Start-ups’ business model changes during the COVID-19 pandemic: Counteracting adversities and pursuing opportunities

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Abstract
This article investigates how start-ups have been affected by, and have responded to, the COVID-19 pandemic by analysing interview data from 32 Australian start-ups during Australia’s second wave of COVID-19. A framework and visualisation were developed, capturing unexplored heterogeneity within these start-ups, depending whether the emphasis was upon opportunities or adversity, and the type and extent of business model changes. Six start-up types were identified: stable beneficiaries, business-as-usual continuers, digital adjusters, adversity survivors, opportunity graspers and lemonade makers. The findings suggest that most start-ups responded to the crisis through business model changes because of crisis-induced opportunities and crisis-induced adversity. The analysis found that the interplay between firm size and crisis influences whether start-ups focus on business model adaptation or business model innovation or a combination of both. We thus contribute to the literature on business models, crisis management and a newly emerging field focusing on the implications of the COVID-19 pandemic for start-ups.

Keywords
Business model innovation, business model adaptation, COVID-19, crisis management

Introduction
On a global basis, the COVID-19 pandemic has resulted in a crisis which has had a negative effect upon business performance (Fernandes, 2020). Crises are ‘highly salient, unexpected, and potentially disruptive’ (Bundy et al., 2017: 1662), and during a crisis, businesses are encouraged to change and transform (Roux-Dufort, 2007) in order to survive. This situation is particularly critical for resource-constrained start-ups (Kuckertz et al., 2020) already dealing with the liabilities of

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newness (Stinchcombe, 1965) and smallness (Gimenez-Fernandez et al., 2020); thus, COVID-19 is likely to have a greater negative impact on their prevailing business models (Ritter and Pedersen, 2020; Salamzadeh and Dana, 2020). However, as would be expected, the adverse impact of the crisis is spread unevenly across start-ups (Kuckertz and Brändle, 2021) which exhibit various response strategies (Kuckertz et al., 2020). However, crises present not only challenges and adversity, but also opportunities (Wan and Yiu, 2009; Vargo and Seville, 2011). Younger businesses are more likely to invest in innovation during the crisis period (Archibugi et al., 2013) whilst entrepreneurial opportunity recognition is seen as an important driver in the growth of new businesses during such times (Devece et al., 2016).

Environmental settings affect how businesses implement changes and transform their activities during crises (Schneider, 2019) with businesses implementing changes to three interconnected dimensions of their business models: value proposition, value creation and value capture (Clauss, 2017; Müller et al., 2018; Teece, 2010; Foss and Saebi, 2018). These result in business model adaptation and innovation (Gebauer et al., 2020; Saebi et al., 2017; Witschel et al., 2019). The former is defined as ‘the process by which management actively aligns the firm’s business model to a changing environment’ (Saebi et al., 2017: 569), and the latter ‘considers the business model instead of products or processes as the subject of innovation’ (Clauss, 2017: 387) and is strategic in nature (Martins et al., 2015).

The crisis management literature has largely neglected small and medium sized enterprises (SMEs) (Herbane, 2010), with authors calling for greater investigation into business model changes after unexpected events (Corbo et al., 2018) and external shocks (Amankwah-Amoah et al., 2020), as well as the role of perceived opportunities when engaging in business model changes (Osiyevskyy and Dewald, 2018). Consequently, gaps remain in our understanding on how SME’s change business models (Miller et al., 2020) and pursue opportunities in times of crisis (Thorgren and Williams, 2020). Consequently, this article seeks to contribute to the literature and debate by exploring two research questions: How did the COVID-19 pandemic affect start-ups? How did start-ups respond by changing their business model? We analyse interview data from 32 Australian start-ups and explore the impact of COVID-19 upon them by deriving a framework and a visualisation, revealing how they navigated the crisis by changing their business model. Data were collected between June and September 2020, during Australia’s second wave of COVID-19, a time of great uncertainty regarding state and national border closures and other restrictions imposed by state governments.

Within this article we offer a contribution to the literature on business models by identifying the conditions that influence firms to change their models (Saebi et al., 2017) and explore the antecedents of business model adaptation and innovation (Foss and Saebi, 2017). Further, we undertake a fine-grained examination of the relationship between crisis-induced adversity and crisis-induced opportunities, start-up business model adaptation and business model innovation and start-up size. Additionally, we contribute to research on entrepreneurial responses to crises (Doern et al., 2018), and crisis management in small firms (Herbane, 2010), by exploring how start-ups respond to crisis through business model changes.

The article proceeds as follows: in the following section, literature relating to the influence of the COVID-19 crisis on businesses, crisis management and business model change is reviewed. Next, the qualitative research methodology is outlined. Subsequently, the findings are discussed. We conclude with a discussion of theoretical contributions, practical implications, limitations and future research directions.
Literature review

Influence of the COVID-19 crisis on businesses

Research regarding the impact of the COVID-19 crisis on start-ups is still in its infancy; however, such firms are resource-constrained and thus, likely to face increased liabilities of newness and smallness (Freeman et al., 1983; Lefebvre, 2020). This means they are likely to be more disadvantaged by adversity related to the COVID-19 crisis than their larger counterparts with a stronger resource base. It is noted that small businesses are faced with an unprecedented negative impact on their operations (Liguori and Pittz, 2020) and are at risk of running out of cash (Cowling et al., 2020). Similarly, it has been found that smaller firms face greater market, economic, financial and operational risks (Grondys et al., 2021), and are likely to reduce R&D and innovation given the crisis (Roper and Turner, 2020). SMEs and start-ups face a ‘strategy/funding chicken-and-egg-problem’ (Eggers, 2020: 206), where there are insufficient resources available to pursue strategies that would protect or enhance firm performance. In support of this argument, evidence has indicated funding challenges for start-ups in China (Brown and Rocha, 2020) and the UK (Brown et al., 2020) during the crisis.

Nevertheless, crises also present new opportunities for businesses to improve performance (Wan and Yiu, 2009) if they are able to take advantage of strategic opportunities (Vargo and Seville, 2011). The COVID-19 pandemic has disrupted many industries, but it has also triggered growth (Donthu and Gustafsson, 2020) so, for example, generating opportunities in areas such as education (Morley and Clarke, 2020; Dhawan, 2020), agri-food (Rowan and Galanakis, 2020) and online food retail (Dannenberg et al., 2020). This evidence aligns with the external enabler approach to entrepreneurship, showing that entrepreneurs and new ventures can gain advantages from changes to the business environment (Kimjeon and Davidsson, 2021), with the COVID-19 pandemic presenting many with such enabling effects (Davidsson et al., 2021; Klyver and Nielsen, 2021).

There is however, also evidence regarding different relationships between business size and performance during crises. Colclough et al. (2019) found that SME innovation orientation is not affected by the size of the resource base but manager’s growth ambitions, and that pursuing ambidextrous innovation strategies yields positive innovation performance outcomes. Moreover, an examination of small business performance in the years after the global financial crisis revealed that young ventures grew faster compared to older firms (Cowling et al., 2018). These studies suggest that while on the one hand, small businesses are strongly affected by adversity in crises, on the other, they also share attributes such as strategic (Choi and Shepherd, 2005) and organisational flexibility (Nagy et al., 2014) allowing them to weather a crisis, and possibly thrive in uncertain times.

Evidence also suggests that some start-ups could benefit from the COVID-19 crisis. For example, businesses might capitalise on the accelerated digital transformation of work (Nagel, 2020); benefactors from such an acceleration are digital start-ups, mostly in artificial intelligence, robotics and other areas where digital offerings are dominant (Soto-Acosta, 2020). Internationalised start-ups in particular may be able to exploit such new opportunities (Zahra, 2021). Start-ups are also likely to benefit from networking opportunities facilitated by a general change in online communication behaviour (Giones et al., 2020); they can more easily pivot to pursue arbitrage opportunities compared to older and larger businesses, as they are not yet committed to or made investments in one direction (Morgan et al., 2020). Start-ups can also respond more quickly than established businesses exhibiting a faster innovation response time (Ebersberger and Kuckertz, 2021).
Crisis management in SMEs

This article focuses on start-ups (which can also be categorised as SMEs) and their crisis management responses. Crises for businesses can be understood as ‘a perception that an individual or set of individuals faces a potentially negative outcome unless some type of corrective action is taken’ (Dutton, 1986: 502). Crises are thus, ‘an event perceived by managers and stakeholders as highly salient, unexpected, and potentially disruptive’ (Bundy et al., 2017: 1662) and encourage businesses to change and transform (Roux-Dufort, 2007). In the crisis management literature, three distinct stages are identified by using internal and external perspectives on how: (a) an organisation prepares for and reduces the probability of a crisis, (b) an organisation’s management takes action after the occurrence of a crisis to manage it and (c) organisational outcomes are affected (Bundy et al., 2017).

Our second research question refers to how start-ups responded to the crisis; hence, this section concentrates solely on literature pertaining to actions taken by management after a crisis.

Extant evidence for instance, suggests that crisis management strategies affect firm value after product recalls (Yan et al., 2017), and cost-cutting and revenue-generating adaptive strategies were used to respond to the global financial crisis (Smallbone et al., 2012). Adapting to crises leads towards a faster recovery (Doern, 2016) and findings suggest that in a developing crisis, businesses engage in activities to limit adversity but also to seize opportunities (Doern, 2021). After an initial adaptation phase, new entrepreneurial opportunities can be identified (Cheung and Kwong, 2017; Scheidgen et al., 2021); furthermore, identifying the right tools to use in crises improves decision-making (Thürmer et al., 2020). In particular, social media can be an effective tool to communicate with stakeholders during a crisis (Eriksson, 2018), and to adjust response strategies according to stakeholder emotions (Vignal Lambret and Barki, 2018). Integrating resources from external business sources aid smaller firms recovering from a disaster (Battisti and Deakins, 2017) whilst innovation, proactivity and willingness to take risks to pursue perceived opportunities all have a positive impact upon performance during an economic crisis (Beliaeva et al., 2020). Firm size and access to finance have also been shown to influence small firm growth in times of recession (Cowling et al., 2015). A study of smaller Russian firms during an exogenous shock revealed the importance of aligning strategies with the environment, as exploration strategies (in contrast to exploitation strategies) increase the level and variability of performance (Osiyevskyy et al., 2020). Compared to their larger counterparts, smaller firms more often respond by using ambidextrous innovation strategies during recessions (Alcalde-Heras et al., 2019); such use is facilitated by openness towards product co-development with external partners (Alcalde-Heras et al., 2019).

Crisis management and business model change

SMEs, including start-ups, change their business models in response to crises. For this study, we differentiate between two types of changes business model adaptation and business model innovation (Gebauer et al., 2020; Saebi et al., 2017; Witschel et al., 2019). Changes in business models as a response to crises have been empirically examined in different ways. A longitudinal study that followed small businesses affected by earthquakes in New Zealand, found that those able to adapt their business models recovered better, and even thrived after the crisis (De Vries and Hamilton, 2021). Business model innovation is seen as a way of potentially overcoming the COVID-19 crisis (Breier et al., 2021) so for example, in Macao, crisis management practices were implemented by hotels in response to COVID-19 (Lai and Wong, 2020) with more than one-third reported responding to the COVID-19 crisis by finding new ways of generating revenue (Duarte Alonso et al., 2021). Consequently, firms engaged in business model experimentation (Björklund
et al., 2020), those who shifted business models benefited from emerging crisis related opportunities (Seetharaman, 2020). For the purposes of this study, we will focus on how start-ups changed their business model by engaging in business model adaptation and innovation to survive and grow during the ongoing COVID-19 pandemic.

Business model adaptation and innovation

Business model research has grown since the mid-1990s (Massa et al., 2017). Some studies have assessed the business model relationship with dynamic capabilities and strategy, according to different time perspectives (DaSilva and Trkman, 2014), whilst others take an activity system perspective (Zott and Amit, 2010), or integrate both a static and dynamic view of business models (Demil and Lecocq, 2010). There has also been a focus on the main functions of business models (Chesbrough, 2007) or analysis of the interdependencies between business model design themes (Kulins et al., 2016). For our purposes, we follow a widely accepted definition of business models; this includes value proposition, value creation and value capture as interconnected dimensions (Clauss, 2017; Müller et al., 2018; Teece, 2010; Foss and Saebi, 2018) and also distinguish between business model adaptation and business model innovation (Gebauer et al., 2020; Saebi et al., 2017; Witschel et al., 2019).

The COVID-19 pandemic has led to significant changes in the external business environment; to adapt to these changes, firms can engage in business model adaptation; this is ‘the process by which management actively aligns the firm’s business model to a changing environment’ (Saebi et al., 2017: 569). As such, business model adaptations do not necessarily have to be innovative and changes can be undertaken in response to both adversity and opportunities (Saebi et al., 2017). Prior research on business model adaptation has highlighted its relevance for value creation (Achtenhagen et al., 2013) and businesses facing disruption (Cozzolino et al., 2018). It aims to achieve a better fit between the changing competitive landscape and an organisation’s business model (Corbo et al., 2018), for example, when internationalising into emerging markets (Landau et al., 2016). Such adaptation helps start-ups develop their offering (Dopfer et al., 2017) and can be linked to platform-based servitisation (Tian et al., 2021).

In contrast, business model innovation ‘considers the business model instead of products or processes as the subject of innovation’ (Clauss, 2017: 387). This approach involves a strategic focus that can be achieved through managerial proactiveness and systematic strategic processes in ideating and designing business models (Martins et al., 2015), taking into account strategic orientation (Aspara et al., 2010; Keiningham et al., 2020) and strategic flexibility (Bock et al., 2012). Business model innovation processes in start-ups, especially in highly dynamic environments, are influenced by their focus on strategic agility (Ghezzi and Cavallo, 2020) demanding planned changes at the heart of the firm’s business model rather than minor adaptations and imitations (Foss and Saebi, 2017). It can originate from both opportunities and threats (Bucherer et al., 2012), such as digitalisation (Rachinger et al., 2019), big data (Sorescu, 2017) and crises (Sosna et al., 2010). The interplay of internal and external factors contributes to a firm engaging in business model innovation (Su et al., 2020); in times of crisis the approach refers to undertaking long-term strategic changes (Kraus et al., 2020).

Methodology

This section presents our qualitative research methodology based on a constructivist grounded theory approach that addressed the research questions guiding this study: How did the COVID-19
pandemic affect start-ups? How did start-ups respond by changing their business model? It further describes our theoretical sampling process and our data collection in the midst of the COVID-19 pandemic in Australia in 2020.

**Research design and setting**

We used a grounded theory approach to aid our inductive development of the theory (Glaser and Strauss, 1967) with the aim of understanding the impact of the COVID-19 pandemic on start-ups and the responses in terms of their business models. This approach allowed us to systematically identify conceptual categories from data and present evidence, such as our data structure (see Figure 1) and the interview codes (see Table 2, and Supplementary Table 3 in Supplementary Appendix 1), to demonstrate the link between the categories and the data (Glaser and Strauss, 1967). We follow a constructivist approach of grounded theory, acknowledging that our perspectives, experiences and study setting influence the research process and product (Charmaz, 2014). We conducted semi-structured interviews with (Co-)Founders, Managing Directors and (Co-)CEOs of start-ups in Australia.

**Sampling and data collection**

We commenced our initial sampling process (Charmaz, 2014) by researching and compiling a list of Australian support organisations (incubators, accelerators and co-working spaces). We then searched related websites (alumni subpages, news sections, blog sections, etc.) for start-ups that participated in dedicated support programmes. Next, we began to contact start-ups electronically, aiming for a sample with a spread in size, age, location and sector. While we expected to see some business model changes from the start-ups in our sample, we soon saw notable differences in business model changes and in how start-ups were impacted by the crisis.

We then performed theoretical sampling (Corbin and Strauss, 2015; Eisenhardt, 1989), to collect data to inform the explication of our emergent categories and theories (Charmaz, 2014: Patton, 2015: Ghezzi and Cavallo, 2020; Mikl et al., 2020). We sampled start-ups that, a priori, we suspected had been exposed to adversity because of the crisis, for example, start-ups in the tourism sector, and those that we considered to have been presented with opportunities arising from the crisis, such as software-as-a-service (SaaS) start-ups. Finally, we also included start-ups where we did not expect the crisis to exert a strong influence either way. While it was difficult to gain insights into differences in business model changes of start-ups, we sampled start-ups where we expected business model innovations, such as changes in value propositions where new products or services were introduced, but also those where we expected business model adaptations, such as changes in value capture where costs were reduced. The sampling, analysis and interviewing process was iterative in that we continued researching and contacting start-ups that met our criteria while conducting interviews and analysing data. This allowed us to reflect on the interview progress so far and so, inform our theoretical sampling. We sampled participants until we determined that we had reached theoretical saturation, meaning that new interviews were only providing minor additional insights (Eisenhardt, 1989), and no new concepts were emerging (Corbin and Strauss, 2015).

Data were collected as part of an overall research project on the relationship between external knowledge, innovation and performance in start-ups. Data relevant to the impact of COVID-19 on was collected in a separate question and sub-questions from other data. Specifically, interviewees were asked about the effect of COVID-19 on their business, their business model and performance, about changes in innovation and the use of external knowledge, the implementation of changes and
### Examples of first order codes

- Declining revenue
  - Increasing cost
  - Acquiring funding more difficult
- Accessing customers and users more strenuous
  - Communicating with corporate partners affected negatively
- Declining productivity
  - Functioning of supply chain negatively impacted
  - Team-building more challenging
- Collaborating with universities easier
  - Partnering for corporates now an option
  - Shifting market
  - Increasing understanding of offering
- Accessing investors from overseas
  - Increasing availability of stakeholders
  - Reaching customers and users remotely
- Accelerating scalable processes
  - Hiring remotely
  - Working remotely more efficient
- Changing fundraising strategy
  - Reducing costs
  - Winning additional grants
- Education customers and users online
  - Selling remotely
  - Changing task allocations
  - Developing new processes and routines
- Introducing new products or services
  - Modifying existing products or services
  - Targeting different customers
- Accessing new capabilities
  - Leveraging existing relationships
  - Increasing collaboration with partners
  - Focusing activities on future value

### Aggregate dimensions

- Adversity
  - Decreased access to customers, partners, and other stakeholders
  - Loss in efficiency and effectiveness
- Opportunity
  - Increased access to customers, partners, and other stakeholders
  - Forced improvement in processes
- Business model adaptation
  - Value capture: Adaptation of revenue, cost, and investment structure
  - Value creation: Adaptation of internal processes, structures, and ways of reaching customers
  - Value proposition: Strategic change of value proposition, target customer
  - Value creation: Strategic change in capabilities, partnerships, and value creating activities

**Figure 1.** Data structure.
how they captured opportunities (if present). However, because start-ups also raised issues relating
to the impact of COVID-19 without prompting, and how they responded to it, this data was also
considered for analysis.

Data collection took place from July until September 2020; for firms in Australia, this was a
chaotic and unpredictable time. Australia closed its international borders to non-citizens and non-
residents on March 19th 2020 (Prime Minister of Australia, 2020). In addition, border-crossing
arrangements between Australian states became more erratic, as individual states closed and
controlled borders differently and inconsistently eased initial community lockdown restrictions
(Storen and Corrigan, 2020). The Australian government introduced significant economic support
packages for businesses (Cassells and Duncan, 2020). At the time of the interviews, Australia
endured the second wave of the pandemic that occurred mostly in Victoria and resulted in increased
case numbers compared to the first wave during March and April 2020 (Australian Government
Department of Health, 2020). This second wave triggered a severe lockdown for the whole state of
Victoria in July that lasted until mid-September (Zhang et al., 2020), while the lockdown in
Melbourne lasted for 112 days (Smith, 2020). Data collected by the Australian Bureau of Statistics
showed that almost half of the surveyed businesses in Australia had experienced decreased revenue
in July (Australian Bureau of Statistics, 2020), and more than one third of businesses surveyed in
August expected difficulties to meet their financial obligation for the next three months (Australian
Bureau of Statistics, 2020).

The collection of data in the midst of the COVID-19 pandemic meant that all interviews were
conducted through video-conferencing software (Zoom). Semi-structured interviews were con-
ducted with one key informant from 32 start-ups in our sample. To qualify as a key informant, the
interviewee had to be a (Co-)Founder, Managing Director or (Co-)CEO. Before interviews started,
we researched the respective start-ups and key informants online to gain a better general under-
standing of their specific ventures and industries (Mathias and Williams, 2018). Interviews lasted
between 38 and 90 min, and consisted of open-ended questions followed with probing questions –
all were audio transcribed. We triangulated interview data with secondary data, most commonly
business websites, social media profiles, business documents, third-party reports and news reports to
minimise possible retrospective bias. It is also noteworthy that some respondents voluntarily used
their screen-share function in Zoom to give the researchers insights into business systems, doc-
uments and other areas of interest. This function clearly provides an opportunity for other re-
searchers in the future to collect additional data.

As depicted in Table 1, the final sample for this study consisted of 32 Australian start-ups spanning business age, sector and size. Start-ups were situated in seven of the eight Australian states and territories, some in rural areas, but mostly in urban ones. Given the limited number of start-ups in some Australian regions (and to ensure participant anonymity), location information is not presented in the table below.

Data analysis

We used the NVivo 12 application for data analysis to code our data. While as researchers we had
limited assumptions about the impact of the COVID-19 pandemic on start-ups and their responses,
we noted these initial assumptions in a memo to allow for reflection and to better control for the
influence of our assumptions. Commonly recommended techniques were used for our data analysis
process, starting the initial coding with line-by-line open-coding to be receptive to arising theo-
retical possibilities (Charmaz, 2014). Our open-coding process resulted in 321 initial codes. We then
aggregated these first-order codes into more abstract second-order themes, which helped us
understand and describe what we observed in the data (Gioia et al., 2013). We further aggregated these second-order themes to aggregate dimensions to finalise building our data structure (Gioia et al., 2013). The resulting data structure presented in Figure 1 is linear, but the data analysis process was also iterative, in that we kept comparing and refining our emerging structure depending on how well it fits the data (Eisenhardt, 1989).

The data for our visualisation is presented in Supplementary Table 4 in Supplementary Appendix 2. Additional measures for establishing a chain of evidence (Yin, 2009) included keeping a researcher diary and a coding book. We also took field notes during interviews and reviewed them afterwards, and involved the researcher not conducting the interviews in the coding process. The evolving coding framework and relevant decisions were discussed in nine researcher meetings during the research process until we reached a consensus. Involving more than one researcher in the

Table 1. Final sample of start-ups.

| #  | Start-up          | Founding year | Employees (range) | Respondent job title² |
|----|-------------------|---------------|-------------------|-----------------------|
| 1  | BioTech           | 2018          | 2-10              | CEO                   |
| 2  | FinTech           | 2016          | 200+              | Co-CEO                |
| 3  | AgTech            | 2017          | 2-10              | Managing Director     |
| 4  | Food & drink      | 2016          | 2-10              | Founder               |
| 5  | Online marketplace| 2018          | 1                 | Founder               |
| 6  | Robotics          | 2016          | 11-50             | Managing Director     |
| 7  | Immersive Tech    | 2012          | 11-50             | Managing Director     |
| 8  | MedTech           | 2019          | 2-10              | CEO                   |
| 9  | E-Learning        | 2016          | 2-10              | CEO                   |
| 10 | Community platform| 2016          | 2-10              | CEO                   |
| 11 | E-Learning        | 2015          | 2-10              | CEO                   |
| 12 | Data analytics    | 2017          | 11-50             | CEO                   |
| 13 | AgTech            | 2014          | 11-50             | Managing Director     |
| 14 | Food & drink      | 2017          | 2-10              | Co-Founder            |
| 15 | SaaS              | 2015          | 11-50             | Co-Founder & Director |
| 16 | Robotics          | 2017          | 11-50             | CEO                   |
| 17 | SaaS              | 2016          | 11-50             | CEO                   |
| 18 | SaaS              | 2017          | 2-10              | CEO                   |
| 19 | Travel            | 2014          | 11-50             | CEO                   |
| 20 | BioTech           | 2014          | 2-10              | CEO                   |
| 21 | InsureTech        | 2018          | 2-10              | CEO                   |
| 22 | Data analytics    | 2018          | 2-10              | CEO                   |
| 23 | AgTech            | 2017          | 2-10              | CEO                   |
| 24 | AgTech            | 2017          | 2-10              | CEO                   |
| 25 | LawTech           | 2019          | 2-10              | CEO                   |
| 26 | Internet of Things| 2018          | 2-10              | CEO                   |
| 27 | FinTech           | 2019          | 2-10              | CEO                   |
| 28 | Social online gambling | 2014³ | 2-10              | CEO                   |
| 29 | HealthTech        | 2017          | 2-10              | CEO                   |
| 30 | SaaS              | 2017          | 2-10              | CEO                   |
| 31 | Robotics          | 2016          | 2-10              | CEO                   |
| 32 | SaaS              | 2016          | 11-50             | CEO                   |
coding and data analysis process as a form of investigator triangulation further improves the credibility of qualitative analysis (Patton, 1999; Thurmond, 2001).

**Findings**

*Impacts of the COVID-19 pandemic on start-ups and their business models: A framework*

We now present evidence from the data structure culminating in a framework of the impact of the COVID-19 pandemic on start-ups and their business models. As one would expect from a worldwide pandemic, start-ups identified many adverse situations that had a negative impact upon the businesses; 29 of the 32 start-ups reported experience of to adversity. As shown in our data structure in Figure 1, start-ups faced severe adversity, mainly financial pressure, but also a loss in efficiency and effectiveness, and decreased access to customers, partners and other stakeholders. Financial pressures were evident for many start-ups, as revenues had declined because of almost static markets (#19, #24), and problems of acquiring funding as investors were less inclined to invest (#3, #26). Interviewees also reported reductions in efficiency and effectiveness related to supply chain delays, especially those where shipping was important (#13, #14). Efficiency and effectiveness were also affected by difficulties in building teams when most work was being undertaken remotely (#7, #30), and internationalisation processes were disrupted (#17, #31). Decreased access to customers, partners and other stakeholders were evident, especially for those who were not able to reach users because of imposed restrictions (#8, #29), and those who could not undertake product development as planned resulting from restricted access to trial sites (#1, #6). This was also evident for those who no longer received communication responses from partners (such as large corporates and universities) (#21, #22), and for whose remote communication (instead of in-person meetings) resulted in reduced and lower quality access to knowledge and networks (#7, #23).

However, 28 start-ups also recognised additional opportunities, mainly increased access to customers, partners and other stakeholders, forced improvements in their processes, and an increased understanding of and need for their product or service offering. In contrast to respondents that saw a decrease in access to customers, partners and other stakeholders, many respondents reported the opposite. Many businesses moving their operations online increasing their visibility and reach. For example, investors from the east coast of Australia were suddenly easier to access for start-ups from other areas (#26), and international investors became easier to reach (#8) as everyone had to go through the same remote processes. Moreover, respondents reported that stakeholders including high-level individuals (#18), other founders and advisors (#12) and customers (#3) (also internationally (#15)), could be reached more easily, with increased familiarity and availability in calendars for remote meetings. Some respondents reported that the pandemic forced them into process improvements, where they benefitted from processes that had to be moved to remote and online, resulting in more scalable processes (#17) and more efficient use of time and resources (#12). This move occurred because there was no viable alternative to remote and online processes. Finally, many start-ups outlined an increased understanding of and need for their product or service offerings, which they attributed to markets (#12) and consumer behaviour (#14) shifting in their favour, as well as a stronger need of some large corporates and universities for collaboration (#11, #16). Unlike some larger organisations that reduced communication and focused internally, these organisations recognised the need for collaboration to survive.

As expected, respondents met the crisis by changing their business models through business model adaptation and business model innovation. Business model adaptations were made by 24 start-ups. These included changes to revenue, cost and investment structure (value capture), internal processes and structures, as well as ways of reaching customers (value creation). Adaptations in
value capture were evident for larger (#13, #19) and smaller (#18, #21) start-up firms that had to implement cost-cutting measures, as their businesses were severely affected, and for those that strengthened their finances in the short-term via small grants (#22) or additional money raised (#17). Adaptations in value creation were most evident in changes to the way in which they access, inform and train customers and users remotely (#8, #31), and in adaptations in task allocations (#30) and processes and routines (#25). This was accompanied with increased digitalisation.

Business model innovation was pursued by 21 start-ups; innovative value proposition and value capture strategies were initiated to achieve long-term improvements. Such innovation in value propositions were overwhelmingly reported by smaller start-ups which faced severe adversity. These businesses strategically modified existing products and services (#10), introduced new ones (#4) or targeted different customers with their offerings (#5). Business model innovation in value creation encompassed strategic changes in capabilities, partnerships and value-creating activities. These were reported mainly by larger start-ups experiencing increased opportunities. To capture these opportunities, capabilities were strengthened (#16), partnerships created and leveraged (#32) and value creating activities (such as solving more customer problems (#7)), were prioritised.

Further detailed explanations and illustrative quotes for the second-order themes of this study are provided in Supplementary Table 3 in Supplementary Appendix 1. Based on the data with key informants in start-ups, we propose a framework of how start-ups navigate in times of crisis. As shown in Figure 2, crises present start-ups with adversity and opportunities and for most, they interact with each other although for some, they remain as discrete experiences. Our analysis has shown that most start-ups manage crises by engaging in business model adaptation and/or business

![Figure 2. Framework of impact of COVID-19 pandemic and start-up responses.](image-url)
model innovation, while few do not engage in any business model changes. We found that most start-ups display both forms of business model changes and that start-up response is influenced by start-up size and the balance of adversity or opportunities which we investigate in the following sections.

**Impacts of the COVID-19 pandemic on start-ups and their business models: A visualisation**

Based on the previous analysis and our data in Supplementary Table 4 in Supplementary Appendix 2, we developed a visualisation in Figure 3 which suggests six types of start-ups navigating the crisis, depending on two main dimensions: the impact of the crisis and business model change. We used these two dimensions to plot start-ups in the visualisation through the difference of scores in adversity and opportunity and the difference of scores in business model innovation and business model adaptation.

Our visualisation shows how start-ups vary in the extent of business model changes and the emphasis on opportunities or adversity because of the COVID-19 pandemic. We also identify which attributes start-ups share in the respective categories. A surprising pattern emerged – smaller start-ups seem more likely to focus on business model innovation, when adversity outweighs opportunities, while larger ones seem more likely to focus on business model adaptation. The opposite pattern emerges when respondents report that opportunities outweigh adversity; larger start-ups seem more likely to focus on business model innovation, while smaller start-ups seem more likely to focus on business model adaptation. The six start-up types presented below highlight heterogeneity within our sample of start-ups depending on the emphasis upon opportunities or adversity, and the type and extent of business model changes. Few do not engage in any business model changes at all. Illustrative quotes per start-up type are provided in Table 2. We acknowledge that type membership may not always seem as straightforward as our reasoning would suggest. For example, for membership in types 5 and 6 start-ups, we used an emphasis on business model innovation over business model adaptation and whether crisis-induced adversity outweighs opportunities or vice versa.

**Figure 3.** Visualisation of the impact of COVID-19 pandemic and start-ups’ business model changes.
Table 2. Illustrative quotes per start-up type

| Start-up type                  | Patterns and start-ups per type | Illustrative quotes                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **Type 1 start-ups: stable beneficiaries** |                                  | 1. 'And, um, and our business, like I said before, it was more luck than good management, um, thrived because we were an online business… that allowed people to stay in touch, even though they couldn’t see each other in person. So that’s probably the three key reasons why we've gone really, really well during the plague or pandemic. Um, none of them to do with any kind of talent'. (Start-up #28, Social online gambling) |
|                               |                                  | 2. 'I don’t think we’ve, we really haven’t seen anything change meaningfully out of COVID yet, but I mean, it’s fairly, nothing moves that quickly. So, um, so it might be, we’ll see it over the next, you know, six to 12 months'. (Start-up #6, Robotics)                                                                                                           |
|                               |                                  | 3. 'Um, and we’ve been, yeah, we, um, we, we had to cut back some staff, um, we’ve slowed down some of activities, we’ve taken on some of the government’s support’. (Start-up #6, Robotics)                                                                                                                     |
|                               |                                  | 4. 'Well, on our online sales and we already had the business model was already suited for this. So to capture it, we’re already set up for online... Yeah, there were, there were some, there’s definitely some delays because we import some of our ingredients from overseas. So we saw, um, some delays in our raw ingredients, um, and to, to, to mitigate that, I just had to order larger quantities and essentially stock up to make sure we could get through this this time'. (Start-up #14, Food & drink) |
| **Type 2 start-ups: business-as-usual continuers** |                                  | 5. 'I mean, honestly for us, it’s had very limited impact. So at this point, um, we were lucky our main clinical trial was already fully enrolled with all patients enrolled. So we weren’t enrolling patients. We were just monitoring their ongoing treatment and that has continued and there was no need has been no need to interrupt it. Um, it hasn’t been interrupted. We know others who have, but we’re fortunate. We have not. Um, we, um, it has made, it has made some, um, some of the logistics things, maybe a little more tricky for us'. (Start-up #20, Biotech) |
|                               |                                  | 6. 'I mean, um, the team get together, can’t get together in person as often as they would, I, every day, uh, some of them are not able to get together at all. We’re conducting daily virtual meetings. And in fact, I have our daily meeting in 10 minutes. Um, and so we have to, we have to arrange things differently. We have to operate in a different fashion. It’s less efficient, it’s less productive. Um, it has impacted our ability to conduct clinical trials and to progress those. It has meant that I have to stretch my funding further and I therefore have to adjust our budget to turn some activities and spend down or off. Um, it’s, it’s not good. So it’s impacted negatively'. (Start-up #1, BioTech) |
7. ‘Everyone’s worked from home, made sure everyone was safe at home. Um, we have daily meetings now. We probably communicate better in a lot of ways than we did in the office where people sat in their cubicles, did their work and went home. Um, we had a weekly meeting now we have daily meetings and we have multiple times a day meetings’. (Start-up #3, AgTech)

8. ‘I had to make the hard decision to lay off 50% to keep our runway going. Um, then we had very, we had zero traction in March, April. It was crickets. Then in May, we started seeing interest, uh, we had new snippets and interest and, uh, and that was aligned very strongly with, um, market optimism and opportunities that were being hailed as coming into the market… And I think we’ve been, we’ve been lucky to cut through red tape of going through the procurement process to get a, or the security process to get a new system implemented. What might have taken 18 months got compressed into three months during COVID to actually get teams assembled up and running on a remote platform, um, that doesn’t meet ISO accreditation, but they don’t care. They’re just trying to exist. And it’s like forgiveness later’. (Start-up #18, SaaS)

9. ‘We’ve got a very well-oiled process of onboarding them. We will know by the end of the conversation. Um, and we can, we can actually get a demo happening for them within minutes, hours, days, whereas before it was weeks just to secure a face to face meeting. Whereas now it’s instant. Um, they’re, they’re able to book, book the demo while they’re on our website, we respond straight away. We’d lock it in the diary. It happens. And we can, we’ve taken the process from nine months down to 90 days at the moment to onboard these, these customers. And they can be up and running in 10 minutes on our platform’. (Start-up #18, SaaS)

10. ‘It’s also something that actually probably more productive. So like generally previously we would be in the office. People would probably come in, you know, between 8.30 and 9.30. Um, and I sort of have to, you know, we, we greet everyone and then we sort of have to one by one sort of chat to them about what they were working on that day. Whereas now we just have a 9am videocall, and then we each run through what we’re working on that day’. (Start-up #30, SaaS)

11. ‘Uh, yeah, actually we, like, we’re kind of lucky the niche that we’re in, um, uh, obviously, you know, online, we’re looking mainly at e-commerce, um, and then collecting data. So a lot of customers that, um, had to close their brick and mortar stores, were focussing a lot more on the ecommerce store. And so actually our insights became even more useful than they had been previously’. (Start-up #30, SaaS)

12. ‘Uh, yeah. Well, I mean, we’re a travel business, so it’s, it’s been, yeah, pretty pretty. I mean, when it first happened, it was a catastrophe. Um, as it was for everybody… we kind of, you know, shifted or pivoted our marketing strategy to this, uh, concept of, you know, it wasn’t original, but you know, travelling from home’. (Start-up #19, Travel)

13. ‘So we, yeah, so we basically had to, you know, typical cost cutting in early March, so everybody down to 4 days 80%, um, cut a few staff, then got them back through JobKeeper. But, um, yeah, just took down all of our expenses, you know, basically ran through every dollar we were spending. Um, and you know, we ended up, I think we ended up cutting out expenses by well, over kind of 60%, which is pretty remarkable. Um, and, uh, that obviously extended our runway, JobKeeper extended our runway… We’ll be looking to get more investment, um, based on what we’ve achieved through COVID, which there’s been some positives there. So we’ll go back to our investor base and, and look to you, um, get a bit of a war chest or a bit of a buffer to get us through this period’. (Start-up #49, Travel)

14. ‘The little impact, um, was, uh, it spooked our investors… also on the product launch side, we were working with a large insurance company, they didn’t tell us that they were delaying the product launch, but when I look back at it now, it probably had about a three or four months, um, impact on the, on the timing of the launch, because they were just really slow to respond’. (Start-up #21, InsureTech)

15. ‘So we cut back on, uh, so we cut back on our ongoing costs by about half. So we had a head of sales and marketing… we just decided not to replace his role’. (Start-up #21, InsureTech)

16. ‘It was a pretty enormous and reasonably traumatic at the beginning. Um, we, we were, you know, we were on a very, very fast growth trajectory in March of this year when COVID sort of, it became apparent to us that COVID was going to impact the world… We were going there to raise 10 million US dollars. And all of a sudden we couldn’t go. I didn’t have a backup plan. And, um, we were burning $250,000 a month. So we immediately had to cut all spending. We had to put all of our staff on notice or the vast majority of them, that, that, um, you know, might need to be stood down. And we stayed in Australia when we raised, um, some money immediately, what would literally, within two weeks it was done’. (Start-up #13, AgTech)

17. ‘It made us think more about, um, having, uh, backup plans for suppliers of different componentry of different electronics and other things. You know, we created a risk management plan around having a parachute packed, you know, a metaphoric parachute to, um, to allow us to survive a number of months, even if our supply chains out of China were, um, cut’. (Start-up #13, AgTech)
| Start-up type | Patterns and start-ups per type | Illustrative quotes |
|---------------|---------------------------------|---------------------|
| Type 5 start-ups: Opportunity grasper | Exploit opportunities in positively affected sectors/niches, mainly by strategically improving value creation (Start-ups #7, #9, #16, and #32) | 18. ‘So look on one side, COVID’s been an opportunity commercially, on the other side, everything’s changed, worker engagements have changed. We’ve had people wanting to join us from United States, from NASA’. (Start-up #16, Robotics)  
19. ‘Yeah there were, um, we took a very critical assessment of our next three year plan and at one year plan and anything that didn’t result in a commercial product that could be commercialised and implemented and sold as a package with marketing and everything else around it was terminated immediately. Um, it did fundamentally shift in a good way. We’ve used it as an opportunity. We’ve used COVID as an opportunity to really shift the dynamic on what were we actually doing?’ (Start-up #16, Robotics)  
20. ‘We were in e-commerce, we provide an e-commerce store, e-commerce has gone bananas... we get a lot of our users from these actual e-commerce platforms. So from Shopify, BigCommerce, et cetera. So we’ve actually been working a lot closer with them throughout COVID to, um, to kind of try and funnel more of their, their, their insane growth, funnel it to us. Um, which has been great. You know, they, both, both of those platforms have sort of featured us as an app during COVID and yeah, like I said, our user growth has been really, really strong’. (Start-up #32, SaaS)  
21. ‘Um, I’m pulling, um, investing every single penny, like I’ve just hired, uh, two, uh, brought on another machine learning PhD, uh, to help solve some of that. Cause we want to start to use computer vision... So I’m probably rolling the dice and shortening my cash runway to take advantage of this moment’. (Start-up #7, Immersive Tech)  
22. ‘So I’m rolling the dice. I’m even using all of my JobKeeper to instead of, uh, cause we have enough money to hire. So that JobKeeper I could use as a little bit of a buffer as to protect me. But I actually said, okay, you get this amount of money every month. I’ll take a risk and say, okay, I’ll bring on somebody. And cause the JobKeeper may stop at any time. But in a sense, I could use that money to hire someone else. And that’s what I’ve done. I’m throwing every single resource to solve as many of these problems’. (Start-up #7, Immersive Tech) |
| Type 6 start-ups: Lemonade makers | Challenge adversity mainly by innovating value proposition to achieve product-market fit (Start-ups #4, #5, #10, #22, #24, #27, #29, and #31) | 23. ‘Uh, so when we started, like, you know, even if you look at six months ago, we were primarily focused on the B2B. So we, you know, we wanted to sell to hospitals and rehab centres, but as a COVID-19 situation has kind of evolved, we’ve sort of found that the people are actually using sort of in home therapy a little bit more. So I think we’ve sort of started looking at sort of, um, looking at our business model a bit more seriously as to how, what we can do to make the a, the B2C model a bit more sort of, uh, attractive for people, you know... Both solutions aren’t, um, not, not, not, not ready for market yet, but, um, I think, um, so, you know, B2C it’s, I think it’s, it, it may happen so that we may do the B2C solution first before we do the B2B solution that could a kind of shift in our strategy’. (Start-up #29, HealthTech)  
24. ‘So at the beginning our product was a buy now pay later platform... I don’t want to be in debt right now. You know? So we pivoted our product to be focused on that financial wellbeing platform. And at the moment we’re still at that platform, right’. (Start-up #27, FinTech)  
25. ‘So within like two weeks, every customer that we had... was gone... I don’t have the runway to get to where they’re going to come back. It’s going to be to make money now, who do we help? I was like, crap. I have got to figure out who our new customers are. And we had 24 different possible customer segments. We were not starved for people to help. We just didn’t know who had the greatest urgency and who’s going to pay the most money. Um, so we took this and said, all right, show me who small businesses are. And so I’ll kind of zoom in on what this looks like. So right here, you can see there’s um, small businesses. I started looking who are the people that are up in this corner. And we saw there was a lot of those small businesses kept kind of coming up. I’m like, Oh, that’s interesting. These guys are here. Oh look, how many small businesses are saying, yes, they’ve got a huge sale potential, but they also have like an urgent need for your solution. And then they’re like, all right, well, these are the ones that we need to focus on the most... And so using the answers that we’re getting from surveys, I would say these are the ones that we go and look at, and we can also give them a scoring system of, of small business and of med techs who are the ones that have the greatest need and the greatest urgency and budget. And that’s how we pivoted our customer segments in the middle of COVID... Cause COVID now, um, my customers do not exist in the same way they used to. It’s completely new. Like all the research that I thought I knew is gone. I gotta start over and do this again. And this is how I did it really quickly’. (Start-up #22, Data analytics) |
versa as criteria. Hence, we assigned #16 to type 5, while it could also be argued that #16 could belong to type 6 or type 3.

**Type 1 start-ups (stable beneficiaries).** Type 1 start-ups either did not report any changes to their business models – neither business model adaptation nor business model innovation (#28) – or were only engaged in minor business model adaptation, but no business model innovation (#6, #14). We term this type of start-up as ‘stable beneficiaries’ as they remained close to their original operating approach prior to the pandemic, but profited from opportunities that arose. Both of the businesses that engaged in minor business model adaptation were offering physical products. The nature of their products meant that they had only to adapt operations to the new environment and did not make any other changes. They benefitted from changing markets, such as a strong increase in online sales in the food and beverage industry. Start-up #28 did not report any business model changes but at the same time, saw many opportunities, especially given the increasing demand in the sector (social online gambling) during COVID-19 pandemic.

**Type 2 start-ups (business-as-usual continuers).** Type 2 start-ups either did not report any changes to their business models – neither business model adaptation nor business model innovation (#20) – or were only engaged in minor business model adaptations but no business model innovation (#1). We term this type of start-up as ‘business-as-usual continuers’ who continued with the course they had taken in the face of adversity. Both businesses were from the BioTech industry, where product development can take considerable time. Issues arose because of changes in the availability of resources in areas such as logistics, conducting clinical trials or reaching stakeholders. Further, both businesses did not see the need to change their value proposition due to how their industry functions and neither reported any new opportunities. Their operations remained almost unchanged by the adversity they faced due to the crisis.

**Type 3 start-ups (digital adjusters).** Type 3 start-ups either reported only business model adaptations (#8, #15, #26) or reported both business model adaptations and business model innovations (#2, #3, #11, #12, #18, #25, #30), usually with a focus on business model adaptations (#2, #12, #18, #25, #30); some with the same level of business model adaptations and innovations (#3, #11). We term this type of start-up as ‘digital adjusters’ as they had digital offerings and mainly adjusted their internal operations to capture opportunities from the crisis. The digital adjusters either offered software to their customers, or software had an important role in their value proposition. For one section of these start-ups (#8, #15, #26), their offerings and value proposition were already suitable for a remote environment before the crisis. They saw opportunities in increasing demand in the market and that customers better understood their offering; hence, they made business model adaptations in areas such as internal processes rather than products or services. The remaining type 3 start-ups also made internal adjustments, such as improving and developing structures and processes for working remotely to align their operations to the new way of doing business. Some faced initial difficulties (#8, #18), for example in accessing customers and users, but they were certain that the market opportunities ahead outweighed any adversity after overcoming these difficulties. Overall, internal adjustments allowed these digital start-ups to capture arising opportunities.

**Type 4 start-ups (adversity survivors).** More than half of type 4 start-ups were larger start-ups (#13, #17, #19), while the others were smaller (#21, #23). All of them saw their industries, or their customer industries (#17, #21), disrupted by changes brought about by the COVID-19 pandemic. We term this type of start-up as ‘adversity survivors’ as they experienced major disruptions and declines but
adapted to survive through the crisis. The group of larger start-ups had already experienced strong
growth prior to the pandemic, but their markets (e.g. travel) were quickly eroded, or their initial growth
and international expansion plans were hindered. Thus, they reacted by severely cutting costs,
changing fundraising strategies and raising smaller investment rounds from existing investors to
quickly gain additional financing. These measures helped their businesses to reduce the risk of
bankruptcy. The second group consists of smaller software and technology businesses (#21 and #23)
that faced difficulties in launching products, reaching out to customers and stakeholders or securing
investment because customer industries were severely affected by the COVID-19 pandemic. As a
result, they focused on surviving and reaching customers in different ways.

Type 5 start-ups (opportunity graspers). Three of the type 5 start-ups were larger start-ups that re-
ported additional growth since the beginning of the crisis (#7, #16, #32), with one (#9) smaller start-
up seeing an increase in demand (e-learning). We term this type of start-up as ‘opportunity graspers’
because they were presented with opportunities and engaged in business model innovation to
capture these opportunities. All type 5 start-ups already operated in sectors/niches that benefitted
from the COVID-19 pandemic and/or saw additional opportunities emerge due to shifting markets.
To capture these opportunities, the three larger start-ups strategically improved their value creation,
while start-up #9 added a new, additional service targeting different customers. By engaging in these
types of business model innovations, all start-ups captured opportunities offered by the market
situation. Start-ups in this quadrant did not switch customer bases because of the COVID-19
pandemic. Only one (#16) had to make minor business model adaptations, improving internal
processes. Three interviewees (#7, #9 and #32) did not highlight any business model adaptations.

Type 6 start-ups (lemonade makers). Type 6 start-ups are from diverse industries: they are all in the
early stages of their business and none have experienced rapid growth. Changes in the market
challenged their initial value proposition, and sometimes products and services were made obsolete.
They were able to pivot their business models by innovating their value proposition, seeking to gain
product-market fit in the changed circumstances. We term this type of start-up as ‘lemonade
makers’, referring to the proverbial saying ‘when life gives you lemons, make lemonade’ and the
related effectual principle of being flexible instead of sticking to previously set courses (Prashantham
et al., 2019). Making the best out of an unfortunate situation mainly included changing or adding
additional customer bases from B2B to B2C, or the other way around (#5, #24 and #29), and developing
new or modified products and services (#4, #10, #22, #27). One start-up (#31) used the crisis to access
capabilities it previously was not able to. Interviewees reported very few opportunities, and many (#5, #10, #22, #29, #31) described also engaging in business model
adaptation, mostly to ensure that they were able to reach customers and communicate the changes
they were implementing. Overall, business model innovations typically allowed these start-ups to
react to the adverse environment they were facing due to the crisis.

Discussion
This article aimed to investigate how start-ups were affected by, and have responded to, the COVID-
19 pandemic. It extends current research on the impact of the COVID-19 pandemic by deriving a
framework and a visualisation revealing how start-ups have navigated the crisis through business
model changes. The visualisation is based on two dimensions: the emphasis on opportunities or
adversity, and business model change. The COVID-19 pandemic has been an unprecedented global
crisis with cascading economic and societal consequences affecting start-ups on many levels. We
discovered that the majority of start-ups responded to this crisis by making changes to their business models. We found evidence for these business model changes in 30 of the 32 start-ups in our sample. Based on this analysis, we suggest the following:

Proposition 1: Start-ups are likely to react to crises by making changes to their business models.

Our data and first proposition mirror the findings of other studies that have shown changes in business models as responses to the COVID-19 pandemic. Business model changes were found in different settings, for example, business model adaptations in German start-ups (Kuckertz et al., 2020) and business model pivots in businesses run by women entrepreneurs (Manolova et al., 2020). However, we found that not all start-ups have been adversely affected. While 29 of the 32 respondents agreed their start-ups had been adversely affected, 28 also reported opportunities because of the crisis. Based on this data, we suggest the following:

Proposition 2: During a crisis, opportunities and adversity prompt start-ups to engage in business model changes.

The role of adversity and opportunities for start-ups to engage in business model changes has been suggested by previous research. Kuckertz et al. (2020) showed that start-ups make changes to their business models as a response to adversity, a relationship also found in other contexts, such as for SMEs (Thorgren and Williams, 2020). Other research indicates that the COVID-19 crisis has given rise to opportunities for entrepreneurial ventures (Kuckertz and Brändle, 2021), who engage in business model changes to capture these (Manolova et al., 2020). Our evidence highlights further differences within our sample. As shown in Sec. 4, we not only find differences in the impact of the crisis but also in business model changes, whereby start-ups engaged in both business model adaptation and business model innovation. Depending on opportunities or adversity related to the COVID-19 pandemic, and a focus on business model adaptation or business model innovation (or not engaging in any business model changes), we find different types of start-ups in our sample. Further, we find that firm size seems to be related to the likelihood of start-ups focusing on either business model adaptation or innovation. As shown in Figure 2, we find that being exposed mainly to opportunities, larger start-ups more often engage in business model innovation, while smaller start-ups more often engage in business model adaptation. Based on this analysis, we suggest the following:

Proposition 3: During a crisis and when opportunities outweigh adversity, larger start-ups are more likely to engage in business model innovation, whereas smaller start-ups are more likely to engage in business model adaptation.

In times of crisis, firm size positively influences firm growth (Cowling et al., 2015). Possibly, when opportunities outweigh adversity, core rigidities (Dororthy, 1992) are less prevalent for larger start-ups, and they can benefit from a size advantage shown in non-crisis related studies. Research suggests that the liability of smallness negatively affects innovation (Vakulenko, 2020), that firm size positively influences certain aspects of business model development in the context of sustainable innovation (Aguilar-Fernández and Otegi-Olaso, 2018), and that larger firms are more likely to engage in business model innovation (Waldner et al., 2015). For start-ups mainly exposed to adversity, we find the opposite. As shown in Figure 2, larger start-ups more often engage in
business model adaptation, whereas smaller ones more often engage in business model innovation. Based on our analysis, we suggest the following:

**Proposition 4:** During a crisis and when adversity outweighs opportunities, smaller start-ups are more likely to engage in business model innovation, whereas larger start-ups are more likely to engage in business model adaptation.

Previous research supports our findings that smaller businesses might be in an advantageous position to innovate when facing adversity. Latham (2009) found that during recessions, smaller start-ups are more likely to respond through revenue-generating activities, while larger businesses focus on reducing their cost and improving internal structures. Our findings extend this view, providing evidence that differentiating start-ups by size yields similar outcomes. When exposed to adversity, smaller start-ups are likely to respond through business model innovation, thereby creating revenue, whereas larger start-ups are more likely to respond through business model adaptation, thereby improving efficiencies and reducing cost. Previous research has shown that start-ups had a faster innovation response time than established businesses during the COVID-19 pandemic (Ebersberger and Kuckertz, 2021). It is plausible that smaller start-ups can respond more quickly to adversity than their larger counterparts. Businesses that acted quickly were more likely to pursue growth-focused strategies as compared to cost-cutting strategies during the COVID-19 crisis (Nguyen et al., 2021). Reflecting this argument, rapid growth was seen to hinder businesses in successfully routinising, which would have increased pre-crisis resilience (Haase and Eberl, 2019), and thus, could have aided in engaging in business model innovation as a response.

It also cannot be ruled out that observed heterogeneity in our sample is driven by industry affiliation. Previous studies have found that sector influences growth in a recession (Cowling et al., 2015) and that industry structure affects business model innovation (Waldner et al., 2015). We also do not know how respondents in our sample were affected by their founder identities as this influences whether situations are perceived as opportunities or threats, thereby influencing strategic choices (Powell and Baker, 2014). Founder identity also contributes to whether start-ups exhibit inertia or flexibility (Zuzul and Tripsas, 2020).

**Theoretical contributions**

Our framework contributes to a fast-evolving research trend in the business and management field – the impact of COVID-19 on businesses, specifically start-ups (Verma and Gustafsson, 2020). Existing research has shown that start-ups have experienced different types of adversity associated with COVID-19 pandemic, and responded by converting adversity into resilience, for example, through business model adaptation (Kuckertz et al., 2020). In line with such evidence, Björklund et al. (2020) found that business model experimentation was a common response to crisis-induced adversity. Our analysis builds on and expands earlier studies by providing a more nuanced picture, highlighting the role of opportunities, adversity and firm size in engaging in business model adaptation and business model innovation for start-ups during the COVID-19 pandemic.

We contribute to the literature on business models by identifying that both adversity and opportunities influence firms to change their business models (Saebi et al., 2017). Previous research has highlighted either the role of external adversity (Corbo et al., 2018; Osiyevskyy and Dewald, 2018) or opportunities (Wirtz et al., 2010; Sabatier et al., 2012). We find that both threats and opportunities combine to shape small firms strategies and business model adaptations (Cozzolino et al., 2018). We also contribute to business model innovation theory by exploring its antecedents
(Foss and Saebi, 2017), in our case, opportunities and adversity in a crisis. Furthermore, we contribute to the crisis management literature by providing a more detailed understanding of entrepreneurial response to crises (Doern et al., 2018) illustrating that start-ups are likely to respond to crises through business model changes. Moreover, we observe that start-up size influences the relationship between adversity and opportunities in a crisis, and as well as their business model adaptation and innovation strategies. We thus, contribute to analyses of crisis management in small businesses in this under-researched field (Herbane, 2010), and identify how firms change their business models in times of crisis (Miller et al., 2020).

**Practical implications**

Our study shows that policymakers should consider different support policies for different groups of start-ups. While governments globally have largely implemented one-size-fits-all support policies for small firms, we suggest that not all start-ups require support, and those requiring support would benefit from more targeted policies. For some start-ups, additional finance and investment measures or government stimuli to increase demand in severely affected markets would help increase their performance. For others, (re-)gaining product-market fit is vital for survival, achieved, for example, through measures such as dedicated grants or online workshops helping them access customer feedback quickly and adequate consultancy services. We also found that access to customers, partners and other stakeholders had changed for many start-ups – better for some, worse for others. Digitalisation can enable access for struggling start-ups. Policy makers could support digitalisation through specific grants or by making digital offerings mandatory for government-funded programmes and entities such as incubators, accelerators or investment funds. This would ensure that access to government-related stakeholders is increased for every start-up in Australia.

Our evidence also highlights the need for executives of start-ups to continually reconsider their business model to counter adversity and capture opportunities. Executives should constantly scan the environment for opportunities (Robinson et al., 2020), even in times of crisis. While measures such as cost-cutting are initially viable for start-ups in adversely affected industries and niches, executives should focus some of their attention on possible business model innovation, such as identifying new customers or developing new value propositions. Especially for larger start-ups, overcoming possible core rigidities (Dorothy, 1992) when facing adversity becomes important when turning towards business model innovation.

**Limitations**

Although this paper has made a contribution to our understanding of start-ups' responses to crisis, it has several limitations. We rely on interviews with one key informant per start-up as our main data source, which did not allow for the perspectives of other key informants in the same venture to be considered. Nor did we interview key informants over time, and thus do not know how successful they were in managing their enterprise over the medium to long term. We collected retrospective data at one point in time, introducing the potential for retrospective bias. However, we believe that following the outlined triangulation measures has reduced the likelihood of retrospective bias. Start-ups were assigned types based on our qualitative reasoning, potentially biasing our analysis. Being an Australian-based study, we do not know how country-specific factors such as culture, institutional factors, government approach, societal views and the severity of the COVID-19 pandemic differ from other contexts. We only contacted start-ups that had engaged in programmes offered by support organisations, thus not capturing those who did not
seek such support. Recruitment and data collection took place via digital tools (Zoom), potentially influencing who decided to participate. This may have also resulted in information that is less rich when compared with in-person interviews (Johnson et al., 2019). Finally, our sample did not include interviewees from start-ups that went bankrupt during the crisis. Our theorising cannot therefore, account for start-ups that never engaged with support programmes or those that faced adversity and failed as a result.

**Future research**

There are substantial avenues for further research that address the strategic responses of small firms during a crisis. Future research could include using quantitative methodologies to test and build on our propositions, preferably across different industries and countries. These enquiries could also reveal the magnitude of the impact of both business model adaptation and business model innovation on firm performance. Additionally, the impact of start-up size on business model adaptation and business model innovation could be tested. Furthermore, in-depth longitudinal case studies of both smaller and larger start-ups during the COVID-19 pandemic would help to improve our understanding of the timing of decisions to engage in business model adaptation and business model innovation. This could include analyses of reasons for doing so and for emphasising one or the other, and the processes involved in balancing the two over time. Both quantitative and qualitative future studies that include ventures that went bankrupt would aid a deeper understanding of the relationship between opportunities, adversity, business model adaptation, business model innovation, firm size and their interplay in navigating a crisis for start-ups.

**Conclusion**

This article has examined how start-ups were affected by the COVID-19 pandemic and how they responded to this crisis using a business model perspective. We found that most start-ups responded by making changes to their business models. Start-ups were found to focus on business model adaptation or business model innovation, or a combination of both, depending on the interplay of crisis-induced opportunities, crisis-induced adversity and firm size. We contribute to research on business model adaptation and business model innovation, on crisis management in SMEs and specifically start-ups, and extend the growing field of studies on the impact of COVID-19 on businesses in the business and management literature.

**Declaration of conflicting interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding**

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Supplementary material

Supplementary Material for this article is available online.

Notes

1. One start-up was founded and headquartered in New Zealand, but had a strong presence in Australia. The key informant we interviewed was also located in their Australian office.

2. All interviewees, except #13 and #20, were (Co-)Founders of the business. We only report the actual job title in this table. For interviewees that did not report an official job title, we instead present founder-related information that they used themselves, e.g. on their respective websites.

3. The interviewee had founded the legal entity with the idea in mind prior to the depicted founding year, but reported starting to work on it in the year reported in this table.

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