidity. Entrepreneurs perceive existential fear.	• Use resources at hand to create solutions to new problems (e.g., creatively combine existing technology and human capital) • Activate network resources (e.g., flexible payment options, joint sales initiatives, flexible staff rotation)	• Offer payment delays, wage subsidies, direct payments • Communicate community feeling to stimulate mutual assistance ("We can do this")
Adapt due to disruptions in core startup infrastructure Interruption in value generation processes, disruptions in the supply chain and increasing hurdles to personnel recruitment and management.	• Restructure internally with a focus of channeling resources only on recently viable and value generating activities • Downsize other activities (retain the possibility to upsize again at a later point)	• Offer employee development programs (e.g., for digitalization) • Support temporal downsizing (e.g., through wage subsidies)
Continue startup growth against all odds Reservations about innovation experienced through a hostile climate for innovative products and services (except solutions to crisis-response) along with additional hurdles in startup funding.	• Discover opportunities creating value in solving consequences of the crisis (e.g., developing hygiene or digital work solutions) • Proactively engage in broader opportunities that may arise in the aftermath of the crisis (e.g., shifting trends and behavior after crisis – boost in digitization)	• Secure future innovativeness through mid-, or long-term policy measures linked to larger policy objectives (e.g., sustainability and/or digital transformation) • Lay foundations for post-crisis recovery (e.g., incentivize investors to provide additional growth capital) • Nurture knowledge diversity and entrepreneurial culture in the ecosystem • Boost positive business climate for consumption and innovation
Respond to mismatch of initial policy measures First policy support services experienced as not being meant for startups ("we are stuck in the middle"). Additional barriers in the application for and implementation of policy support services specifically for startups.	• Gather information and best-practice through entrepreneurial networks (e.g., exchange information in online crisis groups, learn about the application and implementation of support services from similar startups) • Support lobbying initiatives of (trade) associations to be included in policy decisions and programs	• Provide information and support services addressing the specific challenges of startups (e.g., hotlines) • Communicate intention for startup specific support early • Decrease specific barriers for startups in the application of startup specific support (e.g., consider future growth trajectories instead of past revenues) and reduce red tape

Appendix 1. Method Qualitative Rapid Response Research

Overview

We relied on a qualitative research design for RQ1 and RQ2. In the past, qualitative research has proven particularly useful in the rapid response research context (Finlay et al., 2013). Generally, qualitative research seems to dominate crisis research in the entrepreneurial context (e.g. Buchanan & Denyer, 2013; Linnenluecke, 2017) and case studies have been successfully applied to capture entrepreneurs' experiences (Herbane, 2010; Runyan, 2006) or to investigate specific crisis events and the emergence of businesses following crisis (Williams & Shepherd, 2016).

Data Collection

To select key informants, we adopt an ecosystem perspective (Kuckertz, 2019; Spigel, 2017). That is, rather than focusing on entrepreneurs alone we selected knowledgeable informants such as venture capital investors, business angels, policymakers, and entrepreneurs to elicit data from. Accordingly, we triangulated the perspectives we collated from entrepreneurs from various angles. More precisely, based on Brown and Mason (2017) we identified relevant entrepreneurial actors, resource providers and connectors who are related to the entrepreneurial ecosystem of Stuttgart, Germany.

Stuttgart in the southern part of Germany is one of the most innovative areas in Europe (Kuckertz & Prochotta, 2017; Strambach, 2002) and thus lends itself to research on innovative startups. We invited 20 ecosystem actors to interview, of whom 16 accepted the invitation (Appendix 2). Our sample includes ten founders of innovative startups with the oldest firm having six years in the market and the largest employing 15 full time employees. The startups cover four different industries ranging from food to software.

Interviews

We conducted and recorded semi-structured interviews with the key ecosystem informants via the video platform Zoom. In total, we video-recorded 266:50 minutes with an average interview duration of 16:41 minutes. By asking entrepreneurs questions like 1) "How is your startup affected by the COVID-19 outbreak?" and 2) "How does your startup respond to these new challenges?" we aimed at gaining a deeper understanding of the adversity the firms of our informants find themselves in and the responses they are making. We adjusted the semi-structured interviews for different actors. For instance, investors were asked the following questions 1) "How would you describe the atmosphere in your startups?" and 2) "Did your startups experience any kind of support in this situation?". The professional service provider AmberScript transcribed the collected voice recordings, resulting in 74 single-spaced pages of text.

Data Analysis

We processed the resulting interview text with MAXQDA software and applied the following steps in our analysis (see Shepherd et al., 2019; Gioia et al., 2013). First, we employed open coding focused on entrepreneurs' perceived adversity and resilience to build first-order categories. Second, we used axial second cycle coding to generate second-order themes. Third, based on second-order themes, the coding team built theoretical dimensions resulting in the key dynamics graph. Based on the grounded theory, codes emerge without a predefined coding scheme (Bryant & Charmaz, 2007). Following Glaser and Strauss (1967), a large number of categories were identified, although the first research question guided our focus in the coding process. The coding team especially looked out for signs of adversity facing the firms of the interviewees and tried to elicit the responses actioned. In order to give respondents a voice and to their perceptions as closely as possible, we used in vivo coding when possible (Bryant & Charmaz, 2007; Gioia et

al., 2013; Saldaña, 2015). Following the process of Shepherd et al. (2019), one author of the coding team used three interviews with entrepreneurs to identify key issues on the research question and built a first version of codes by aggregating similarities. Two authors then used the code list to code unprocessed interviews. In a subsequent iterative approach, constantly comparing data, codes, and categories (Bryant & Charmaz, 2007), the coding team discussed and agreed upon a list of first-order codes (Locke, 2001). Based on the evolving understanding of our codes and theory we also adjusted the semi-structured questionnaire (Strauss & Corbin, 1994). One of the authors created a first version of aggregated codes and first-order categories leading to second-order themes. Two other authors assessed the categories and themes and generated an adjusted list of second-order themes based on the consensus within the coding team (Appendix 3). The second-order themes were then directed toward overarching dimensions relating to existing theory (Gioia et al., 2013; Strauss & Corbin, 1994). We terminated data collection once we achieved theoretical saturation (Glaser & Strauss, 1967). The data structure model (Figure 1) illustrates the data development from interviews to codes, themes, and dimensions whereas the key dynamics model (Figure 3) provides indications for theoretical implications stemming from the data structure (in line with Shepherd et al., 2019; Nag et al., 2007).

Appendix 2. Description of the qualitative sample

#	Date of Founding	Employees	Sector	Function	Role
1	2019	3	Software	Startup	Actor
2	2016	3	Food	Startup	Actor
3	2019	0	Food	Startup	Actor
4	2015	15	Consulting	Startup	Actor
5	2018	5	Cosmetic	Startup	Actor
6	2018	15	Software	Startup	Actor
7	2015	11	Software	Startup	Actor
8	2019	2	Software	Startup	Actor
9	2014	11	Consulting	Startup	Actor
10	2016	10	Software	Startup	Actor
11	n/a	-	Finance	Corporate	Resource provider
12	1998	-	Finance	Investor	Resource provider
13	2017	-	Finance	Investor	Resource provider
14	2017	-	Social	Startup Community	Connector
15	2016	-	General	Accelerator	Connector
16	2014	-	Public	Association	Connector

Appendix 3. Representative quotes

Theme	Representative quotes
Reservations toward innovation and progress	I would say in crises; our attention always shifts away from innovation to life-saving measures. Unfortunately, innovation is always cut back very early on. (Interview 15_Accelerator)
	As long as there is uncertainty about how long these restrictions will be in place, our customers will not be willing to invest big. (Interview 10_Start-up)
	It's like looking into a crystal ball. What is true today is not true tomorrow. (Interview 4_Startup)
Disruption of the in-company/in-house infrastructure	And, the third major challenge is the issue of employees, i.e. to reassure them and of course to lead them during the crisis. This is of course a challenge for a young manager or founder that we have never had before. (Interview 7_Startup)
Disruption of the off-company infrastructure	Generally speaking, meetings with potential customers are simply put back, we are noticing a huge drop in trade shows, which is the most important source of customer acquisition for us at this stage. (Interview 8_Startup)
	[...] we have two main producers: one from Taiwan and one from Korea. Whereas the Korean has just received subcontracted parts from China. And then it started with the fact that the supply chain had, so to speak, stopped working at one customer [...] (Interview 10_Start-up)
Growth-impeding factors	I think that a certain sensitization has already taken place, that people, the investors, are taking a closer look and are asking for more information. It's also to point out that investors are also trying harder to protect their investments. (Interview 11_Corporate)
	We had originally planned to start our Series-A in the middle of the year (investment round). We've put that on hold now because the financing terms are gonna be crazy. In other words, maybe you just won't get anything. (Interview 10_Start-up)
	What happens if, for example, financing rounds are no longer held because investors no longer want to invest? (Interview 12_Investor)
Illiquidity/Ruin	That's why we have lost sales down to zero, so we really don't have any sales at all right now. (Interview 3_Startup)
	The issue of liquidity is the focus of our attention right now and is having a major impact - the crisis has reached us one hundred percent. (Interview 7_Startup)
Threat to existence	And indeed, since last Monday we have existential fears, which we have just overcome through various measures, no, we have threats to our existence, which we have to compensate by various measures (Interview 6_Startup)
Capital accumulation through internal measures	Yes, so cash-in measures are simply to ensure that invoices are generated as quickly as possible for existing customers. (Interview 6_Startup)

Appendix 3. Representative quotes (continued)

Theme	Representative quotes
Goodwill of business partners/Business Partner Goodwill	Thank God the companies are also very flexible, so they can cancel everything [we ordered]. (Interview 3_Startup)
Capital accumulation through government support	With the tax office, it's also about the deferral of taxes. It's also being implemented there. Accordingly, I think we can be satisfied, so to speak, with what is happening. (Interview 6_Startup)
Adaptation of the business model	Maybe even adjust to the crisis. Well, I have already seen an extremely large number of startups that have turned around immediately and partially redirected their technologies to Covid19 topics or coronavirus topics wherever possible (Interview 15_Accelerator)
	We are currently in the process of optimizing our own innovation process, so that we can use all the creative potential that lies dormant in the company to move forward and emerge from the crisis even stronger, at least on an idea level. (Interview 9_Start-up)
Consultation of the business network	The crisis has led to startups exchanging ideas across disciplines and locations. In the end, I see a positive effect in this. (Interview 6_Startup)
Broker support	Fortunately, existing investors are being very cooperative...they have now also created a slack group, where they only exchange information about where the portfolio startups should exchange information. (Interview 6_Startup)
Internal restructuring	[…] we have now moved to week-based capacity planning because, of course, as a result of short-time working, we now have to look closely at how much time each employee now spends on which topics, which we did not do at all before. (Interview 9_Start-up)
Political Support	The first thing to do now is to support the companies, and then at some point you can evaluate that again, but at the moment it's a question of who can save themselves. And I think the attitude is good, it is communicated a little bit like that on a political level, and I think it is implemented like that (Interview 6_Startup)
Implementation problems of political support/Barriers to the use of political support services	Companies that are overindebted are already assessed in advance as companies in difficulty and therefore do not receive emergency aid. And which is the case with 90 percent of startups (Interview 13_Investor)
	But I also talked to KfW [German promotional bank] again this morning and the head of the KfW gave an interview this morning in the Handelsblatt [German business newspaper], and you could read there that the loans that they issue, that they are actually only meant for companies that would actually be bankable without the coronavirus, i.e., those that would basically get a loan otherwise. And we know that normally a startup company doesn't get a loan, no matter how great the business model is, no matter how good the prospects are, but if they are not cash flow positive and the balance sheet ratios and all those things aren't right, then they just don't get a loan. (Interview 12_Investor)

Appendix 3. Representative quotes (continued)

Theme	Representative quotes
	[…] this emergency aid program BW [federal government aid program], sounded great at first, we also prepared an application, until I read the guidelines on page five or so and saw that we do not formally meet these criteria at the moment [...] (Interview 9_Start-up)
A priori resilience	Fortunately, we had an extremely good 2019 and were able to build up many reserves. Of course, if this goes on for more than a year, then it will be existential for many companies, but the existence of the company is not threatened in the first one or two months, if no sales should come in. (Interview 7_Startup)
	Financially, we have the very fortunate situation that we just got money and not yet a high burn rate, you can calculate that yourself, ten FTEs, 1.3 million. Our survival is assured, I think. We can survive a longer situation. (Interview 10_Start-up)

Appendix 4. Method Quantitative Rapid Response Research

Data Collection

In order to understand what immediate policy measures have been called for, announced, and implemented with the objective of protecting innovative startups during the COVID-19 crisis and the subsequent discussion (RQ3), we retrieved 536 media reports from the database Nexis. The search terms applied covered policy measures (search string: "Policy measure*" OR "policy respon*" OR "government* support" OR "bail out" OR "government* aid") linked to the COVID-19 crisis (search string: Covid 19 OR Corona* OR SARS CoV 2) focusing on *startups* and s*mall and medium sized enterprises* (search string: Startup* OR "new venture" OR "self employ*" OR entrep* OR "small and medium size enterprises" OR "SMEs" OR "small firms" based on Köhn (2018) and Karami et al. (in press)) published between December 31 2019 and March, 24 2020. The next step was to apply several inclusion and exclusion criteria to identify the relevant articles, leading to 152 articles to be analyzed.

Coding

A codebook created the basis to analyze the media excerpts (MacQueen et al., 1998; Hruschka et al., 2004) concerning the policy measures to support SMEs or startups. In the absence of appropriate concepts due to the uniqueness of the COVID-19 crisis, we developed a codebook applying inductive content analysis in contrast to a deductive approach that requires established concepts (Elo and Kyngäs, 2008). The inclusion and exclusion criteria and the coding according to the codebook were tested, interrater reliability was measured after each round, discussed, and refined among three researchers with a sub-sample until the final versions of the criteria and the codebook were completed. The final interrater reliability was calculated by using the average pairwise percent agreement (APPA) (Larsson, 1993) resulting in an APPA of 83.33 %, which

indicates substantial agreement between the three coders. Following Colquitt and Zapata-Phelan (2007), having established a substantial interrater reliability for each concept, three researchers coded one third of the total volume of articles each.

Measures

The unit of analysis was all policy measures explicitly and specifically mentioned in the investigated articles. In the 152 media articles, we identified 427 non-unique policy measures in 40 countries, since different media reports might have reported on the same measure. For each policy measure we identified its type (18 different categories and others for free text), the country concerned, the actor calling for or announcing the measure, the status (called for or announced by the government or central bank), the types of companies that are eligible to benefit from the measure (all companies, startups, SMEs, self-employed), whether access requirements were explicitly and specifically mentioned, the time horizon for the implementation of the measure (short-/ mid- or long-term) and the targeted territory of the mentioned policy measure (regional/ national/ international / EU-wide). To avoid a bias toward English-speaking countries when calculating the frequencies of the policy measures announced by governments or central banks, we considered every unique policy measure only once per country. All variables are presented in detail in the attached codebook which is available upon request.

Highlights

Startups in times of crisis – a rapid response to the COVID-19 pandemic

- We develop a rapid response to the exogenous shock for innovative startups caused by the outbreak of COVID-19
- We utilize a mixed-methods design combining a qualitative approach with a quantitative analysis of international media
- First, we determine the adversities startups face due to the COVID-19 crisis
- Second, we illustrate how by utilizing bricolage responses innovative startups cope
- Third, we collect suggested policy responses aimed at supporting startups during the COVID-19 crisis

Startups in times of crisis – a rapid response to the COVID-19 pandemic

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Startups in times of crisis – a rapid response to the COVID-19 pandemic

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