Understanding small business adaptation to natural hazards: A critical review

Harries, T., 2021. Understanding small business adaptation to natural hazards: A critical review. *International Journal of Disaster Risk Reduction*, p.102403.

Abstract

Research into small business adaptation to natural hazards is immature and poorly focussed, with too much emphasis on capacity factors and too little focus on the motivators of adaptation. More theorisation and use of models would help avoid such omissions in future. There is firm evidence for the importance of some predictors: relevant skills; perceptions of response costs; building tenure; owner education; business sector, and business size. More qualitative and quantitative exploration is now needed to identify the factors that mediate these predictors and to establish the reasons for the inconsistent findings on the influence of hazard experience. Furthermore, evidence on the importance of other potentially important predictors is partial and fragmented – for example, social norms, social prompting and the concentration of clients in the area affected by a hazard event. More research also needs to be conducted in the Global South, where natural hazards have the greatest impact and the socio-cultural environment differs to that elsewhere. Given the importance of small businesses for economic development, equity of opportunity and the resilience of the wider community, it is important for these lacunae to be addressed.

Key words: small business; adaptation; natural hazard

Graphical/Visual Abstract (colour image)

Evidence of the factors that influence small businesses' behavioural adaptations to the risk of natural hazards. One important factor remains un-researched; others have only been evaluated in single studies. The categories Capability, Motivation and Opportunity are taken from the COM-B taxonomy of behavioural influences (Michie, van Stralen, & West, 2011).

STATISTICAL EVIDENCE	Capability *psychological and physical capacity to engage in the activity concerned, including possession of knowledge and skills*	Motivations *all brain processes that energize and direct behaviour: conscious, analytical decision-making, habitual processes and emotional responses.*	Opportunities *all factors outside the business that make the behaviour possible or prompt it*
Multiple studies	**Adaptation-relevant skills** **Business size** **Business sector**	**Perceived response costs** **Perceived self-efficacy** **Relationship with natural environment**	Prompting by customers and business associates*
Single study		Threat appraisal	Social norms **Location of clients**
Contradictory	**Owner education** **Owner gender**		**Previous hazard experience** **Ownership of premises** Prompting by government*
None – but large effects amongst householders		**Perceived response-efficacy**	

* Effect size unknown

KEY **Strong effects**
Medium effects
Weak effects

1. INTRODUCTION

The resilience of small businesses to natural hazards is of increasing societal importance as the effects of climate change become more common, so it is vital to establish the factors that influence these businesses to implement appropriate adaptations. However, research on this question is fragmented and no systematic review of the literature has yet been published.

A vibrant small business sector enhances competitiveness and innovation (Ackermann, 1999; Bennett, 2014), helps avoid economic stagnation (Carlsson, 1999) and aids growth in developing economies (Romer, 1994). Furthermore, small businesses promote equity of opportunity, facilitate the entrance of marginalised groups into the economic and social mainstream (Ackermann, 1999; Bennett, 2014) and help the disaster-recovery of communities (Peek, 2017; Storr et al., 2016). Their vulnerability to natural hazards, however, is evident from, inter alia, recent disasters in Japan, Thailand, the USA (UNISDR, 2013) and Europe (Cabinet Office, 2008; Chatterton et al., 2016; Chatterton et al., 2010; Civil Contingencies Secretariat, 2013; Kreibich et al., 2005; Marsh et al., 2016).

Resilience to natural hazards is a multifaceted notion. Perhaps most of all, it includes dynamic capability (Teece, 2007; Teece et al., 1997): the organisational routines and management skills that enable a firm to shape its internal competencies in a manner that facilitates faster recovery (Neise & Diez, 2019; Skouloudis et al., 2020). Recovery is also aided, however, by material arrangements, financial arrangements and planning processes that reduce the damage and disruption caused by the flood, earthquake, wild-fire etc. This latter aspect of resilience is the focus of the present literature review, which asks why small businesses do, or do not, introduce such arrangements. There is no systematic collection of data on small businesses' use of these arrangements (Park et al., 2020). However, in the UK less than a third of at-risk small businesses are thought to have adapted to that country's most common natural hazard, flooding (Park et al., 2020), and it is assumed in policy circles that the major barriers to practical adaptation have yet to be addressed (Bonfield, 2016, p2).

Small businesses have different vulnerabilities to larger ones, so need to be treated separately. They are less able to deal with the financial impacts of natural hazards (Sullivan-Taylor and Branicki, 2011; Webb et al., 2000) and tend to have more localised sale and supply networks (Webb et al., 2002) and to operate from single locations (Krollet al., 1991). They are also less likely to implement material, financial and planning measures to reduce their vulnerability: 50-60% of large companies have plans for dealing with climate-related risks, but only 37% of SMEs and 28% of those with fewer than ten staff (UNFCCC Adaptation Committee, 2017).

The reasons for this low take-up have received little attention in the research literature (Linnenluecke & Smith, 2018; Zhang et al., 2009). Although small business resilience in general is a much-researched topic, most studies focus on adjustments to changing competition environments, new products, and changed political, economic, and legal conditions; few look at responses to changes in the natural environment (Linnenluecke et al, 2013). As a result, the evidential basis for policy intervention is weak (World Bank, 2020). This study aims to draw attention to that omission; to inform those planning to intervene in this area, and to stimulate additional research. It does this by identifying gaps in the existing research and highlighting directions for future work.

The first challenge faced by such a venture is the polysemic nature of the term 'small business'. In the US, a manufacturer or mining company is considered 'small' if it has fewer than 500 employees, and a non-manufacturing business if it has less than $7.5m in annual receipts (US Small Business Administration, 2017). In the EU, 'small' businesses have fewer than 50 employees and a turnover/balance sheet of less than 10m Euros (European-Commission, 2003) and 'SMEs' have fewer than 250 employees and either an annual turnover not exceeding 50m Euros or an annual balance sheet total not exceeding 43m Euros (European Commission, 2020). As a final example, in India a 'small' manufacturer must have less than 50m rupees ($0.75m) invested in plant and machinery and a 'small' service business, less than 20m rupees ($0.3m) invested in equipment (Government-of-India, 2017). In this review, 'small' is defined in terms of employees rather than turnover or investment in infrastructure because this is the way the variable is usually operationalised in the empirical literature. Given that much of the relevant work is conducted in the US, and in order not to exclude this constituency, I take the broadest, US, definition and include all studies that report on businesses with less than 500 employees.

To identify the gaps in the research on small businesses, I compare it with research into a more widely researched at-risk population: householders. Many of the underlying behavioural, emotional and psychological factors that influence risk response behaviours amongst households and small businesses are similar (Park et al., 2020) and they differ from larger organisations in three salient ways: they generally lack the expertise and time to anticipate and plan for low probability risks such as flooding (Poussin et al., 2014) they are less bureaucratic and formal in their approach to planning (Sullivan-Taylor & Branicki, 2011) and investments in adaptation represent a large proportion of their overall budgets.

As a second means of identifying gaps in the extant research on small businesses, I apply a taxonomy of behavioural influences, COM-B (Michie et al., 2011). COM-B proposes that behaviours are generated by interactions between Capability, Opportunity and Motivation. Capability is defined as an individual's "psychological and physical capacity to engage in the activity concerned", including the knowledge and mental capacity to engage in the necessary thought processes and the skills necessary to engage in the necessary physical processes. Opportunity covers all factors "outside the individual that make the behaviour possible or prompt it" – including physical opportunities provided by the environment and the cultural milieu that influences how people think about things. Motivation is defined as "all those brain processes that energize and direct behaviour": conscious, analytical decision-making, but also habitual processes and emotional responding. Each component

can influence behaviour directly but Capability and Opportunity impacts can also be mediated by their effects on Motivation.

2. METHODS

The systematic literature review reported in this paper mapped and assessed the intellectual territory around small business reactions to natural hazards. Systematic reviews are particularly suited to immature topics, for they can help direct future research by flagging up omissions and areas of uncertainty (Petticrew & Roberts, 2006). Their systematic nature reduces the implicit bias inherent in the narrative reviews commonly used in empirical papers, thereby increasing legitimacy, increasing authority and reducing loss of knowledge (Tranfield et al., 2003). Systematic reviews provide a more comprehensive and trustworthy picture of a topic (Oakley, 2016) and are more explicit and accountable (Gough et al., 2017). In comparison to the natural sciences, where the dominant positivist paradigm indicates the use of meta-syntheses, the immature, "fragmented" and "divergent" field of management studies requires a "theory-led" approach to systematic reviews (Bygrave, 2007; Tranfield et al., 2003).

This review is designed to be broad in geography, methodology and influences on resilient behaviour. However, geographical coverage is constrained by the focus on English-language publications, which limits contributions from the non-Anglophone world. Rather than favouring any particular research tradition, it argues (Feyerabend, 1975) that scientific understanding benefits most from a diversity of methods. To this end, a mixed methods synthesis was conducted (Thomas et al., 2017). No review protocol exists.

The review process draws on PRISMA (Liberati et al., 2009), the gold-standard guide for literature reviews in medicine established in 2009 (Tranfield et al., 2003). However, as PRISMA was designed for reviews of the medical literature and the evaluation of evidence on particular interventions, I have not followed all PRISMA prescriptions: I have not made any assessment of publication bias or selective reporting within studies; nor, given the heterogeneity of the types of study design included in this review, has it been practical to provide summary data from individual studies.

For quantitative studies that use multivariate regression, the paper reports the standardised regression coefficients ("ES") of variables that met the significance criterion of 95% confidence. Where no standardised regression coefficients were reported or only bivariate analysis was used, an alternative effect size statistic is provided. Quantitative meta-analysis was severely constrained by the variability of participants, variability in the specification and operationalisation of predictor and outcome variables (Cooper, 2003; Lipsey & Wilson, 2001; Thomas et al., 2017) and the lack of enough studies to provide the power needed to use the heterogeneity statistic (Thomas et al., 2017). When meta-analysis was possible, the number of participants was used as a proxy for variance to provide each study with a weighting (Thomas et al., 2017). In what is a critical component of qualitative synthesis (Britten et al., 2002) analysis of the qualitative studies used the notion of *translation*: "pulling corroborating concepts together and […] going beyond the content of the original studies" (Thomas & Harden, 2008, p. 3) by providing novel interpretations (Thorne et al., 2004).

2.1 Information sources

Three databases were searched for relevant academic publications: Scopus, because it is the "largest abstract and citation database of peer-reviewed literature" (Scopus, 2017); Web of Science, because it is considered complementary to Scopus (Burnham, 2006), and ABI/INFORM Global for additional coverage of business publications. The last search was run on 20th December 2019.

For immature subjects such as the one considered here, it is recommended that literature not controlled by commercial publishing organisations is included alongside that of the academic

literature (Adams et al., 2016; Adams et al., 2017). Searches for such "grey" publications were conducted in the online databases of the UK's Environment Agency, PreventionWeb (https://www.preventionweb.net/english/), the World Bank, the United Nations Disaster Risk Reduction publications webpage and the Global Facility for Disaster Reduction and Recovery. In line with common practice (Adams et al., 2017), these sources were selected on the basis of reputation, authority and search functionality. The bibliographies of the identified publications were also searched for relevant publications.

2.2 Eligibility for inclusion in the review

Reports and academic papers were included if they were published after 1974; were in English; claimed to focus on businesses with less than 500 employees, and analysed the factors influencing any behaviour/s intended to increase material or financial resilience to climate change events, volcanoes or earthquakes. These behaviours included taking out specialised insurance (where available); disaster planning (including financial planning); business continuity planning; adaptations to buildings; the preparation of deployable protection measures and the backing up of records.

Only research reports, academic journal papers, books and book chapters were included; conference papers, slide presentations and short, graphical summaries were not included, because of the potential for issues with quality and completeness of reporting.

2.3 Search Terms

In a first search of the academic literature, studies were included whose titles, abstract and key-word lists used at least one term from each of sets A, B and C (Table 1).

Table 1 | search terms used in first search

Set A	Set B	Set C
resilien*	small ~ business	extreme ~ event
business continuity	small ~ firm	extreme weather
adaptation	single proprietor	global warming
protection	sole proprietor	global environmental change
vulnerability	entrepreneur*	flood*
disaster planning	micro ~ business	storm*
flood plan	micro ~ enterprise	tidal wave
hazard adjustment	microenterprise	hurricane
hazard management	startup	snow*
disaster preparedness	SME	blizzard
disaster recovery	small and medium enterprise	volcano
precautionary measures	small and medium-sized enterprise	earthquake
	family ~ business	wildfire
	community ~ business	bushfire
		tsunami
		landslide
		lightning
		natural hazard
		disaster
		acute interruption

~ with proximity operator

To identify papers relating to business in general that might also have covered small businesses, a subsequent search included the term "business" in Set B. As this would otherwise have captured many thousands of papers, the range of terms in Set A and Set C was narrowed to specify hazard resilience measures (Set A) and natural hazards (Set C). In both searches, studies were excluded if they used the terms "social entrepreneur" or "policy entrepreneur".

Table 2 | search terms used in second search

Set A	Set B	Set C	
disaster planning flood plan hazard adjustment hazard management disaster preparedness disaster recovery	business (but not small business, micro business, family business or community business)	flood* storm* tidal wave hurricane snow* blizzard volcano	earthquake wildfire bushfire tsunami landslide lightning natural hazard

2.4a Grey literature

Due to the variation in the search functions available within online databases of the grey literature, a different search approach was taken to search each of the non-academic databases (Table 3.)

Table 3 | use of online databases to search the grey literature

	Search design	Public-ations identified	Additional publications identified from bibliographies	Reasons for rejections	Select-ed
World Bank Open Knowledge Repository	Search terms: 'disaster' AND 'business'. Domains: 'Technical Papers'; 'Working Papers'.	26	0	• 8 – no empirical evidence on reasons for mitigation • 18 – resilience actions of small businesses not addressed	0
United Nations Disaster Risk Reduction	Search terms: 'business' and 'SME' Disaster categories: "cyclone", "flood", "landslide", "storm-surge",	17	14[1]	• 4 – duplicates • 5 – full publication not available • 12 – no empirical evidence on reasons for mitigation • 2 – resilience actions of small businesses not addressed	4

[1] All from the bibliography of one report (UNDRR, 2020)

	"tornado", "tsunami", "volcano", "wild fire"			• 1 – related to public sector only • 1 – full publication not available in English • 1 – findings for smaller businesses not distinguished from those for larger • 1 – only large corporations addressed	
Global Facility for Disaster Reduction and Recovery	Search term: 'businesses' Content type: *publication*	18	None	• 1 – duplication • 9 – no empirical evidence on reasons for mitigation • 8 – resilience actions of small businesses not addressed • 1 – related to public sector only	0
Prevention Web	All 'Documents and Publications'; 'Disaster risk management'; 'Social impacts and social resilience'	590		• 585 – not relevant • 4 – unavailable	1
UK Environment Agency 'Science & Research Projects'	Search terms: "flood" AND "protection"; "flood" AND "resilience"	5	none	• 3 unrelated to businesses • 1 no empirical evidence on business take-up of resilience	1

2.4 Study selection

A total of 1,031 documents were retrieved from the academic databases. Of these, 238 were duplicates. The titles and abstracts of the remaining 793 papers were reviewed and 740 excluded for having low relevance: 164 because they did not concern small businesses; 130 because they were not empirical; 164 because they made no reference to any natural hazard, and 282 because they were not about actions intended to increase resilience to natural hazards, volcanoes or earthquakes. After reading the full texts a further ten were excluded: three for lack of relevance; one for reporting the same data as another paper in the selection; three because they were not empirical, and three because they were not about resilience.

Details of 666 documents were retrieved from the grey literature. Of these, seven were duplicates, full reports were unavailable for nine, the full report was only available in Japanese for one, 626 did not address small business adaptation and 23 provided no empirical support for claims made. Six were included in the review.

Two quality criteria were applied by to the full texts of the remaining 51 records: records were excluded if they did not describe findings separately for small businesses or include business size as an independent variable (N=12), or if no attempt was made to empirically justify findings (N=2). This process was conducted by the author.

No further criteria were applied to study selection due to the lack of consensus about what constitutes high-quality research (Bryman & Bell, 2015; Lipsey & Wilson, 2001). Issues of quality are instead raised in the analysis sections of the paper, where the authors' prejudices can be more easily exposed to scrutiny and decisions about the treatment of findings made accountable.

A data extraction sheet was pilot tested on ten randomly selected studies and refined accordingly. The management and presentation of data from the remaining papers was facilitated by an Excel spreadsheet (Table 4).

Table 4 | Codebook for content analysis

Code	Code definition
Research question	The research question as stated or implied
Population:	
Natural hazard	The natural hazards that population members were exposed to
'Small business'	As defined by number of employees or annual turnover
Business sector/s	e.g. manufacturing, tourism, retail
Type of business	e.g. family businesses, start-ups, home-based businesses
Type of risk	e.g. flood, earthquake
Geographical coverage	Where data were collected
Aspect of resilience	e.g. business continuity planning; insurance; physical adaptations
Element of COM-B model	Capacity, Opportunity, Motivation
Methods	
Paradigm	Qualitative, quantitative, mixed methods
Data source	Survey, qualitative interviews, ethnography, administrative data
Sampling	Method; response rate; sample size; sample characteristics
Analysis methods	E.g. multi-variate; bivariate; thematic; grounded; discourse
Findings	What they are; whether justified empirically; whether reported separately for small businesses

3. DESCRIPTIVE FINDINGS

The search identified just 31 academic studies of small business adaptation and six reports from the grey literature (Appendix 1). These low numbers confirm the assertion (Halkos et al., 2018; Park et al., 2020) that the topic is relatively under-studied, for a recent review of research into household adaptation that focussed exclusively on quantitative research found 106 such studies (van Valkengoed & Steg, 2019). However, engagement with the topic of small business resilience to natural hazards is growing: 6 of the 31 academic papers were published in the 1990s and 2000s; 27 in 2010-2020, and 10 in 2018-20 alone. All but one of the reports from the grey literature was published after 2010.

Half the articles and reports had mixed populations of small and large businesses; half focussed on small businesses alone – i.e. two studies focussed on firms with five or less employees; six on those with less than 20 employees; three on those with less than 50 employees; five on those with less

than 100 employees, and ten on those with less than 300 employees. Eight gave no details of the size of the businesses and two specified SMEs but without defining what this meant. Twenty focussed on particular forms of natural hazard; six included a range of natural hazards, and nine listed other forms of business interruption alongside natural hazards, or else did not specify the source of the business disruption. While most covered a wide range of business types, some focussed specifically on tourism, finance, construction or high-street businesses.

Twenty-nine of the papers and reports analysed survey or administrative data and eight reported the analysis of interviews or focus groups. Several papers provided no conclusions regarding the determinants of small business adaptation, despite promising to do so in abstracts and/or titles (Drabek, 1995; Wedawatta & Ingirige, 2012; Xiao & Peacock, 2014).

Much of the grey literature focuses on the Global South – in contrast with the academic literature. Only 1 in 4 of the academic papers drew on data from Asia, despite this continent being home to 83% of the affected population, while half draw on data from the Americas, where only 14% of the affected population reside. No World Bank designated *low income* country is covered by the academic papers and only one *lower middle income* country.

As shown in Table 5, some predictive factors were tested far more often than others. Company size and business sector are particularly prevalent, most factors belong to the COM-B category of Capability and Motivation factors have seldom been tested.

Table 5 | Coverage of the different COM-B categories of predictor

COM-B Category	Factor	Academic studies	Grey literature
Capability (psychological and physical capacity to engage in the activity concerned, including possession of the necessary knowledge and skills)	Company size	12	1
	Business sector	8	1
	Financial costs of adaptation	5	1
	Adaptation-related skills	5	
	Business age	4	
	Owner educational level	4	
	Time costs of adaptation	2	1
	Owner gender	3	
Opportunity (factors outside the individual that make the behaviour possible or prompt it)	External prompting/advice	4	2
	Hazard experience	4	1
	Premises ownership	5	
	Social norms	5	
	Concentration of clients in the locality	1	
Motivation (all brain processes that energize and direct behaviour: conscious, analytical decision-making; habitual processes, and emotional responses)	Perceived self-efficacy	4	1
	Perceived response-efficacy	1	
	Threat appraisal	1	
	Environmentalism	1	
	Emotional connection with the land-scape	1	

The level and rigour of the data analysis varied dramatically between the studies. Only twelve of the 29 quantitative studies used multivariate analyses to reduce the effect of spurious associations and discriminate between direct associations and associations via intervening variables (Bohrnstedt & Knoke, 1994). Twelve made no attempt at all to test statistical significance of the findings they

reported, including all six from the grey literature. Three others used only bivariate significance testing and four failed to report their analytical technique.

4. ANALYTICAL FINDINGS

Capability

Capability: the psychological and physical capacity to engage in the activity concerned, including possession of the necessary knowledge and skills	• Business size is positively associated with adaptation. • Financial costs deter adaptation. • Time costs deter adaptation. • Skill requirements hamper adaptation. • Some business sectors are more likely to adapt than others. • Business age is non-significant or has very small effects. • Female owners and college educated owners seem to adapt more, but there is also contradictory evidence.

The size of a business is frequently argued to be the most important influence on adaptation (Han & Nigg, 2011; Webb et al., 2000). This review found ten journal papers and one study from the grey literature analysed this factor – two others (Fowler et al., 2007; Kato & Charoenrat, 2018) appeared to have done so, but had actually measured perceptions of preparedness rather than preparedness behaviours themselves. It is clear from these studies that business size has a statistically significant influence. Two multivariate studies (Halkos & Skouloudis, 2020a; Han & Nigg, 2011)(Halkos & Skouloudis, 2020a; Han & Nigg, 2011) concluded that increases in company size were associated with the take-up of adaptation measures in general, as did one bivariate study (Okabe & Nagahira, 2014). Halkos and Skouladis' analysis of the relationship between size and barriers to adaptation shows that the predictive power of size on general adaptation is greater for smaller companies than it is for larger ones. Other studies found associations with single adaptation measures: multivariate analyses found associations with insurance (average weighted ES=0.16) (Josephson et al., 2017; Lo et al., 2019; Yoshida & Deyle, 2005) and storing supplies at other locations (Lo et al., 2019) (ES=0.09) and strong bivariate effects were reported for the relationship between business size and business continuity planning (Asian Disaster Reduction Centre, 2011; Kimura et al., 2019; Pickard, 2017; Sarmiento et al., 2015). The depiction of small businesses, in the wider literature, as time-poor (Gibb, 1997), capital-poor and less able to resource specialist skills and roles (Walker, Redmond, Webster, & Le Clus, 2007) suggest that the influence of business size might be mediated by perceived response costs and perceived skill requirements.

Numerous studies report evidence that requirements for time (Halkos et al., 2018; Yoshida & Deyle, 2005), finance (Chinh et al., 2016; Halkos et al., 2018; Kato & Charoenrat, 2018; Sullivan-Taylor & Branicki, 2011; Thurston et al., 2008; Yoshida & Deyle, 2005) and adaptation-related skills (Halkos et al., 2018; Kato & Charoenrat, 2018; Sullivan-Taylor & Branicki, 2011; Yoshida & Deyle, 2005) (Scarinci, 2014) are important barriers to adaptation. The studies have little to say on the question of whether these are Capacity issues, Opportunity issues or Motivational issues. However, the fact that value-for-money and financial capacity are listed as barriers by the same proportion of SMEs (UNFCCC Adaptation Committee, 2017) suggests that financial costs belong to both the Capacity category and the Motivational category.

Another factor included here under the Capabilities heading is business sector (Table 6). Numerous studies tested the predictive power of business sector; five of these used multivariate analyses, so

the ones that did not (Asian Disaster Reduction Centre, 2011; Kreibich et al., 2005; Orhan, 2016; Sarmiento et al., 2015) are not reported here. Five sectors are reported as being strong predictors of adaptation in general: membership of the finance, services or retail sectors are positively associated with adaptation, while the wholesale and construction industries are less likely than others to engage in adaptation. Furthermore, the barriers to resilient adaptation are higher in manufacturing than in the service sector (Halkos & Skouloudis, 2020a) (ES=0.4).

Other sectors are only associated with some types of adaptation: engineering/architecture/ accounts companies are far more likely to adapt their buildings than other sectors; the transport sector is most strongly associated with planning; manufacturers are more likely than others to elevate utility points out of reach of flood waters, and in the Asian Pacific, a greater proportion of finance companies have business continuity plans than in any other sector.

Table 6 | Statistical findings: relationships between adaptation and business sector

Business sector		ES	Studies[2]
Finance	General	1.42	C
	Adaptations to buildings (compliance with wind standards)	1.45	A
	Planning	2.11	B
Service	General	0.93	D
Retail	General	0.45	A
	Elevate utility points	0.66	A
	Plan	0.29	A
	Property insurance	0.38	A
Construction	General	-0.41	A
	Written plan	0.51	A
	Elevate utilities	-0.11	A
Wholesale	General	-0.54	A
	Plan	-0.54	A
	Property insurance	-0.56	A
Engineering/archi-tecture/accounts	Adaptations to buildings	2.68	B
Transport	Planning	1.36	A
	Elevate utility points	0.71	A
	Property insurance	0.12	A
Manufacturing	Elevate utility points	1.16	A
	Adaptations to buildings (compliance with wind standards)	0.67	A
Agriculture	Planning	0.60	A
	Elevate records/equipment	0.55	A
	Property insurance	0.30	A
Wholesale	Insurance/finance	-0.56	A
	Elevate utility points	0.55	A
	Elevate records/equipment	0.55	A
	Planning	-0.54	A

[2] A: Josephson et al.,2017; B: Yoshida & Deyle, 2005; C: Hann & Nigg, 2011; D: Howe, 2011

No evidence is offered on the factors that mediate the influence of business sector. However, it is reasonable to speculate that professional skills explain the association between engineering and the selection and implementation of building adaptation, and that the skills required for success in the transport sector lend themselves to disaster planning. Given the criticality of power supplies for manufacturing, the association of this sector with the elevation of utility points could be mediated by the motivation to avoid power loss, and the relationship between the transport sector and disaster planning could be explained by the motivation to protect fragile transport networks from natural disasters.

Four academic papers reported the findings of multivariate tests of the effects of the age of the business on adaptation. However, either no statistically significant relationship was revealed (Dahlhamer & D 'souza, 1997; Howe, 2011) or effect sizes were very small (Halkos & Skouloudis, 2020; Han & Nigg, 2011; Josephson et al., 2017).

The evidence is ambivalent for a further two potential Capability factors: owner education and gender. While a study in China found that education did not predict adaptation (Lo et al., 2019), research with businesses in the US found a positive relationship (ES=0.52) between college-level education and adaptation (Josephson et al., 2017) and a study in Turkey (Orhan, 2016) reported that college educated owners were more than eight times as likely to adapt than others (OR=8.61). These strong effect sizes contrast with those amongst householders, where effects are small (Bubeck et al., 2012 - and for a recent example, see Ahmad & Afzal, 2020). Evidence from Chenai, India, suggests that this influence might be mediated by the confidence that education brings – for example, in dealing with insurance agents (KPMG in India, 2016).

As for gender, while a study of hurricane storm surge in Florida found no correlation between gender and adaptation (Howe, 2011) hurricane preparedness in Mississippi (Josephson et al., 2017) and storm-surge preparation in China (Lo et al., 2019) were more likely in female-owned businesses. No evidence is offered as to the mediators of this relationship.

Opportunity

Opportunity: all factors outside the individual that make the behaviour possible or prompt it	• Previous experience of a hazard sometimes predicts adaptation. • Ownership of the business premises sometimes predicts adaptation. • Customers and business associates can prompt adaptation. • In some countries, government advice/prompting encourages adaptation. • Social norms influence adaptation. • The concentration of clients in the local area appears to be negatively associated with adaptation.

There is contradictory evidence regarding the importance of experience as an opportunity. One multivariate analysis (Josephson et al., 2017) of data from Mississippi shows moderate positive effects on building adaptations (ES=0.38) and the elevation of utilities (ES=0.46), and bivariate analyses show positive effects on planning both globally and in Thailand (AXA Group, 2015; Kato & Charoenrat, 2018). In contrast, analysis of data from Turkish small businesses (Orhan, 2016) indicates that those with flood experience were only a fifth as likely to prepare as those without it. Similarly, in North Dakota, USA (Flynn, 2007) there was no change in levels of small business emergency planning before and after a flood and businesses moving into the affected area after an event had significantly higher levels of disaster planning. Various suggestions are made for the

mediators of experience. There is no support (Lo et al., 2019) for the suggestion in some household studies (Owusu et al., 2015; Takao et al., 2004) that it is mediated by the extent of the damage. Rather, the data suggests that its impact is mediated by experience frequency (Halkos & Skouloudis, 2020a), recency (Davlasheridze & Geylani, 2017) or changes in sensemaking structures prompted by the emotional intensity of an experience (Bubeck et al., 2012; Harries et al., 2018). A failure to take these mediating factors into account perhaps explains the weak effect sizes found in this review as also in research with householders (Atreya et al., 2017; Bamberg, Masson, Brewitt, & Nemetschek, 2017; Bubeck et al., 2012).

The evidence is mixed, too, for a second Opportunity factor: property tenure. Tenure was reported as affecting overall adaptation to earthquakes in Tennessee (ES=0.13) (Dahlhamer & D 'souza, 1997), floods in Iowa (ES=0.07) (Dahlhamer & D 'souza, 1997) and hurricanes in Mississippi (ES=0.76) (Josephson et al., 2017), and in Turkey, owners of business premises are 1.8 times as likely as tenants to prepare for earthquakes (Orhan, 2016). However, one study found no correlation between tenure and earthquakes in California (Han & Nigg, 2011) and in Japan, ownership of the business premises is a negative predictor of flood planning (ES=3.5) and is not correlated with either flood insurance or property flood adaptations (Yoshida & Deyle, 2005). Research with households reveals security of tenure as a strong mediator (Dangol & Day, 2017; Mashi, Inkani, Obaro, & Asanarimam, 2020), so this factor deserves exploration in future small business research.

The receipt of external advice and guidance is also an opportunity to implement adaptation measures because businesses hesitate to adapt in the absence of technical guidance and confirmation that it is their responsibility to do so (Adekola & Clelland, 2019; Wedawatta & Ingirige, 2016). In China, customers and business associates are an influential provider of such prompting and advice on structural measures (Yoshida & Deyle, 2005), as are contractual and client requirements on disaster planning amongst UK construction organisations (Sapeciay, Wilkinson, & Costello, 2017) and Thai companies (Pickard, 2017). Indeed, 24% of SMEs in Thailand area claim that they would adopt a business continuity plan (BCP) if it were a customer requirement (Pickard, 2017) and 41% of those that have a BCP say that they one motivation was to gain clients' confidence. Information from government, while a "very important" determinant of structural measures and disaster insurance and a preferred source of mitigation information in China (Yoshida & Deyle, 2005) lacks impact in the UK because of a perceived lack of credibility (Park et al., 2020).

Another Motivation indicated by the literature is that provided by social norms. Several qualitative studies (Muñoz et al., 2019; Tervo-Kankare, 2018 and to some extent Harries, Mcewen, & Wragg, 2018 and Sullivan-Taylor & Branicki, 2011b) argue that the take-up of resilience measures increases when hazards and adaptation are normalised. Normalisation allows changes to the interpretation frameworks that determine individual actions (Harries et al., 2018) and facilitates the formation of collectives that further encourage and facilitate adaptation (Muñoz et al., 2019). Hence, perceived injunctive norms predict the moving of assets, inventories and people to safer locations and the pooling of resources with other local businesses (Lo et al., 2019)[3]. The adoption of such norms is said to depend on the mix of positive and negative emotions that a hazard event generates, the emotional investment in existing social identities (Harries et al., 2018) the opinions of clients and insurers (Sullivan-Taylor & Branicki, 2011), and the extent to which a company is networked with others (Lo et al., 2019).

A single study (Howe, 2011) tested the influence of a company having most of its clients in the local area. This was found to have a moderate negative influence on adaptation (ES=-0.52).

[3] Effect size not reported

Motivation

Motivation: all brain processes that energize and direct behaviour: conscious, analytical decision-making; habitual processes, and emotional responses.	• Perceived self-efficacy predicts adaptation. • Perceived response-efficacy might be important. • Threat appraisal has a weak effect. • Relationship with the natural environment has moderate effects.

Of the two Motivation factors with the greatest influence on householder adaptation, perceived self-efficacy and perceived response-efficacy (Bamberg et al., 2017; van Valkengoed & Steg, 2019), one is well represented in this review. Five studies report perceived self-efficacy as a barrier to adaptation (Adekola & Clelland, 2019; Sullivan-Taylor & Branicki, 2011; Thurston et al., 2008; Wedawatta & Ingirige, 2016; Yoshida & Deyle, 2005) with one arguing that self-efficacy is lower for natural hazards because they are driven by external factors and, therefore, less easily understood crises driven by internal factors such as IT or personnel (Herbane, 2015). Only one study (Yoshida & Deyle, 2005) reports perceived-response efficacy as an 'important' barrier to adaptation and only one tested the role of threat appraisal (Han & Nigg, 2011; ES=0.11).

The only other motivational factor reported in the literature was the relationship to the natural environment. Engagement in environmentalist behaviours was found by one study to have a moderate positive effect on adaptation (Kimura et al., 2019) (ES=0.30-0.54), as was an emotional connection with the landscape that harbours the threat (Muñoz et al., 2019).

5. DISCUSSION AND CONCLUSION

As far as the author has been able to ascertain, this paper is the first attempt to synthesise the evidence on the influences on the adaptation of small businesses to natural hazards. The review shows the field to be an immature one, for there are relatively few studies and key factors have been studies little. More research is needed. This should include a focus on motivational factors, which are currently underrepresented, as well as on those predictors that are of proven importance for householder adaptation – especially perceived response efficacy and risk perception. There is also a need for more analysis to be more rigorous. Many existing studies fail to test for statistical significance or to seek out the mediating variables of predictors that cannot directly influence adaptation (i.e. *2nd-order* predictors such as business sector, business size, owner education, hazard experience, property tenure, owner gender and the age of the business); some rely on bivariate analytical techniques that are unable to isolate the influence of different variables. Furthermore, while there can be no dispute about causal direction for most 2nd-order variables (it makes no sense to argue that adaptive behaviour can change tenure, change gender or bring about a flood) there is little reflection on the direction of the causal relationships between adaptation and perceptions of risk, social norms, response efficacy and self-efficacy, all of which might be influenced by past decisions over adaptation.

Future research should also pay more attention to social and cultural predictors of adaptation. Only two studies in this review analysed the direct effects of social influences; one analysed the influence of social norms, and none analysed the influence of culture. This represents a significant gap. Culturally specific coping strategies such as denial (Noll, Filatova, & Need, 2020) play an important role in hazard adaptation amongst householders (Brondi, Benedetti, Tanga, & Bertoldo, 2021; Harries, 2008), as do individualism and the propensity towards uncertainty avoidance – both of

which predispose populations towards reduced property-level hazard adaptation (Noll et al., 2020). It seems likely that these factors will be influential amongst the individuals that own and run small businesses.

It also seems likely that such cultural factors will vary between the world's poorer and richer countries. Here too, there is a gap in the extant research. Although this review identified some systematic academic analysis of data from the Global South (e.g. Kato & Charoenrat, 2018; Sarmiento et al., 2015), much analysis (AXA Group, 2015; KPMG in India, 2016; UNFCCC Adaptation Committee, 2017) lacked the sophistication required to identify important predictors and distinguish causal variables from mediating variables. More research and analysis are needed in the Global South, where the threat from natural hazards is often greatest and the contribution of small businesses towards well-being of particular importance. Until such additional research has been conducted, policymakers must not extrapolate from research in wealthy countries and apply findings to the Global South.

The use of COM-B in this review demonstrates two benefits of the application of such a taxonomy. Firstly, it exposes the shortage of research into Motivation factors. This is an important oversight, for only 14% of small businesses in developed economies and 20% in emerging economies list natural hazards as one of their top five concerns (AXA Group, 2015) and it is sometimes argued that the resilience of a company's own premises and activities is less important for small businesses because of their greater reliance on external providers (Sullivan-Taylor & Branicki, 2011). These findings indicate that Motivation might be a critical part of the puzzle; most existing research focusses on Capability factors as determinants of adaptation.

A second advantage of COM-B is that it obliges analysts to go beyond a simple identification of statistical significance and effect size by prompting them to reflect on causal mechanisms in order to ask whether each predictor belongs to the category Capability, Opportunity or Motivation. This increases the relevance of the findings to the design of future research tools and behavioural interventions. In this study, for example, the evidence is conclusive on the influence of the financial and time costs involved in selecting and implementing adaptation but is unable to conclude whether this is principally a Motivation factor or a Capability factor. This is an important distinction. An intervention designed on the assumption that finance is a Capacity issue will be very different from one designed on the assumption that its primary means of impacting on behaviour is via Motivation, and survey questions that fail to distinguish cost-as-constraint from cost-as-motivation will suffer from poor external validity.

The lack of evidence on threat appraisal is indicative of another lacuna in the literature on small businesses and natural hazard adaptation: the use of Protection Motivation Theory (PMT). First formulated to explain individuals' responses to health risk, PMT predicts that people protect themselves if their threat appraisal and coping appraisal are both high – where, as well as response costs, the latter includes 'response-efficacy' (a perception that the available protective measures will be effective and 'self-efficacy' (ease of implementation). Given its genesis in the study of health behaviours and its emphasis on individuals rather than institutions, the neglect of PMT amongst business researchers is perhaps unsurprising. However, small businesses behave more like individuals than other institutions because they are individual owners often excerpt a great deal

more influence than they do over other institutions. Furthermore, PMT has been used widely and with much success in research with householders, which suggests that it should also be applied to small businesses.

Use of Protection Motivation Theory would highlight the need to pay more attention to the role of threat appraisal, which dominated international research into household responses to natural hazards for much of the late 20th-Century (Gaillard & Texier, 2008). Its salience as a predictor of practical adaptation is not self-evident, however, for depending on the blend of positive and negative emotions that it generates, it can have a greater effect on emotional adaptation than on practical behaviours (Babcicky & Seebauer, 2019; Brondi et al., 2021; Byrne & Shepherd, 2015). Furthermore, recent meta-analyses of the evidence on threat appraisal and household adaptation yield contradictory results, with one reporting it as having a weak effect (Bubeck et al., 2012) and the other as having a strong effect (Bamberg et al., 2017).

Use of the COM-B taxonomy also exposed the need to understand the mediators of predictors that have no direct influence on adaptation. This study revealed several statistically significant predictors of this kind: owner education and gender; business age, and business sector. The identification of the mediators of these predictors is essential if research findings are to be of use in the design of behavioural interventions. The identification of gender as a predictor, for example, is of little practical use unless it is known whether women are more likely to adapt because of enhanced Capacity, Opportunity or Motivation.

In conclusion, this review confirms the assertion that the evidential basis for intervention is weak. It reveals that the factors behind small business adaptation to climate hazard remain poorly understood and that the field would benefit from greater use of taxonomies and models such as Protection Motivation Theory, and from the analysis of variables found to be of important in research into household adaptation. Research into cultural and social influences, especially in the Global South, would greatly increase the applicability of the research and more analysis of mediating factors would improve its usefulness to those designing behavioural interventions.

References

Ackermann, S. J. (1999). *Are small firms important? Their role and impact*. New York: Springer.

Adams, J., Hillier-Brown, F., Moore, H., Lake, A. A., Araujo-Soares, V., White, M., & Summerbell, C. (2016). Searching and synthesising “grey literature” and “grey information” in public health: Critical reflections on three case studies. *Systematic Reviews*, *5*(1), 164. https://doi.org/10.1186/s13643-016-0337-y

Adams, R. J., Smart, P., & Huff, A. S. (2017). Shades of Grey: Guidelines for Working with the Grey Literature in Systematic Reviews for Management and Organizational Studies. *International Journal of Management Reviews*, *19*(4), 432–454. https://doi.org/10.1111/ijmr.12102

Adekola, J., & Clelland, D. (2019). Two sides of the same coin: Business resilience and community resilience. *Journal of Contingencies and Crisis Management*. https://doi.org/10.1111/1468-5973.12275

Ahmad, D., & Afzal, M. (2020). Flood hazards and factors influencing household flood perception and mitigation strategies in Pakistan. *Environmental Science and Pollution Research*, *27*, 15375–

15387. https://doi.org/10.1007/s11356-020-08057-z

Asian Disaster Reduction Centre. (2011). *BCP status of the Private Sector in the APEC Region 2011*. Kobe, Japan.

Atreya, A., Czajkowski, J., Botzen, W., Bustamante, G., Campbell, K., Collier, B., … Montgomery, M. (2017). Adoption of flood preparedness actions: A household level study in rural communities in Tabasco, Mexico. https://doi.org/10.1016/j.ijdrr.2017.05.025

AXA Group. (2015). *Business Unusual: Why The Climate is Changing the Rules for our Cities and SMEs*. Paris.

Babcicky, P., & Seebauer, S. (2019). Unpacking Protection Motivation Theory: Evidence for a separate protective and non-protective route in private flood mitigation behavior. *Journal of Risk Research*, *22*(12), 1503–1521.

Bamberg, S., Masson, T., Brewitt, K., & Nemetschek, N. (2017). Threat, coping and flood prevention – A meta-analysis. *Journal of Environmental Psychology*, *54*, 116–126. https://doi.org/10.1016/j.jenvp.2017.08.001

Bennett, R. (2014). *Entrepreneurship, Small Business and Public Policy*. London: Routledge. https://doi.org/10.4324/9780203078624

Bohrnstedt, G. W., & Knoke, D. (1994). *Statistics for social data analysis* (3rd ed.). Itasca, Illinois: F.E. Peacock Publishers.

Bonfield, P. (2016). *Improving property level flood resilience - An action plan to enable better uptake of resilience measures for properties at high flood risk*. London. Retrieved from https://www.gov.uk/government/publications/improving-property-level-flood-resilience-bonfield-2016-action-plan

Britten, N., Campbell, R., Pope, C., Donovan, J., Morgan, M., & Pill, R. (2002). Using meta ethnography to synthesise qualitative research: A worked example. *Journal of Health Services Research and Policy*, *7*(4), 209–215. https://doi.org/10.1258/135581902320432732

Brondi, S., Benedetti, L., Tanga, R. C., & Bertoldo, R. (2021). Between oblivion and drastic evidence: How local communities cope with seismic risk by forgetting and remembering. *International Journal of Disaster Risk Reduction*, *56*, 102132. https://doi.org/10.1016/j.ijdrr.2021.102132

Bryman, A., & Bell, E. (2015). *Business research methods* (3rd ed.). Oxford: Oxford University Press. Retrieved from https://books.google.co.uk/books?hl=en&lr=&id=I7u6BwAAQBAJ&oi=fnd&pg=PP1&dq=bryman+business+research+methods&ots=AwLhy8LVRp&sig=KKqoBc2rUwTlJpbKb534finrDUE#v=onepage&q=bryman business research methods&f=false

Bubeck, P., Botzen, W. J. W., & Aerts, J. C. J. H. (2012). A review of risk perceptions and other factors that influence flood mitigation behavior. *Risk Analysis*, *32*(9), 1481–1495. https://doi.org/10.1111/j.1539-6924.2011.01783.x

Burnham, J. F. (2006). Scopus database: a review. *Biomedical Digital Libraries*, *3*(1), 8. https://doi.org/10.1186/1742-5581-3-1

Bygrave, W. D. (2007). The entrepreneurship paradigm (I) revisited. *Handbook of Qualitative Research Methods in Entrepreneurship*, 17–48.

Byrne, O., & Shepherd, D. A. (2015). Different strokes for different folks: Entrepreneurial narratives of emotion, cognition, and making sense of business failure. *Entrepreneurship Theory and Practice*, *39*(2), 375–405. https://doi.org/10.1111/etap.12046

Cabinet Office. (2008). *Learning lessons from the 2007 floods*. London. Retrieved from http://webarchive.nationalarchives.gov.uk/20100812084907/http:/archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full pdf.pdf

Carlsson, B. (1999). Small Business, Entrepreneurship, and Industrial Dynamics. In Acs Z.J. (Ed.), *Are Small Firms Important? Their Role and Impact* (pp. 99–110). Boston, MA: Springer US. https://doi.org/10.1007/978-1-4615-5173-7_6

Chatterton, J., Clarke, C., Daly, E., Dawks, S., Elding, C., Fenn, T., … Salado, R. (2016). *The costs and impacts of the Winter 2013 to 2014 floods.* Bristol. Retrieved from https://www.gov.uk/government/publications/the-costs-and-impacts-of-the-winter-2013-to-2014-floods

Chatterton, J., Viavattene, C., Morris, J., Penning-Rowsell, E., & Tapsell, S. (2010). *The costs of the Summer 2007 floods in England*. Bristol. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291190/scho1109brja-e-e.pdf

Chinh, D., Bubeck, P., Dung, N. V., & Kreibich, H. (2016). The 2011 flood event in the Mekong Delta: Preparedness, response, damage and recovery of private households and small businesses. *Disasters*, *40*(4), 753–778. https://doi.org/10.1111/disa.12171

Civil Contingencies Secretariat. (2013). *The role of Local Resilience Forums: A reference document* (2nd ed.). London: Cabinet Office. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/62277/The_role_of_Local_Resilience_Forums-_A_reference_document_v2_July_2013.pdf

Cooper, H. (2003). Psychological Bulletin: Editorial. *Psychological Bulletin*, *129*(1), 3–9. https://doi.org/10.1037/0033-2909.129.1.3

Dahlhamer, J. M., & D ’souza, M. J. (1997). Determinants of business disaster preparedness in two U.S. metropolitan areas. *International Journal of Mass Emergencies and Disasters*, *15*(2), 265–281. Retrieved from http://udspace.udel.edu/bitstream/handle/19716/632/PP224.pdf?...

Dangol, N., & Day, J. (2017). Flood adaptation by informal settlers in Kathmandu and their fear of eviction. *Int. J. of Safety and Security Eng*, *7*(2), 147–156. https://doi.org/10.2495/SAFE-V7-N2-147-156

Davlasheridze, M., & Geylani, P. C. (2017). Small Business vulnerability to floods and the effects of disaster loans. *Small Business Economics*, *49*(4), 865–888. https://doi.org/10.1007/s11187-017-9859-5

Drabek, T. E. (1995). Disaster Planning and Response by Tourist Business Executives. *Cornell Hotel and Restaurant Administration Quarterly*, *36*(3), 86–96. https://doi.org/10.1177/001088049503600325

European-Commission. (2003). EUR-Lex - 32003H0361 - EN. *Official Journal L 124 , 20/05/2003 P. 0036 - 0041;* Retrieved from http://eur-lex.europa.eu/legal-

content/EN/TXT/HTML/?uri=CELEX:32003H0361&from=EN

European Commission. (2020). *User guide to the SME Definition*. Luxembourg.

Feyerabend, P. (1975). *Against Method*. New York: New Left Books. Retrieved from http://www.amazon.com/dp/0860916464

Flynn, D. T. (2007). The impact of disasters on small business disaster planning: A case study. *Disasters*, *31*(4), 508–515. https://doi.org/10.1111/j.1467-7717.2007.01022.x

Fowler, K. L., Kling, N. D., & Larson, M. D. (2007). Organizational Preparedness for Coping With a Major Crisis or Disaster. *Business and Society*, *46*(1), 88–103. https://doi.org/http://dx.doi.org/10.1177/0007650306293390

Gaillard, J. C., & Texier, P. (2008, June 20). Guest editorial. *Disaster Prevention and Management: An International Journal*. Emerald Group Publishing Limited. https://doi.org/10.1108/dpm.2008.07317caa.001

Gibb, A. (1997). Small firms' training and competitiveness. Building upon the small business as a learning organisation. *International Small Business Journal*, *15*(3), 13–29.

Gough, D. A., Oliver, S., & Thomas, J. (2017). Introducing systematic reviews. In D. A. Gough, S. Oliver, & J. Thomas (Eds.), *An Introduction to Systematic Reviews* (2nd ed.). London: Sage.

Government-of-India. (2017). What are Micro, Small & Medium Enterprises? Retrieved December 4, 2017, from http://dcmsme.gov.in/ssiindia/defination_msme.htm

Halkos, G., & Skouloudis, A. (2020). Investigating resilience barriers of small and medium-sized enterprises to flash floods: a quantile regression of determining factors. *Climate and Development*, *12*(1), 57–66. https://doi.org/10.1080/17565529.2019.1596782

Halkos, G., Skouloudis, A., Malesios, C., & Evangelinos, K. (2018). Bouncing back from extreme weather events: Some preliminary findings on resilience barriers facing small and medium-sized enterprises. *Business Strategy and the Environment*, *27*(4), 547–559. https://doi.org/10.1002/bse.2019

Han, Z., & Nigg, J. (2011). The influences of business and decision makers' characteristics on disaster preparedness—A study on the 1989 Loma Prieta earthquake. *International Journal of Disaster Risk Science*, *2*(4), 22–31. Retrieved from https://link.springer.com/article/10.1007/s13753-011-0017-4

Harries, T. (2008). Feeling secure or being secure? Why it can seem better not to protect yourself against a natural hazard. *Health, Risk and Society*, *10*(5). https://doi.org/10.1080/13698570802381162

Harries, Tim, McEwen, L., & Wragg, A. (2018). Why it takes an 'ontological shock' to prompt increases in small firm resilience: Sensemaking, emotions and flood risk. *International Small Business Journal: Researching Entrepreneurship*, *36*(6), 712–733. https://doi.org/10.1177/0266242618765231

Howe, P. D. (2011). Hurricane preparedness as anticipatory adaptation: A case study of community businesses. *Global Environmental Change*, *21*(2), 711–720. https://doi.org/10.1016/j.gloenvcha.2011.02.001

Josephson, A, Schrank, H., & Marshall, M. (2017). Assessing preparedness of small businesses for hurricane disasters: Analysis of pre-disaster owner, business and location characteristics. *International Journal of Disaster Risk Reduction*, *23*, 25–35. https://doi.org/10.1016/j.ijdrr.2017.03.013

Kato, M., & Charoenrat, T. (2018). Business continuity management of small and medium sized enterprises: Evidence from Thailand. *International Journal of Disaster Risk Reduction*, *27*, 577–587. https://doi.org/10.1016/j.ijdrr.2017.10.002

Kimura, N., Hoshino, S., & Onitsuka, K. (2019). Analyzing the association between disaster risk preparedness and environmental consciousness of small and medium-sized enterprises: The case of Sukagawa City, Fukushima Prefecture, Japan. *Journal of Disaster Research*, *14*(8), 1047–1058. https://doi.org/10.20965/jdr.2019.p1047

KPMG in India. (2016). *Preparing MSMEs for effective disaster management*.

Kreibich, H., Thieken, A., Merz, B., & Müller, M. (2005). Precautionary measures reduce flood losses of households and companies–insights from the 2002 flood in Saxony, Germany. In *Floods, from Defence to Management*. London: Taylor & Francis Group. Retrieved from https://books.google.com/books?hl=en&lr=&id=HVJsBgAAQBAJ&oi=fnd&pg=PA362&dq=Precautionary+measures+reduce+flood+losses+of+households+and+companies+–+Insights+from+the+2002+flood+in+Saxony,+Germany&ots=Pq9bR0X2OE&sig=N4BUymsLHmpJ9PSiEUwUL4xuJvw

Kroll, A., Landis, C. A., & Shen, J. D. (1991). Economic Impacts of the Loma Prieta Earthquake: A Focus on Small Business. *Berkeley Planning Journal*, *5*(1), 38–58. Retrieved from https://escholarship.org/uc/item/8kz940rs

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Ioannidis, J. P. a, Clarke, M., … Moher, D. (2009). Annals of Internal Medicine Academia and Clinic The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions : *Annals of Internal Medicine*, *151*(4), W65–W94. https://doi.org/10.1371/journal.pmed.1000100

Linnenluecke, M. K., Griffiths, A., & Winn, M. I. (2013). Firm and industry adaptation to climate change: A review of climate adaptation studies in the business and management field. *Wiley Interdisciplinary Reviews: Climate Change*, *4*(5), 397–416. https://doi.org/10.1002/wcc.214

Linnenluecke, M., & Smith, T. (2018). Adaptation of MSMEs to climate change: a review of the existing literature. In C. Schaer & N. Kuruppu (Eds.), *Private-sector action in adaptation - Perspectives on the role of micro, small and medium size enterprises* (pp. 19–27). Copenhagen: UNEP DTU Partnership. Retrieved from https://researchers.mq.edu.au/en/publications/adaptation-of-msmes-to-climate-change-a-review-of-the-existing-li

Lipsey, M., & Wilson, D. (2001). *Practical Meta-Analysis*. Thousand Oaks: Sage.

Lo, A. Y., Chow, A. S. Y., Liu, S., & Cheung, L. T. O. (2019). Community business resilience: Adaptation practice of micro- and small enterprises around the Pearl River Estuary. *Climatic Change*, *157*(3–4), 565–585. https://doi.org/10.1007/s10584-019-02562-y

Marsh, T., Kirby, C., Muchan, K., Barker, L., Henderson, E., & Hannaford, J. (2016). *The winter floods of 2015/2016 in the UK -a review*. Wallingford. Retrieved from www.ceh.ac.uk

Mashi, S. A., Inkani, A. I., Obaro, O., & Asanarimam, A. S. (2020). Community perception, response and adaptation strategies towards flood risk in a traditional African city. *Natural Hazards*, *103*(2), 1727–1759. https://doi.org/10.1007/s11069-020-04052-2

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 11. https://doi.org/10.1186/1748-5908-6-42

Muñoz, P., Kimmitt, J., Kibler, E., & Farny, S. (2019). Living on the slopes: entrepreneurial preparedness in a context under continuous threat. *Entrepreneurship & Regional Development: An International Journal*, *31*(5–6), 413–434. https://doi.org/10.1080/08985626.2018.1541591

Neise, T., & Diez, J. D. (2019). Adapt, move or surrender? Manufacturing firms' routines and dynamic capabilities on flood risk reduction in coastal cities of Indonesia. *International Journal of Disaster Risk Reduction*. Retrieved from https://www.sciencedirect.com/science/article/pii/S2212420918308124

Noll, B., Filatova, T., & Need, A. (2020, June 1). How does private adaptation motivation to climate change vary across cultures? Evidence from a meta-analysis. *International Journal of Disaster Risk Reduction*. Elsevier Ltd. https://doi.org/10.1016/j.ijdrr.2020.101615

Oakley, A. (2016). Forward. In D. A. Gough, S. Oliver, & J. Thomas (Eds.), *An introduction to systematic reviews* (2nd ed.). London: Sage.

Okabe, S., & Nagahira, A. (2014). Organizational promoting factors for SME BCP. *Journal of Disaster Research*, *9*(5), 849–857.

Orhan, E. (2016). Building community resilience: Business preparedness lessons in the case of Adapazari, Turkey. *Disasters*, *40*(1), 45–64. https://doi.org/10.1111/disa.12132

Owusu, S., Wright, G., & Arthur, S. (2015). Public attitudes towards flooding and property level flood protection measures. *Natural Hazards*, *77*(3), 1963–1978.

Park, T., Oakley, M., & Luptakova, V. (2020). *Applying behavioural insights to property flood resilience*. London. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/913967/Applying_behavioural_insights_to_property_flood_resilience_-_report.pdf

Peek, L. (2017). The role of local entrepreneurs in promoting disaster recovery: a review of community revival in the wake of disaster. *Review of Austrian Economics*. https://doi.org/10.1007/s11138-017-0401-4

Petticrew, M., & Roberts, H. (2006). *Systematic reviews in the social sciences: A practical guide*. Blackwell Pub. Retrieved from https://books.google.co.uk/books?hl=en&lr=&id=ZwZ1_xU3E80C&oi=fnd&pg=PR5&dq=systematic+reviews+in+the+social+sciences&ots=wYP6tOIULw&sig=3Xs1UFk0uBdZbxOCYU6EypBwjHM#v=onepage&q=systematic reviews in the social sciences&f=false

Pickard, M. (2017). *Strengthening Disaster and Climate Resilience of Small & Medium Enterprises in Asia (Thailand)*. Bangkok. Retrieved from https://www.apec.org/Publications/2011/12/BCP-status-of-the-Private-Sector-in-the-APEC-Region-2011

Poussin, J. K., Botzen, W. W., & Aerts, J. C. (2014). Factors of influence on flood damage mitigation behaviour by households. *Environmental Science & Policy*, *40*, 69–77.

Romer, P. M. (1994). The Origins of Endogenous Growth. *Journal of Economic Perspectives*, *8*(1), 3–22. Retrieved from http://www.jstor.org/stable/pdf/2138148.pdf

Sapeciay, Z., Wilkinson, S., & Costello, S. B. (2017). Building organisational resilience for the construction industry. *International Journal of Disaster Resilience in the Built Environment*, *8*(1), 98–108. Retrieved from https://search.proquest.com/docview/1870607080?accountid=14557

Sarmiento, J. P., Hoberman, G., Ilcheva, M., Asgary, A., Majano, A. M., Poggione, S., & Duran, L. R. (2015). Private sector and disaster risk reduction: The Cases of Bogota, Miami, Kingston, San Jose, Santiago, and Vancouver. *International Journal of Disaster Risk Reduction*, *14*, 225–237. https://doi.org/10.1016/j.ijdrr.2014.09.008

Scarinci, C. A. (2014). Contingency Planning and Disaster Recovery after Hurricane Sandy. *The CPA Journal*, *84*(6), 60–63. Retrieved from https://search.proquest.com/docview/1553402138?accountid=14557

Scopus. (2017). Scopus: The largest database of peer-reviewed literature. Retrieved December 11, 2017, from https://www.elsevier.com/solutions/scopus

Skouloudis, A., Tsalis, T., Nikolaou, I., Evangelinos, K., & Leal Filho, W. (2020). Small and Medium-Sized Enterprises, Organizational Resilience Capacity and Flash Floods: Insights from a Literature Review. *Sustainability*, *12*(18). https://doi.org/10.3390/su12187437

Storr, V. H., Haeffele-Balch, S., & Grube, L. E. (2016). *Community revival in the wake of disaster : Lessons in local entrepreneurship*. Basingstoke: Palgrave MacMillan. Retrieved from https://books.google.co.uk/books?hl=en&lr=&id=y4SRCwAAQBAJ&oi=fnd&pg=PP1&dq=The+role+of+local+entrepreneurs+in+promoting+disaster+recovery:+a+review+of+Community+Revival+in+the+Wake+of+Disaster&ots=3sqKtAWdx2&sig=NO-pvmkzVvEucBfKPLngOnpzmf4#v=onepage&q&f=

Sullivan-Taylor, B., & Branicki, L. (2011). Creating resilient SMEs: Why one size might not fit all. *International Journal of Production Research*, *49*(18), 5565–5579. https://doi.org/10.1080/00207543.2011.563837

Takao, K., Motoyoshi, T., Sato, T., Fukuzono, T., Seo, K., & Ikeda, S. (2004, October). Factors determining residents' preparedness for floods in modern megalopolises: The case of the Tokai flood disaster in Japan. *Journal of Risk Research*. https://doi.org/10.1080/1366987031000075996

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Tervo-Kankare, K. (2018). Entrepreneurship in nature-based tourism under a changing climate. *Current Issues in Tourism*, 1–13. https://doi.org/10.1080/13683500.2018.1439457

Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, *8*(8). https://doi.org/10.1186/1471-2288-8-45

Thomas, J., O'Mara-Eves, A., Harden, A., & Newman, M. (2017). Synthesis Methods for Combining and Configuring Textual or Mixed Methods Data. In D. Gough, S. Oliver, & J. Thomas (Eds.), *An Introduction to Systematic Reviews* (pp. 181–209). London: Sage.

Thorne, S., Jensen, L., Kearney, M. H., Noblit, G., & Sandelowski, M. (2004). Qualitative Metasynthesis: Reflections on Methodological Orientation and Ideological Agenda. https://doi.org/10.1177/1049732304269888

Thurston, N., B, F., Breakspear, R., Williams, N., Shaw, J., & Chatterton, J. (2008). *Developing the Evidence Base for Flood Resilience, FD2607/TR*. London.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, *14*(3), 207–222.

UNDRR. (2020). *Reducing Risk and Building Resilience of SMEs to Disasters*. Geneva. Retrieved from file:///C:/Users/Tim Harries/Downloads/UNDRR Resilience of SMEs Report.pdf

UNFCCC Adaptation Committee. (2017). *Advancing the Engagement of the Private Sector in Adaptation. Results of the Survey of Private Sector Organizations (AC12)*. Retrieved from https://unfccc.int/documents/63716

UNISDR. (2013). Global Assessment Report on Disaster Risk Reduction: From Shared Risk to Shared Value –The Business Case for Disaster Risk Reduction. *Global Assessment Report on Disaster Risk Reduction*, 246. Retrieved from https://archive-ouverte.unige.ch/unige:32532

US Small Business Administration. (2017). Summary of Size Standards by Industry Sector. Retrieved December 4, 2017, from https://www.sba.gov/contracting/getting-started-contractor/make-sure-you-meet-sba-size-standards/summary-size-standards-industry-sector

van Valkengoed, A. M., & Steg, L. (2019). Meta-analyses of factors motivating climate change adaptation behaviour. *Nature Climate Change*, *9*(2), 158–163. https://doi.org/10.1038/s41558-018-0371-y

Walker, E., Redmond, J., Webster, B., & Le Clus, M. (2007). Small business owners: too busy to train? *Journal of Small Business and Enterprise Development*, *14*(2), 294–306. https://doi.org/10.1108/14626000710746718

Webb, G., Tierney, K., & Dahlhamer, J. (2000). Businesses and disasters: Empirical patterns and unan- swered questions. *Natural Hazards Review*, *1*(2), 83–90.

Webb, G., Tierney, K., & Dahlhamer, J. (2002). Predicting long-term business recovery from disaster: a comparison of the Loma Prieta earthquake and Hurricane Andrew. *Global Environmental Change Part B: Environmental Hazards*, *4*(2–3), 45–58. https://doi.org/10.1016/S1464-2867(03)00005-6

Wedawatta, G., & Ingirige, B. (2012). Resilience and adaptation of small and medium-sized enterprises to flood risk. *Disaster Prevention and Management*, *21*(4). https://doi.org/10.1108/09653561211256170

Wedawatta, G., & Ingirige, B. (2016). A conceptual framework for understanding resilience of construction SMEs to extreme weather events. *Built Environment Project and Asset Management*, *6*(4), 428–443. https://doi.org/10.1108/BEPAM-06-2015-0023

World Bank. (2018). World Bank Country and Lending Groups – World Bank Data Help Desk. Retrieved January 14, 2019, from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

World Bank. (2020). *Resilient Industries : Competitiveness in the Face of Disasters*. Washington, DC. Retrieved from https://openknowledge.worldbank.org/handle/10986/34764

Xiao, Y., & Peacock, W. G. (2014). Do hazard mitigation and preparedness reduce physical damage to businesses in disasters? Critical role of business disaster planning. *Natural Hazards Review*, *15*(3). https://doi.org/10.1061/(ASCE)NH.1527-6996.0000137

Yoshida, K., & Deyle, R. E. (2005). Determinants of small business hazard mitigation. *Natural Hazards Review*, *6*(1), 1–12. https://doi.org/10.1061/(ASCE)1527-6988(2005)6:1(1)

Zhang, Y., Lindell, M. K., & Prater, C. S. (2009). Vulnerability of community businesses to environmental disasters. *Disasters*, *33*(1), 38–57. https://doi.org/10.1111/j.1467-7717.2008.01061.x