

Innovating from Changes in the Natural Environment
and Spontaneous Entrepreneurial Venturing from Disasters

by

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Abstract

The first paper of this two paper thesis proposes that changes in the natural environment are a source of information for entrepreneurial opportunity, along with the previously identified sources of technological, political/regulatory, and sociodemographic changes. The paper finds that opportunities from changes in the natural environment are exploited through mitigation, adaptation, or a combination of the two. The second paper takes an exploratory approach to study the processes, enabling and constraining factors, and motivations of disaster related entrepreneurial venturing. The findings point toward unique characteristics of disaster related venturing in general, as well as specific considerations for spontaneous venturing from disaster and venturing during a disaster. The paper proposes that disaster characteristics, disaster management culture and context, and dual logics of helping and profit shape the entrepreneurial experience of disaster related venturing.

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CHAPTER 1

INTRODUCTION

The two papers in this thesis share a common idea – that changes in the natural environment are a source of entrepreneurial opportunity. Disaster related entrepreneurial venturing, the focus of the second paper, is one potential outcome of such changes.

The first paper proposes that changes in the natural environment are a source of information for entrepreneurial opportunity, along with the previously identified sources of technological, political/regulatory, and sociodemographic changes (Shane, 2003). When changes occur in the natural environment, new information becomes available which may form the basis for an entrepreneurial opportunity (Eckhardt & Shane, 2003). Foundational literature in the sustainability field (Carson, 1962; Hawken, Lovins, & Lovins, 2000; World Commission on Environment and Development, 1987) as well as more recent reports (IPCC, 2012; Millennium Ecosystem Assessment, 2005) point toward the increasing frequency of changes in the natural environment. Given the current and predicted future changes in the natural environment, it is timely to investigate the connection between the natural environment and entrepreneurial opportunity.

The paper also proposes that opportunities from changes in the natural environment are exploited through mitigation, adaptation, or a combination of two. Drawing inspiration from the climate change community (IPCC, 2012), mitigation is characterized as human intervention to reduce the sources of or reverse natural environment degradation while adaptation is viewed as changing human preferences or changing the manner in which human well-being is achieved.

The linkage between mitigation and adaptation, and entrepreneurial opportunity is made through the concept of ecosystem services, which are defined as *the benefits people obtain from*

ecosystems (Millennium Ecosystem Assessment, 2005, p. v) and include provisioning, regulating, cultural, and supporting services Ventures may offer products or services that reverse or prevent changes to the environment's natural ecosystem services in an attempt to mitigate the environmental changes, or may offer an adaptation to the changes. Adaptation provides an alternative that replicates the function provided by the lost ecosystem service rather than attempting to address the root causes of the natural environment change.

An exploration of the extent and forms of these opportunities as demonstrated by the fastest 500 growing firms on the Inc. 5000 List of America's Fastest Growing Companies shows that these companies most commonly exploit changes in ecosystem services related to land and water pollution, climate regulation, and natural hazard regulation, with natural hazard regulation as the most common ecosystem service exploited through adaptation. Disasters resulting from natural hazards may reveal that the natural environment is not as certain or stable as previously understood. This introduces a potential opportunity for a new product or service that provides an adaptation with a high level outcome of stability. This outcome may be achieved through a wide range of products that work to prevent the loss of stability or return to stability as quickly as possible. For instance, providing flood protection to a community prevents the damaging effects of high water, while post-disaster reconstruction restores damaged homes to their former conditions.

Following from the findings that entrepreneurial opportunity may be found in providing natural hazard regulation ecosystem services, the second paper turns its focus to the experience of disaster related entrepreneurial venturing. In line with the view that disasters are defined by their social impacts rather than their agentic causes (e.g. hurricanes, earthquakes) (Boin, 2005; Gilbert, 2005; Quarantelli, 2005), this paper expands its scope to include both 'natural' and

‘human-induced’¹ events. While expanding its disaster scope, it also narrows its focus to spontaneous entrepreneurial venturing within a disaster related context. This focus is a response to Shepherd’s (2015) call for research on this type of venturing as well as the limited disaster research about entrepreneurship. Drawing on Hindle’ (2010) model of entrepreneurship, spontaneous venturing is defined as a process in which new information (in this case revealed by disaster) prompts a near simultaneous progression from opportunity evaluation (forming a business ‘idea’ or ‘model’), to commitment, to action toward a previously unconsidered creation of new value for defined stakeholders.

Using an exploratory approach with data gathered through interviews and archival sources, I identify three key moderating themes that contribute to a unique entrepreneurial experience for those that venture in a disaster related context. One of these themes - disaster characteristics – relates to the natural environment through elements such as geographic location and the frequency of disaster occurrence. The two other themes – disaster management culture and context, considered from the perspective of government as the primary customer; and dual logics (helping and profit) are influenced by disaster characteristics in addition to other contextual elements. A key finding is that while disaster related spontaneous venturing is likely quite similar to disaster related venturing in most respects, venturing during disaster, in contrast with venturing outside a disaster period, may introduce additional unique considerations for the entrepreneurial experience related to the expectations and limitations of customers and other

¹ In a sense, all disasters may be viewed as human-induced as it is the intersection of the hazard agent and a society of humans and their interests that provides the setting for disaster. If a natural hazard event occurs in a location where humans do not reside or wish to maintain environmental stability, such an occurrence may not be viewed as a disaster.

stakeholders during disaster response. As an example, a government customer that was engaged in responding to a disaster might not be able to evaluate the suitability of a new product due to limitations in time and human resources. This would make it difficult to entrepreneurs venturing in disaster to exploit potential entrepreneurial opportunities. The data also suggests that spontaneous disaster related venturing may shift entrepreneurial commitment earlier in the entrepreneurial process while pushing evaluation of opportunities toward a business model to a later time.

Together, these papers demonstrate that when it comes to entrepreneurial opportunity, the natural environment is not simply a source of resources (Schumpeter, 1942), a benign context (Marcus, Kurucz, Colbert, 2010), or a target for sustainable development efforts (Hall, Daneke, & Lenox, 2010). It is instead a dynamic force that shapes the availability of opportunities and the experience of exploiting them.

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CHAPTER 2

INNOVATING FROM CHANGES IN THE NATURAL ENVIRONMENT:
TOWARDS A MITIGATION AND ADAPTATION FRAMEWORK

It was on a Saturday in November of 2009 that Ger Brennan and I had our Eureka moment. He and I had set out that morning to help a good friend of ours in Galway whose home was surrounded by flood water... Coming back in the car that night, the idea dropped out of the sky. Entire swathes of the country were under water. Towns and cities were being flooded. It was a national crisis and a hot political topic. Why couldn't we design a better flood-barrier system than just a wall of bloody sandbags? Here was an opportunity right in front of our noses. If there wasn't already a better way of tackling floods than sandbags, then we'd develop one." (Curran, 2014, pp. 156–158)

Entrepreneurial opportunity is a fundamental element of the entrepreneurial process. Entrepreneurial opportunities are often categorized as either discovered or created (Alvarez & Barney, 2007; Venkataraman, Sarasvathy, Dew, & Forster, 2012). The discovery perspective suggests that opportunities are discovered from objective sources of change that exist outside of the entrepreneur. Traditionally these opportunities arise from three main changes in the external environment: changes in technology, the political/regulatory environment, and sociodemographics (Shane, 2003). These changes generate new information about how resources might be used differently (Eckhardt & Shane, 2003). While these three areas of change have long constituted the main sources of new information for entrepreneurial opportunities, an often-overlooked area of change comes from the natural environment.

Foundational literature in the sustainability field such as *Silent Spring* (Carson, 1962), *Our common future* (World Commission on Environment and Development, 1987) and *Natural Capitalism* (Hawken, Lovins, & Lovins, 2000) all report that environmental trends could

radically alter the planet and negatively impact the species upon it. More recently, the Millennium Ecosystem Assessment (2005) concluded that over the past 50 years, humans had changed ecosystems more rapidly and extensively than in any comparable period of time in human history. The 2012 Intergovernmental Panel for Climate Change (IPCC) reported that natural climate variability and human-generated climate change had influenced the frequency, intensity, spatial extent, and duration of some extreme weather and climate events and further increases in these events are projected over the 21st century (IPCC, 2012). Table 1 highlights some of the identified changes in the natural environment.

This paper rests at the interface of changes in the natural environment and changes that form the basis for entrepreneurial opportunities. Based on both the increasing frequency of changes in the natural environment and an increased awareness of the anthropogenic nature of such changes, we explore if changes in the natural environment serve as a source of entrepreneurial opportunities. To facilitate this exploration, we analyze the relationship between the natural environment as a source of change and opportunity identification for the fastest 500 growing firms on the Inc. 5000 fastest growing firm list. The paper concludes with implications and directions for future research.

Background Literature

Venkataram et al. (2012) describe an entrepreneurial opportunity as consisting of at least three things: an objective person-opportunity nexus, wherein an opportunity has to exist and someone has to find it (Shane, 2003), a subjective interpretation of objective data, in that someone has to recognize that it is an opportunity (Kirzner, 1997; Shane, 2000), and an intersubjective basis for a market, in which others acknowledge the value of the opportunity and are willing and able to exchange something of value for it. In terms of opportunity discovery there are classically two positions on the sources of entrepreneurship – exogenous shocks and

Table 1

Changes in the Natural Environment

Changes in Ecosystems	
Marine, Coastal and Island Systems	<ul style="list-style-type: none"> Approximately 20% of the world's coral reefs were lost and an additional 20% degraded in the last several decades of the twentieth century. Approximately 35% of mangrove area was lost during this time (in countries for which sufficient data exist, which encompass about half of the area of mangroves). Episodes of harmful (including toxic) algal blooms in coastal waters are increasing in frequency and intensity, harming other marine resources such as fisheries as well as human health.
Urban, Dryland, and Polar Systems	<ul style="list-style-type: none"> The world's urban population increased from about 200 million in 1900 to 2.9 billion in 2000, and the number of cities with populations in excess of 1 million increased from 17 in 1900 to 388 in 2000. Temperature in polar systems is on average warmer now than at any time in the last 400 years, resulting in widespread thaw of permafrost and reduction of sea ice.
Forest Systems	<ul style="list-style-type: none"> The global area of forest systems has been reduced by one half over the past three centuries.
Cultivated Systems	<ul style="list-style-type: none"> More land was converted to cropland in the 30 years after 1950 than

in the 150 years between 1700 and 1850. Cultivated systems (areas where at least 30% of the landscape is in crop-lands, shifting cultivation, confined livestock production, or freshwater aquaculture) now cover one quarter of Earth's terrestrial surface.

- | | |
|-----------------------------------|---|
| Inland Water and Mountain Systems | <ul style="list-style-type: none"> • The amount of water impounded behind dams quadrupled since 1960, and three to six times as much water is held in reservoirs as in natural rivers. Water withdrawals from rivers and lakes doubled since 1960; most water use (70% worldwide) is for agriculture. • The biodiversity of inland waters appears to be in a worse condition than that of any other system, driven by declines in both the area of wetlands and the water quality in inland waters. |
|-----------------------------------|---|

Changes in Ecosystem Processes

- *Water Cycle:* Water withdrawals from rivers and lakes for irrigation or for urban or industrial use doubled between 1960 and 2000.
- *Carbon Cycle:* Since 1750, the atmospheric concentration of carbon dioxide has increased by about 34% (from about 280 parts per million to 376 parts per million in 2003).
Approximately 60% of that increase (60 parts per million) has taken place since 1959.
- *Nitrogen Cycle:* The total amount of reactive, or biologically available, nitrogen created by human activities increased ninefold between 1890 and 1990, with most of that increase taking place in the second half of the century in association with increased use of fertilizers.
- *Phosphorus Cycle:* The use of phosphorus fertilizers and the rate of phosphorus accumulation in agricultural soils increased nearly threefold between 1960 and 1990, although the rate has

declined somewhat since that time.

Changes in Biodiversity

- The number of species on the planet is declining. Over the past few hundred years, humans have increased the species extinction rate by as much as 1,000 times over background rates typical over the planet's history (medium certainty). Some 10–30% of mammal, bird, and amphibian species are currently threatened with extinction (medium to high certainty). Freshwater ecosystems tend to have the highest proportion of species threatened with extinction.
- Genetic diversity has declined globally, particularly among cultivated species.

Increased Likelihood of Nonlinear (Stepped) and

Potentially Abrupt Changes in Ecosystems

Examples of Potentially Abrupt Changes

- Disease emergence
- Eutrophication and hypoxia
- Fisheries collapse
- Species introduction and losses
- Regional climate change

Examples of Contributing Actions

- Growing bushmeat trade placing pressure on many species, especially in African and Asia
- Loss of biodiversity
- Growing pressures from overharvesting, climate change, invasive species, and nutrient loading

information asymmetry (Eckhardt & Shane, 2003; Shane, 2003). Schumpeter (1934) describes economic life as a circular flow in which improvements continuously occur in an incremental manner.

However, a new phenomenon characterizing development occasionally appears. This discontinuous development is defined by the carrying out of new combinations, described by Schumpeter (1934) as:

- (1) The introduction of a new good – that is one with which consumers are not yet familiar – or of a new quality of a good.
- (2) The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture concerned, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially.
- (3) The opening of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before.
- (4) The conquest of a new source of supply of raw materials or half-manufactured goods, again irrespective of whether this source already exists or whether it has first to be created.
- (5) The carrying out of the new organisation of any industry, like the creation of a monopoly position (for example through trustification) or the breaking up of a monopoly position (p. 66).

These new combinations are the essence of development and will often result in the elimination of the old. Shane (2001; 2003) suggests that not only do Schumpeterian opportunities create a disequilibrium in markets and require new information, they are also very innovative,

rare, and involve creation. These opportunities often arise from changes in the external environment, with the three main sources of change in the environment being technological change, political/regulatory change, and sociodemographic change (Shane, 2003).

Changes in the Natural Environment and Entrepreneurial Opportunity

The previous section reviewed three major underlying changes that create potential entrepreneurial opportunities. We now investigate the idea that changes in the natural environment are a source of objective entrepreneurial opportunity, starting with a review of entrepreneurship literature.

The entrepreneurship literature provides support for the idea that the natural environment impacts entrepreneurial opportunity. When natural environment resources increase or decrease, so does the potential availability of inputs required for entrepreneurial exploitation. Schumpeter (1942) links the changing availability of resources to entrepreneurial opportunity, noting that the opening up of new lands with virgin environments and the discovery of resources such as coal, iron ore, and petroleum have contributed to the economic performance of capitalism.

In recent decades, entrepreneurship literature has approached the natural environment through the concept of sustainable development (Hall, Daneke, & Lenox, 2010). Sustainable development entrepreneurship literature implies or explicitly states that current or past business practices have contributed to changes in natural resource availability, evidenced through effects such as climate change, and environmental pollution and destruction. Business opportunities are thought to reside in integrating sustainable development practices into existing businesses, or developing green ventures (Cohen & Winn, 2007). Dean and McMullen (2007) argue that “environmentally relevant market failures represent opportunities for achieving profitability while simultaneously reducing environmentally degrading economic behaviors” (p. 1). York and Venkataraman (2010) also propose that entrepreneurial opportunities exist in creating sustainable

solutions to the environmental crisis. However, they view uncertainty as a driver of entrepreneurial action and thus attribute this potential for opportunity to the environmental and economic uncertainty surrounding environmental issues.

Whether viewing changes to the natural environment as impacting resource availability and valuation, or as informing an opportunity to provide sustainable alternatives to current business practices, economic and entrepreneurship literature suggests that entrepreneurial opportunity is impacted by changes in the natural environment. Further, sustainable development entrepreneurship literature indicates that not only is entrepreneurship impacted by changing availability of resources, but entrepreneurs can also take action in response to these changes (Hall et al., 2010).

Mitigation and Adaptation as the Means of Exploitation

In addition to exploring changes in the natural environment as a source of opportunity, we explore the idea that mitigation and adaptation are the means by which opportunities arising from changes in the natural environment may be exploited. Identifying the means provides a framework with which to understand entrepreneurial action related to the natural environment and recognize when these opportunities are being exploited.

The United Nations Framework Convention on Climate Change identifies adaptation and mitigation as the key mechanisms with which to address climate change (United Nations, 1992). Similarly, the Intergovernmental Panel for Climate Change identifies adaptation as the necessary approach to addressing extreme events and disasters (IPCC, 2012). Adaptation in a general sense is a modification of an organism or its parts that makes it more fit for existence under the conditions of its environment (“Adaptation,” 2013). The climate change community defines adaptation in terms of human systems as a “process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities” (IPCC, 2012, p.

556). Because humans are unlikely to modify their physical selves, at least in the short term, adjustment then refers to changing human preferences or changing the manner in which human well-being is achieved.

Mitigation of climate change refers to “human intervention to reduce the sources or enhance the sinks of greenhouse gases” (IPCC, 2012, p. 561). Generalizing this definition, we consider mitigation to be human intervention to reduce the sources of or reverse natural environment degradation. While adaptation seeks to adjust to changes, mitigation seeks to reverse damage or prevent changes from occurring by addressing the sources of change.

To link mitigation and adaptation with entrepreneurial opportunity requires the addition of the concept of ecosystem services. Ecosystem services are defined as *the benefits people obtain from ecosystems* (Millennium Ecosystem Assessment, 2005, p. v), or alternatively as services provided to us by the natural environment. The Millennium Ecosystem Assessment (2005) identifies four categories of ecosystem services: provisioning, regulating, cultural, and supporting. Provisioning services such as food are described as “the products obtained from ecosystems”, regulating services such as climate regulation are “the benefits obtained from the regulation of ecosystem processes”, cultural services are “the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences”, and supporting services are those that are “necessary for the product of all other ecosystem services” (p. 40). Soil formation and nutrient cycling are examples of supporting services. These ecosystem services contribute to constituents of human well-being including security, basic materials for good life, health, and good social relations. The concept of ecosystem services provides an effective approach to considering entrepreneurial opportunities, as it reflects services to humans and human well-being. Just as businesses provide services to humans, so does the natural environment. The key to connecting ecosystem services with

entrepreneurial opportunity is the recognition that businesses may offer services that replicate the outcomes of the services provided by the natural environment.

Exploring this concept first with mitigation, we recall that mitigation involves preventing an unwanted environmental change from occurring, or restoring the environment to its previous functioning. Finding the entrepreneurial opportunity requires recognizing which ecosystem service might be lost or has been lost thus leading to an unwanted environmental change. The entrepreneur must then find a way to prevent or reverse this change. As an example, if timber services decline, humans lose the benefits of housing materials. Assuming that humans depend on and desire the benefits that were provided by the timber services, entrepreneurs have an opportunity to provide a product or service that can a) prevent further losses of these timber services or b) restore services in their original form. In this scenario, if the losses were caused by an insect infestation, the entrepreneur could find a way to remove the damaging insects. If the losses were caused by erosion from severe storms, the entrepreneur could plant trees in another area as a replacement for the lost trees.

Turning to adaptation, we recall that adaptation involves adjustment to new environmental conditions. To find an entrepreneurial opportunity, the entrepreneur must identify a way to provide an alternative to these services. Taking the timber services example, an adaptation opportunity might be to import stone to provide a substitute building material.

To further illustrate this way of analyzing opportunities from changes in the natural environment, we offer additional examples:

Example 1 – *A drastic reduction of a predator fish results in a disruption to the natural food chain and a loss of a food ecosystem service.* In this scenario, a mitigation opportunity might include providing a river patrol service to stop illegal fishing (mitigation – prevent), restocking wild fisheries with predator fish (mitigation – restore), or providing an alternative protein option

to affected consumers (adaptation). These opportunities all involve provisioning services. Getting a bit more creative, the entrepreneur could invent an automated system that removed a similar amount of fish that were second in the chain to replicate the service that the fish provided in the food chain. Although this solution doesn't address the loss of the fish in terms of its food service, it can be viewed as mitigation to restore the food chain service. This opportunity relates to a supporting service. It should be noted that some of these 'opportunities' could be perceived as providing a public good and thus more appropriate to the public or not-for-profit sectors. However, this confusion disappears when these sectors are viewed as the customer that delivers a public good indirectly by purchasing the products and services of companies.

Example 2 – *An increased occurrence of natural disasters represents a decline in regulating services.* This scenario is a bit more complicated in that it requires the recognition that the service provided by the absence of such events is environmental stability. A mitigation opportunity might include preventing a flood-related disaster by seeding clouds to reduce heavy storms (mitigation - prevent), taking measures to reduce climate change and thus the source of the more extreme weather (mitigation – restore), or building a dike to limit disruption to society (adaptation). By building a dike, the large amounts of water aren't reduced but the impacts of the water on society are. The dike then provides an alternative means to achieve the level of environmental stability previously provided by the natural environment. These opportunities are examples of providing regulating services, and may possibly address impacts to provisioning services such as food and fresh water.

Example 3 – *Mitigation and adaptation from the same innovation.* The previous examples demonstrate how an entrepreneur could exploit a single change in the natural environment through either mitigation or adaptation. However, it is also possible that an entrepreneur could use a single product or service to exploit the same or different changes in the natural

environment. For example, if the drastic reduction of fish described in Example 1 was caused by overconsumption, the provision of an alternative source of protein could also redirect consumption habits such that the remaining fish population would be left alone and have an opportunity to restore itself over time and possibly be consumed again (hopefully in a more sustainable manner.) In this way, a single innovation would represent both means of exploitation.

In summary, we suggest that entrepreneurial opportunities related to environmental change may be classified as adaptation or mitigation. Entrepreneurs can identify opportunities by evaluating how changes in the natural environment impact ecosystem services and then identifying adaptation or mitigation solutions to the change in services.

Methods

To explore entrepreneurial opportunities from changes in the natural environment we adopt a two-stage qualitative inductive design. In the first stage of our research we utilized purposive sampling (Yin, 2015) to identify six innovations that were developed based on a change in the natural environment. These particular innovations were also selected because of their contributions to sustainable development. From these six caselets we found support for our analytic framework that we then applied to the second phase of our research.

In the second phase of our research we followed Bhidé (2000) and Markman and Gartner (2002) and drew our data from the Inc. 5000 List of America's Fastest Growing Companies. We first examined the top 500 companies listed on the 2012 Inc. 5000 List of America's Fastest Growing Companies for evidence of a relationship between these companies' business lines and changes in the natural environment. To do so, we reviewed company descriptions included on the Inc. 5000 website, and further examined company websites for evidence of business offerings, goals, principles, and customers related to changes in the natural environment, mitigation, or adaptation. Assessments for each company were made independently by two coders and further

reviewed by third researcher. Most decisions were agreed on, with the occasional disagreements in coding noted and discussed until consensus was reached.

For each company that demonstrated some tie to the natural environment concept, we then identified whether opportunities were exploited in the form of adaptation, mitigation, or both adaptation and mitigation, as per our framework. To examine additional themes, we also recorded the Inc. 5000 industry categories and founding dates of each of these companies, and reviewed our subset for information about opportunity combinations, target customers, and characteristics of adaptation opportunities.

Results and Discussion

Phase 1 Results

The results from the first phase of our inductive design, which included analyzing six cases of sustainable development innovation opportunities from the natural environment, supported the idea that the opportunities are adaptation-, mitigation- or adaptation and mitigation focussed. Below we present six short cases to illustrate the role of adaptation and mitigation as forms of opportunity exploitation from changes in the natural environment.

Adaptation focused.

Case 1 – Rainwater harvesting. Water shortages in regions around the world have prompted entrepreneurial action. Mexico City faces such shortages, with a 2009 drought forcing the government to cut off water to some areas of the city due to dangerously low reservoir levels.

In response to situations such as these and information provided by the World Resource Institute's Aqueduct project which maps areas at risk for water shortage, four entrepreneurs in Mexico City founded Sistemas de Captación de Agua Pluvial (SCAP), a company providing rainwater harvesting solutions to clients in Mexico in 2012 (Reig, 2012). This case demonstrates an adaptation response to a decrease in fresh water provisioning services.

Case 2 – Raised buildings. In consideration of forecasts of rising sea levels, a design firm decided to elevate sections of a new recycling plant in Brooklyn, New York to heights that exceeded city requirements by four feet. Six years later, when Hurricane Sandy created a 12-foot storm surge that impacted nearby streets and parking lots, the adaptation measures proved effective and the plant did not flood. Following Hurricane Sandy, a resiliency task force will likely recommend changes to building codes and require retrofits of existing structures and floodproofing for new projects (Navarro, 2012; Stemple, 2017). In addition, some in the real estate industry speculate that residents' experiences of being trapped on upper level floors when electrical equipment flooded and failed during the storm, may prompt an increase in demand for mid-rise buildings (Navarro, 2012). This case offers an example of opportunities from adapting to rising sea levels.

Mitigation focused.

Case 3 – Acid rain prevention. Acid rain was discovered in 1853, but became more widely known by scientists in the 1960s and the wider public in the 1970s. Taylor, Rubin, and Hounshell (2003) examined technological innovation related to SO₂ control by examining U.S. patents between 1887 and 1997. They identified 2681 relevant class-patents in this time period, with electronic keyword searches refining the list to 1237 patents between 1976 and 1996 (database keyword searchable from 1975). An onset of patenting activity coincides with the 1970s Clean Air Act with additional bursts in patent activity corresponding with later legislative and regulatory action. While technology patents do not necessarily equate to entrepreneurial exploitation, many researchers have used patents as a proxy for entrepreneurial activity (Lowe & Ziedonis, 2006; Shane, 2000, 2001). Innovative solutions currently used to reduce emissions include installing pollution control equipment; switching from high-sulfur coal to medium- or low-sulfur coal, fuel blends, or natural gas; employing energy-efficiency measures and/or

renewable generation; and buying excess allowances from other sources that have reduced their emissions (US EPA, 2002).

This case provides an example of entrepreneurial opportunity related to provisioning and regulating services, as acid deposition has negative effects on freshwater lakes and streams, coastal estuaries, and forests (Chestnut & Mills, 2005). It also addresses decreased cultural ecosystem services as acid rain also damages historical and culturally-significant buildings, statues, and sculptures (US EPA, 2012).

Case 4 – Cattail water purification. The Cattail Initiative, developed by the International Institute for Sustainable Development, demonstrates several examples of mitigation. Through this initiative, farmers grow cattails on marginal agricultural land, harvest the cattails, and turn them into compressed fuel products used for bioenergy production. This alternative energy source mitigates the need for fossil fuels that have higher greenhouse gas emissions, and it removes phosphorus from the marsh which decreases downstream nutrient loading. Beyond mitigation, this initiative improves habitats by removing dead plants and renewing plant growth and wildlife habitat. The initiative also offers several new sources of revenue for farmers. In addition to the compressed fuel product, the cattail biomass generates profitable carbon credits, and the phosphorus in the ash of burned cattails can be recycled into lucrative fertilizer (Benanati, 2012). In terms of ecosystem services, this innovation provides fuel services and addresses changes in climate regulation services.

Mitigation-adaptation focused.

Case 5 – Floating solar. SPG solar developed Floatovoltaics technology as a hybrid solar system built on water. From a mitigation perspective, the solar panels provide a lower carbon source of energy, and are actually more effective in doing so because of the natural cooling effect of the water. From an adaptation perspective, the technology addresses water conservation in the

face of increasing water scarcity. When placed on reservoirs the solar panels reduce evaporation. With the system shading the water, evaporation is reduced by up to 70%, saving 1,400,000 gallons of water for every acre covered by solar panels. A three-acre storage pond covered with a floating solar system could save over four million gallons of water annually—enough to provide drinking water to more than 40 homes for a year. The system also improves water quality by reducing organic matter growth in the water (e.g. algae). Algae clogs pumping and filtration systems and require costly treatment to control. By shading the water, algae growth is reduced, minimizing the associated treatment and labor costs (SPG Solar, 2011). This innovation provides fresh water and climate regulation ecosystem services.

Case 6 – Amphibex. The Amphibex, an amphibious excavator developed by Normrock Industries Inc. of Terrebonne, Quebec, is used for both adaptation and mitigation. Originally developed as a means of carrying out a number of riverside activities that require an excavator – dredging, installing water pipelines and submarine cables, cleaning wastewater treatment ponds, controlling vegetation – without destroying the environment, it has been used to restore famous marshes at the mouths of the Tigris and Euphrates, previously drained after the Gulf War in 1991 (Hein, 2011; Murray, 2011). Shortly after its creation in 1987, it was deployed to assist in a flood in Quebec (Hein, 2011). It is now being used for this purpose in a number of Canadian provinces, including the province of Manitoba. Until recently, the provincial government and its municipalities had fought floods using sandbags and other measures that protected homes, business, and critical infrastructure from rapidly rising water caused by ice jams. However, because of the unpredictability of ice jams, these measures were not always possible. In 2006, two local municipalities, supported by the provincial government, purchased an Amphibex to break up ice prior to spring run-off. In preparation for major floods in 2009 and 2011, the provincial government added two more Amphibexes to its fleet (Province of Manitoba, 2011).

Because marshes perform functions such as filtering for pollutants, this case offers an example of a mitigation opportunity related to a reduction in water purification regulating ecosystem services. It also highlights an adaptation opportunity from decreased natural hazard regulating services.

Phase 2 Results

Phase 2 of our research design involved analyzing data from the Inc. 5000 list. We found an initial eight categories that related in some way to businesses' exploiting opportunities from the natural environment. The initial categories were labelled main product, goal/value/principle, one related product or business line, certifications, associations, partners, customers, and non-product practices (such as recycling office paper). Through the iterative coding process these eight categories were refined to three categories, defined as follows:

1. Main product – company's main product focus is related to changes in the natural environment.
2. Goal/value/principle of company is that products contribute to adaptation (i.e. resiliency, no down time, short recovery time) or mitigation (i.e. environmental sustainability, green, reduce environmental impacts).
3. One product or business line that is related to changes in the natural environment.

The following are examples of the types of statements that identified businesses as exploiting opportunities from the natural environment:

Mitigation: "Astrum Solar's mission is to spread solar power to the rooftops of America...people around the country are ready to...reduce their electricity bills and carbon footprints."

Keen's Mission: Helping clients conserve today - to preserve tomorrow

Adaptation: “At Rapier Solutions, we understand the importance of relevant data recovery plans. Although we cannot prevent natural disasters (floods, fires, earthquakes, etc), our IT specialists can prevent informational loss.”

Adaptation-Mitigation: From Saratoga roofing: “Solar roofing systems are a great way to decrease your carbon footprint...Our disaster response service will provide you with the assurance of a quick and effective disaster repair.”

Using the three categories, our initial list of 121/500 companies was narrowed to 98. Even with the more stringent criteria, we found that almost 20% of companies started their business in some relation to the natural environment. This lends support to the focus of the study - that changes in the natural environment do serve as a source of entrepreneurial opportunity. Thus, formally stated we propose:

Proposition 1: Changes in the natural environment are a source of entrepreneurial opportunity.

Further, the opportunities from the natural environment took the form of adaptation and/or mitigation to the change in the natural environment. While the majority of opportunities (57%) fall within the mitigation-only category, there is support for companies starting from the other two categories in our analytic framework. Thus, we propose:

Proposition 2: Entrepreneurial opportunity related to changes in the natural environment take the forms of adaptation, mitigation, or both adaptation and mitigation.

To lend support to our two main propositions and to offer insight into areas for further development, we provide some additional key findings from our analysis in the following paragraphs. These descriptions are organized by themes.

Approach to exploiting natural environment opportunities. Companies vary in their focus on business lines related to changes in the natural environment. Some companies dedicate

all of their business lines toward mitigation or adaptation, while others offer natural environment-related products and services as just one of their lines. For instance, OnForce Solar works exclusively with solar power, while Clearview Electric offers customers the option of purchasing electricity generated from traditional energy sources or wind and solar energy sources.

Some of the companies that we classified as exploiting opportunities in the forms of both mitigation and adaptation did so by offering business lines that focused on mitigation and adaptation separately. For instance, Innovative Construction provides post-disaster restoration services as well as green roofing products. Other companies offer similar services for both mitigation and adaptation. For example, Hernandez Consulting provides consulting services for environmental remediation and disaster recovery projects.

Industry categories. The companies that we identified as exploiting opportunities related to changes in the natural environment represent 21 of 25 industry categories represented by the first 500 companies on the Inc. 5000 list. These results suggest that natural environment opportunities are not limited to just a few industries. In fact, some of the industries represented are surprising. For instance, one advertising and marketing company made the list because it offers a line of electric mobile marketing promotional vehicles.

Companies identified as exploiting opportunities from the natural environment represent 96% and 100% respectively of companies in the energy and environmental services industry categories, 50% and 67% respectively of companies in the security and engineering categories, and 21% to 35% of companies in construction, manufacturing, government services, telecommunications, business products and services, retail, and IT services categories. Companies in the ten other industry categories make up between 2% and 18% of the total number of companies in their categories. This may indicate that there are more opportunities available in some industries than in others. In contrast, it is possible that companies in some industries have

simply not recognized opportunities to offer products and services related to changes in the natural environment that are entirely new or offer incremental improvements that differentiate companies from their competitors.

In some cases, mitigation and adaptation opportunities are captured in different industry categories. For instance, mitigation is exploited primarily in the energy, environmental services, retail, and consumer products and services industries, while adaptation is captured primarily in the IT services, software, and security industries. Entrepreneurs exploit both mitigation and adaptation opportunities in industries such as business products and services, construction, and government services industries.

Ecosystem services. Most companies' offerings can be linked to multiple ecosystem services. Opportunities related to changes in at least 15 ecosystem services were identified among the products and services, with many companies responding to changes in multiple ecosystem services. Nearly all ecosystem services can be classified as provisioning services or regulation services, with a small number in supporting services. The most frequently identified ecosystem services relate to addressing land and water pollution (71% of companies). Specific ecosystem services under this umbrella might, for instance, include providing fresh water and safe soil. As an example, Urban Office Products works to prevent loss of these ecosystem services through its safe recycling of IT products and office furniture. A close second in ecosystem services is climate regulation (63% of companies), which often related to efforts to prevent or reverse climate change. 37% of companies responded to changes in natural hazard regulation, usually through disaster preparedness and post-disaster recovery products and services.

Implications for the natural environment. Much of the entrepreneurship literature related to changes in the natural environment takes a sustainable development perspective that

incorporates moral concepts and beneficial outcomes. Haughton (1999) for instance, explains that sustainable development includes principles related to

- futurity – inter-generational equity;
 - social justice – intra-generational equity;
 - trans-frontier responsibility – geographical equity;
 - open and fair treatment of people – procedural equity; and
 - value placed on survival of both human and non-human species – inter-species equity
- (pp. 235-237).

While the caselet examples of exploited opportunities presented in this paper are quite positive, entrepreneurial actions related to changes in the natural environment may, in fact, be detrimental to sustainable development, and may threaten social equality and environmental integrity (Eriksen & Brown, 2011). Providing an alternate form of an ecosystem service through the use of a particular technology may not consider consequences of entrepreneurial actions to environmental elements such as the ozone layer, photosynthesis, or the water cycle (Hopwood, Mellor, & O'Brien, 2005). Some adaptation entrepreneurship may offer unsustainable products, services, and processes for some members of this generation and for future generations. For instance, air-conditioning alleviates the indoor effects of summer heat but increases emissions of CO₂ as well as HCF-134a (Tol, 2005). Its potential for pollution may thus work directly against the goals of mitigation.

At the same time, mitigation agendas may conflict with adaptation by limiting the solutions available to address the changing natural environment. Albrecht (2002) states, “a rigid zero growth approach of what some groups call now sustainable development can hinder the development of these adaptive capabilities...” (p. 660). These agendas may also take resources

away from adaptation solutions that may have a more positive impact than mitigation in some cases (Tol, 2005). Therefore, opportunities derived from changes in the natural environment are not inherently productive, and conflicts may arise between adaptation and mitigation entrepreneurial opportunities. Said another way, opportunities arising from changes in the natural environment may not provide any benefit back to the environment. This means that these types of opportunities cannot be automatically equated with opportunities for sustainable development.

Future Research and Limitations

Most of the case examples and Inc. 5000 list presented in this paper capture the entrepreneurial efforts of newer firms, rather than incumbent firms. Future research could examine whether newer firms and incumbent firms differ in their tendencies to exploit changes in the natural environment through mitigation or adaptation. For instance, the World Resources Institute targets existing corporations in its ecosystem services review tools, which lead corporations to address the risks and opportunities of environmental change, primarily through adaptation (World Resources Institute, n.d.). The New York building adaptation case, in which an existing firm modified building designs to adapt to rising sea levels, suggests that adaptation may only require modification of existing technologies or transfer of technologies from one area or application to another. Because of this, it is possible that incumbent firms, more than new ventures, might be better positioned to pursue adaptation opportunities, or at least adaptation opportunities in established industries.

In addition, further research could identify whether new ventures and incumbent firms exploiting mitigation and adaptation opportunities follow the same pattern of inter-relating that has been identified for sustainable development entrepreneurship, or whether firms differ based on the type of opportunity. For instance, Hockerts and Wustenhagen (2010) suggest that bioneers or social bricoleurs start the sustainability transformation, followed by some early Goliath

adopters who implement sustainability in a few product lines. This is followed by start-ups that are more interested in growth than earlier start-ups, followed by the extension of sustainability products and processes into mass-market brands. Similarly, Schaltegger and Wagner (2011) explain that sustainability innovation is often radical innovation created through distributed research and development groups institutions and scientists and thus doesn't have a champion. As a result, researchers target niche markets that are unattractive for large firms. Because of this, initial opportunity exploitation is often pursued by small firms. These small firms are often better poised to pursue radical innovations; however, large firms are likely to have assets that allow them to be a fast second and bring the innovations to a mass market. Large multinational energy suppliers may do this by acquiring smaller firms, and partly by developing capabilities on their own. Because sustainable development appears to be more closely related to mitigation rather than adaptation, findings regarding the roles of established firms and new start-ups toward sustainable development opportunities might better reflect mitigation focused ventures.

Another area for future focus is the conditions under which entrepreneurs will exploit opportunities informed by changes in the natural environment. The entrepreneurship literature has proposed a number of beneficial conditions in relation to sustainable development and environmental entrepreneurship. For instance, Pacheco, Dean, and Payne (2010) suggest that entrepreneurs will pursue opportunities for sustainable entrepreneurship when institutions - norms, property rights, and legislation – are transformed by potential entrepreneurs so as to overcome negative market incentives. Dean and McMullen (2007) similarly propose that environmental entrepreneurial opportunities exist through “develop[ing] property rights regimes to create excludability,” “reduc[ing] transaction costs through the establishment of economic institutions,” “break[ing] monopoly position[s] of incumbent firms,” “alter[ing] [the] nature of government subsidies and other incentives through the political process,” “discover[ing] new

environmentally superior means of supply or customer segments with environmental preferences,” and “enhanc[ing] customer information regarding environmental attributes of products of processes” (p. 71).

Aragón-Correa and Sharma (2003) theorize that perceived state uncertainty and perceived munificence (low hostility) in the business environment will increase the likelihood that a firm will use its capabilities and resources to develop proactive environmental strategies. Cohen and Winn (2007) propose that collective knowledge of environmental issues and social pressure from policy makers, consumer groups, environmental activists, employees and others for firms, may also lead to innovative solutions to environmental degradation. Meek, Pacheco, and York (2010) investigate new firm entry in the solar energy industry, and conclude that not only are state-sponsored incentives related to new firm entry, so too are environmental consumption norms, and norms of family interdependence.

As mentioned earlier, adaption and mitigation reports link the prevalence of adaptation and mitigation to government support. In regard to adaptation specifically, Smit and Pilifosova (2001) suggest that determinants include economic resources, technology, information and skills, infrastructure, social institutions, and equitable access to resources. In this paper, the importance of information is highlighted by the case example of the Mexican entrepreneurs providing rainwater harvesting technology, who were supported by the World Resource Institute’s Aqueduct project which maps areas at risk for water shortage. Further research will be required to determine if conditions related to sustainable development and adaptation support both mitigation and adaptation equally.

Contributions and Conclusion

The theoretical contributions of this paper include a theoretical linking of mitigation and adaptation – key concepts in the climate change domain – to entrepreneurial opportunity by

introducing the concept of ecosystem services. This paper also offers an analytical framework of mitigation and adaption opportunities with which to classify opportunities. The empirical contributions of this paper include evidence that entrepreneurs are exploiting information from changes in the natural environment in the form of adaptation, mitigation, or adaptation and mitigation. Further these businesses represent a substantial proportion of fast growing ventures and a large number of industries. Finally, the practical contribution of this paper is the mitigation/adaptation ecosystem services opportunities analysis approach. This may be used as a tool by nascent entrepreneurs to recognize the significance of a change in the environment and generate ideas for entrepreneurial opportunities.

The perspective that we present in this paper regarding the natural environment and entrepreneurship provides a unique alternative to the sustainable development perspective found in entrepreneurship literature. Our new perspective expands the scope of opportunities related to changes in the natural environment thus opening the door for wider investigation of entrepreneurial opportunity. Further, it directs readers to consider a source of change that may generate discontinuous, valuable opportunities.

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CHAPTER 3

BORN IN TIMES OF TROUBLE: AN EXPLORATION OF SPONTANEOUS
ENTREPRENEURIAL VENTURING FROM DISASTERS

Research on disaster related entrepreneurial venturing is relatively new with just a handful of studies published in recent years. Disaster related venturing in this study refers to entrepreneurial venturing that focuses on products and services applicable to disaster-specific needs. Foam for hazardous materials spills; flood tubes for rapid, temporary diking; and emergency communication and coordination software are examples of such products. This is in contrast with disaster assistance provided by businesses at the time of a disaster, which may take the form of donated products and/or more general products with everyday uses rather than those specifically designed for disasters. In the U.S., for example, Walmart works collaboratively with the American Red Cross and The Salvation Army to provide needed items for disaster response. For Walmart, this includes setting up an internal emergency operations centre to make sure stores receive sufficient stocks even in disrupted environments (PwC, n.d.; Wal-Mart Stores, Inc., n.d.). While disaster related businesses may offer assistance during a disaster, they are distinguished by the products and services they offer rather than the period in which they offer those products.

Not only is research on disaster related venturing sparse, research on the relationship between business and disaster is also limited. Researchers have primarily examined the role of existing businesses in disaster response and recovery and occasionally in planning and mitigation activities (Johnson, Connolly, & Carter, 2011). A number of papers have also examined the recovery of businesses following disaster (Dahlhamer, Webb, & Tierney, 1999; Tierney, 1995; Tierney & Webb, 2001; Webb, Tierney, & Dahlhamer, 1999; Webb, Tierney, & Dahlhamer,

2000). In his proposal for the future of entrepreneurial research, Shepherd (2015) asserts a need for research on a particular type of disaster related venturing which he refers to as “spontaneous venturing”, defined as the rapid creation of ventures, particularly those that form in response to events that cause human suffering, and notes the lack of information on this particular phenomena. Recent studies that have responded to the call to look at entrepreneurship following disaster have focused on the impact of business actions on community resilience (Linnenluecke, Linnenluecke, McKnight, & McKnight, 2017; Williams & Shepherd, 2016). However, these studies have only started to fill the gaps in understanding on this segment of entrepreneurship and the interaction between disaster related entrepreneurship and other groups engaged with disasters.

This qualitative inductive study takes an exploratory approach to reveal elements of the process, enabling and constraining factors, and motivations of disaster related entrepreneurial venturing. Taking Shepherd’s proposal as a starting point, I focus primarily on spontaneous venturing during or outside of disaster. However, the findings point toward unique characteristics of disaster related venturing in general, as well as some specific considerations for spontaneous venturing from disaster, and for venturing or routine exploitation by an established business during a disaster. Using Hindle’s (2010) model of entrepreneurship as a framework, I propose that disaster characteristics, disaster management culture and context, and dual logics of helping and profit shape the entrepreneurial experience of disaster related venturing.

Exploring this application of entrepreneurship contributes to the small but growing body of disaster related entrepreneurship literature, while offering insights (many cautionary) to entrepreneurs that wish to participate in this particular market space. Disaster related entrepreneurship, like social, environmental, and sustainable entrepreneurship, is affected by

social value, thus these findings may contribute to the understanding of these other subsets of entrepreneurship. In terms of disaster research, this study provides the opportunity to examine what is different about venturing in a disaster context. Drabek (2002), in his wish list for future disaster studies and research, notes that disasters are “nonroutine social problems” and thus argues that it is important to “understand better why disasters are relevant to *and different from* other social problems” (p. 152). Because this study looks at venturing during and outside of disaster, it also responds to Drabek and McEntire’s (2003) call for additional attention to emergence in disaster phases other than response and in diverse types of disasters. Finally, disaster research shows that governments, which have the primary legislated role in responding to disasters, often struggle to incorporate non-government and emergent groups in particular into disaster responses (Moynihan, 2009). The findings of this study will contribute to literature that seeks to address this challenge (Bui & Sebastian, 2011; Drabek & McEntire, 2003; Quarantelli, 1997; Voorhees, 2008).

In the following section, I present the theoretical underpinnings for this study and highlight research on emergence in disaster. A small review of literature on rapid development, a potential feature of this type spontaneous venturing in disaster, is available in Appendix A.

Theoretical Underpinnings

For this paper, I adopt Hindle’s (2010) model of entrepreneurship, which developed out of Moroz and Hindle’s (2012) analysis of entrepreneurship models with the purpose of identifying what is unique to entrepreneurship compared with business activities in general.² Entrepreneurship has been variously defined based on theoretical perspective, context, and

² The Moroz and Hindle (2012) paper was originally presented at the Academy of Management Conference in 2010 and was forthcoming at the time of Hindle’s (2010) book chapter.

application (Steyaert, 2007). Moroz and Hindle (2012) suggest that four models of entrepreneurship best capture what is both generic and distinct about entrepreneurship. They summarize these models as the emergence perspective (Gartner, 1985), value creation perspective (Bruyat & Julien, 2001), creative process perspective (Sarasvathy, 2001, 2006), and opportunity discovery perspective (Shane, 2003) (p. 810). They further identify six key characteristics that are present in these models: 1) acknowledgement of a relationship between individuals and opportunities, 2) a transformative and disruptive element, 3) the creation of value for stakeholders through new and often novel means, 4) recognition of timing and market receptiveness, 5) the taking of action, and 6) acknowledging the role of context (p. 811).

Hindle (2010) builds off of these findings to propose a new definition of entrepreneurship: “the process of evaluating, committing to and achieving, under contextual constraints, the creation of new value from new knowledge for the benefit of defined stakeholders” (p. 107). Hindle views evaluation as the action that is distinct to entrepreneurship. In his supporting process model which draws heavily on Shane (2003), he describes three domains: strategic, personal, and tactical. The primary activity of the strategic domain is the evaluation of opportunities toward a business idea or model. Hindle uses ‘business model’ in a loose sense, adopting Downing’s (2005) definition of a “set of expectations about how the business will be successful in its environment” (p. 186). Following Shane (2003), he also proposes that a business model could be viewed as the outcome of evaluation that satisfies the entrepreneur that he or she has “a new means-end framework that the entrepreneur *believes* will yield a profit” (p. 18). Additionally, it is preferable that the business model “articulates exactly what needs to be done to achieve specified results” and answers the question, “does an opportunity exist that we can potentially exploit?” (Hindle, 2010, pp. 102 and 109).

Individuals or groups engage in the iterative process of evaluation until they produce an interim business model that they think can “create value and of which they can capture a portion of that value themselves” (Chesbrough, 2006, p. xiii). Hindle depicts evaluation as an activity that considers both generic and contextual elements. Contextual elements will be more prominent when considering opportunities in particular industries or niche areas. However, even if a business opportunity is more generic, evaluation is always situated in a context. Hindle also suggests that there is a two-way relationship between evaluation and opportunity existence, leaving the possibility for opportunities to be both discovered and created. Because of this approach, evaluation is to be interpreted in a general way such that it can encompass all the forms of evaluation explicitly or implicitly contained in perspectives such as Schumpeterian and Kirznerian opportunities, effectuation, and bricolage.

The primary activity of the personal domain is commitment, in a psychological sense, of pursuing the implementation of the business model. Hindle suggests that the voluntary aspect of commitment is what makes this a ‘personal’ commitment. The primary activity of the tactical domain is exploitation with the creation of value as the focal outcome. This domain is viewed as being about managerial capacity rather than entrepreneurial capacity of the strategic domain. Because Hindle only considers the first domain to be “entrepreneurial”, it is possible that the activities of the personal and tactical domains could be carried out by someone other than the creator of the business idea or model.

Hindle’s model is appropriate to this study because of its theoretical flexibility. This flexibility arises from presenting the model as non-deterministic in terms of order of activities, placing no limiters on where new value is created making it applicable to new start-ups and corporate venturing, allowing for various contextual environments such as for-profit business or

not-for-profit organizations, and taking an agnostic approach toward opportunity existence or creation. This flexibility provides the opportunity to insert a particular constraint where necessary or leave a theoretical approach undefined in advance of collecting data. The model's differentiation between the concepts of evaluation, commitment, and action is also useful to more clearly defining spontaneous venturing, as I do in the next section.

Spontaneous Venturing

Shepherd (2015) proposes the study of “spontaneous venturing” by which he appears to mean the rapid creation of ventures, particularly those that form in response to events that cause human suffering. This concept is linked to his previous work (Shepherd & Williams, 2014) on compassion organizing, defined as “a collective response to a particular incident of human suffering that entails the coordination of individual compassion” (Dutton, Worline, Frost, & Lilius, 2006, p. 61) in the context of events such as disasters. In Shepherd and Williams' (2014) paper, the element of spontaneity in organizing is not explicitly discussed and defined. However, spontaneity may be intimated in their definition of local venturing which focuses on locals acting apart from their primary non-disaster roles. At the same time, local venturing as the authors present it, allows for the possibility for latent (pre-planned) disaster roles rather than those that are strictly spontaneous. Thus, Shepherd and William's (2014) paper provides limited insight on defining “spontaneous” in relation to entrepreneurship.

In other entrepreneurship literature, the idea of ‘spontaneous’ is present though not common and not tied to disaster in any way. When used, it is described as the opposite of induced, policy-driven, or planned (Del Giudice, Della Peruta, & Maggioni, 2013; Huang, Yu, & Seetoo, 2012; Tikkanen & Parvinen, 2006). This use is more in line with dictionary definitions of spontaneous such as:

Coming or resulting from a natural impulse or tendency; without effort

or premeditation; natural and unconstrained; unplanned (“Spontaneous,” n.d.-a)

Happening or done in a natural, often sudden way, without any planning or without being forced (“Spontaneous,” n.d.-b)

The elements that appear to be most applicable to explaining the phenomenon of spontaneous venturing are 1) acting without premeditation, or 2) acting in a sudden way. Drawing on Hindle’s model and these elements, I define spontaneous venturing as *a process in which new information prompts a near simultaneous progression from opportunity evaluation (forming a business ‘idea’ or ‘model’), to commitment, to action toward a previously unconsidered creation of new value for an entrepreneurial outcome*. In this definition, ‘new information’ and ‘previously unconsidered’ are in relation to a focal individual or group.

Hindle’s differentiation between the concepts of evaluation, commitment, and action supports a clearer picture of where spontaneity connects into the entrepreneurial process. Premeditation or planning cannot, by definition, exist if evaluation has not taken place. If an individual has previously considered the opportunity or some form of it and how the business idea would be carried out, then any evaluation conducted at the time of receiving the new information cannot be seen as the start of a strictly spontaneous response. Thus spontaneity must start before evaluation. At the same time, one could argue that even spontaneous action is preceded by at least some forethought (e.g. suddenly jumping off a cliff is preceded by a decision to take steps toward the cliff edge and leap). However, an almost immediate move to commitment and action minimizes this state of planning and completes the idea of spontaneity. This is why the proposed definition states that there needs to be a rapid succession from evaluation to commitment to action for venturing to be viewed as spontaneous.

Disaster

Disaster has been conceptualized in numerous ways including patterns of war, social vulnerability, measures of harm, betrayal or loss of control, social vulnerability, and uncertainty (Gilbert, 1995; Horlick-Jones, 1995). Newer approaches move away from focusing on agents (meaning the physical contributors to disaster such as hurricanes and earthquakes) and damage to a social perspective, such as the role of social evaluation of a human group in defining disaster (Boin, 2005; Gilbert, 1995) and disaster being the consequences of social change (Quarantelli, 2005a). *An Emergency Management Framework for Canada* (Ministers Responsible For Emergency Management, 2017) recognizes both the social and agentic views to some extent, defining disaster as “essentially a social phenomenon that results when a hazard intersects with a vulnerable community in a way that exceeds or overwhelms the community's ability to cope and may cause serious harm to the safety, health, welfare, property or environment of people” (p. 21). Perry (2005) notes that even in the varied views on definition of disaster, “there remains agreement that disasters are defined as social occasions, that they are disruptive, and that they are related to social change” (p. 315). Boin (2005) suggests a hierarchy between crisis (a term used more frequently than ‘disaster’ in entrepreneurship and management literature) and disaster, stating, “crisis, then, pertains to the process of perceived disruption; disaster applies to the collectively arrived-at appraisal of such a process in negative terms. In this perspective, a disaster is a crisis with a bad ending” (p. 165). For this study, I focus on disaster rather than crisis and adopt the social interpretation approach described by Boin. Perry (2005) views the idea of defining disaster as what people say is disaster as an extreme position. However, I view this approach as appropriate to the study of spontaneous venturing as the entrepreneurs’ actions are based on their interpretations and understandings of a circumstance. Practically, this means that

if an entrepreneur or other interviewed informant perceives something to be a disaster or of a scope that it would be addressed by those in the field of disaster management, and it would generally be considered by others to be such, then it is a disaster for the purpose of this study. At the same time, I adopt Quarantelli's (2005a) view that "it is best to think of the concept of disaster as an occasion involving an immediate crisis or emergency" (p. 335), thus I exclude "all very diffused events" such as long standing disease epidemics (p. 335).

For simplicity, I apply the term 'disaster' to a wide continuum of events ranging from non-routine/major emergencies to catastrophes, but excluding routine emergencies. Definitions of emergency generally focus on the need for rapid action to address a harmful or potentially harmful situation. *An Emergency Management Framework for Canada* defines emergency as "a present or imminent event that requires prompt coordination of actions concerning persons or property to protect the health, safety or welfare of people, or to limit damage to property or the environment" (p. 21). The emergency/disaster management community typically separates emergencies which are typically handled on a daily basis by local first responders (police, fire, ambulance, public works, etc.) from major emergencies. At the other end of the spectrum are catastrophes such as Hurricane Katrina in which there is a "complete disruption of social life and the community no longer function[s] in any meaningful sense" (Quarantelli, 1997, p. 40). Quarantelli (2005b) suggests that there are qualitative differences between disaster and catastrophe at the organizational, community, and societal levels. For instance, in a catastrophe, "help from nearby communities cannot be provided" because they are also affected and "the mass media especially in recent times socially constructs catastrophes even more than they do disasters" (p. 5).

Spontaneous Behaviour in Disasters

Disaster literature occasionally refers to “spontaneous” behavior, such as spontaneous planning undertaken by response organizations at the time of a disaster event (McEntire, Kelly, Kendra, & Long, 2013). More often, it examines emergent behaviour. Emergent behaviour in disaster is not synonymous with spontaneous behaviour. For instance, although much of the emergence literature focuses on volunteers, Cottrell (2012) further recognizes that only some volunteers are spontaneous, defined as “those who seek to contribute on impulse” (p. 2). Forrest (1974) argues that “emergent behavior is not a spontaneous or discontinuous response but is predicated upon a reformulation or synthesis of previous existing patterns and attributes” (p. 92). Similarly, Mileti, Drabek, and Haas (1975) state, “non-victims, not unlike victims, seek to ‘structure’ the situation and ‘normalize’ it, i.e., integrate the novelty of the disaster into conceptual schemes used in everyday life” (p. 63). I suggest that these statements explain the particular form that emergent behaviours take rather than negating the idea that emergent behaviour in disasters is relevant to and overlaps with the concept of spontaneous action in this context.

Emergent behavior in disasters may take a wide variety of forms, such as immediate rescue work, coordinating the provision of supplies to affected areas, and collating and verifying crowdsourced information to aid on-the-ground responders. Emergent behaviours are typically short-lived and disappear once the emergency subsides or in the post-impact phase (Mileti et al., 1975; Provitolo, Dubos-Paillard, & Müller, 2011). As an example, a recovery software company found that 70% of helping offers by the public occurred in the first five to six days after Hurricane Sandy and then dropped off dramatically (Recovers, 2013). Exceptions to short-lived responses may include non-affected individuals sharing their housing with evacuees (Barton,

1969). Emergent behaviours may also occur outside of disaster as preparedness against a particular hazard. However, these groups also have a short lifespan (Drabek, 1986).

Emergent behavior in disaster literature has generally focused on individuals and groups, with increasing interest in recent decades in the internal workings and roles of emergent groups within a multi-organizational response system, and in the emergent nature of the systems themselves. With a focus on groups, Dynes (1970) presents a typology of four types of organized behaviour in disasters. These types represent combinations of old or new structures and old or new tasks. Organizations may be classified as established (old structure/regular tasks), expanding (new structure/regular tasks), extending (old structure/nonregular tasks), and emergent (new structure/nonregular tasks). Established organizations might include routine emergency responders, such as police or firefighters. Expanding organizations might include relief organizations, and extending organizations might include construction companies. Emergent organizations are typically those that form at the time of disaster. Later research suggests that emergent behaviours are not uncommon among all four types of organized behaviours, prompting an updated typology that allows for emergence in all quadrants. This typology describes the types as quasi-emergent behavior (old structure/old functions or tasks), task emergence (old structure/new functions or tasks), structural emergence behavior (new structure/old functions or tasks), and group emergence which is the same as the old emergent type (Quarantelli, 1995). Additional research has also identified emergent forms referred to as Type V (or supraorganization), emergent group with latent knowledge (same as emergent but group members have been trained in emergency response), and interstitial (emergent group formed between organizations to facilitate coordination) (Drabek & McEntire, 2003). Thus responding groups make take numerous forms, and exhibit various degrees of emergence.

Emergent behaviour in disaster literature is commonly tied to concepts of helping, altruistic, and volunteer behaviors in response to a potential, imminent, or actual disaster. Dynes makes a case that “disasters create unity rather than disorganization” (1970, p. 84). He explains that in disaster, an almost automatic process happens whereby values that are most critical to survival become most important resulting in a system of priorities and supporting norms that are widely accepted by the community. He notes that the features of a ‘therapeutic community’ are generally, “the development of an emergency consensus, the development of altruistic norms and behavior, the expansion of the citizenship role, the minimization of community conflict, and the generation of hostility towards outsiders” (p. 101). As a result, factors that contribute to emergent and helping behaviours in disaster cannot always be readily separated.

Barton (1969) proposes a many-factored model (with much detail not covered here) to explain how individuals come to help those affected by disaster. In his model, an individual’s helping behaviour is directly affected by sympathetic identification with victims, the individual’s moral standards requiring helping, perception of social norms requiring helping, and practical considerations related to the ability to help such as the individual’s own deprivation and access to those that need help³. Sympathetic identification “involves a desire to help the victim because we “suffer with” him; we feel a sense of identity with him and are made unhappy by his deprivation” (p. 238). Types of identification include long-standing primary group identification

³ Barton (1969) notes that “while *immediate* aid may be limited to those physically present at the scene of a disaster, it is now possible for people anywhere in the world to make indirect contact with victims of collective deprivations anywhere else in the world” (p. 273). Web-based crowdsourcing information tools currently available for disaster response now allow direct, virtual contact and support for those affected by disaster.

such as close family and friends, secondary group identification such as neighbours or people of the same ethnicity, emotional identification based on similarity – those “just like me” in various ways, with a potential for universal emotional identification with anyone who is suffering.

Awareness of deprivation, and perceptions of victims’ deprivation, need, and role in bringing on their own deprivation (i.e. are they to blame?) have direct and indirect influences on the key factors affecting helping behaviour. In this model, characteristics of the disaster itself such as its suddenness, severity, randomness of impact on people, and proximity to the individual also contribute to awareness and perceptions directly and indirectly. For example, a severe and proximate disaster is more likely to result in an individual receiving information from the media about the disaster and engaging in conversations about and with victims, which will in turn influence awareness and perceptions.

Recent surveys of volunteers in disaster situations corroborate many of the proposed factors in the model. For instance, a survey of spontaneous disaster volunteering in Australia found that important factors in volunteering were feeling the need to help, upset at what was happening, and having family or friends affected in the disaster. Further interviews identified an emotional response to the unfolding crisis as the strongest factor, with examples including a desire to help, good feelings from helping, feeling lucky or guilty not to be affected, and a sense of civic or moral duty. Experiential factors such as current or previous experience as someone affected by disaster or exposure to those currently affected, familiarity with volunteering, having relevant skills, and wanting to give in a non-financial way also had an impact. Cultural influences related to religion or family norms, being asked to help, and the significance of community were also identified. Finally, external factors included geographic proximity, having time available, exposure to media stories, coordination of opportunities to help through the

media, and accessibility to areas where help was needed (Barraket, Keast, Newton, Walters, & James, 2013, pp. 23–29). Researchers identified similar volunteer motivations in the aftermath of an oil spill in New Zealand: a sense of duty, enjoyment in helping or the view that volunteering is part of who they are, the New Zealand cultural mindset of do-it-yourself rather than waiting for experts, to have a place in history, a sense of belonging to a community who needed to do clean-up work, thinking of future generations, concern about the environment, because they were able or had time, having time but not money to donate to charities, to meet new people or be connected, to deal with emotions generated by oil spill, having a sense of collective responsibility, for personal benefit, and to assist local business community (Hamerton, Sargisson, Smith, & Hunt, 2015, pp. 262–264). A study on donations notes that a top reason for willingness or unwillingness to donate to a disaster situation was the severity of the victim's need with frequent references to the victims' finances, the scale of the disaster, and the nature of the disaster. Other frequently mentioned reasons include the impact of the donation, donations by others (with people more likely to donate if they perceived that others were not donating), the cause of the disaster ('natural' vs 'manmade'), victim blame, awareness through the media, knowing or relating to victims, knowledge of the situation, and personal finances (Zagefka, Noor, Brown, Hopthrow, & Moura, 2012). These studies highlight that a decision to respond to a disaster is multi-factored and varies between people.

While research and models that look at individuals highlight a myriad of contextual factors related to the disaster, social context, and individual psychological and physical factors that contribute to this behaviour, research on the formation of emergent groups highlights emergence as a reaction to the response itself. For instance, emergent groups may form in response to unmet social needs, in situations that require urgent responses, when there are

insufficient or inappropriate tasks or structures, or when a community feels it is necessary to do so (Drabek & McEntire, 2003; Neal & McCabe, 1984; Quarantelli, 1995). Mileti et al. (1975)

compile a number of situations that may lead to a perceived need for emergent response:

- emergency demands exceed the community's organizational capability,
- inter-organizational coordination is low and organizations carry on their operations independently or with other organizations,
- when legitimate incumbents of authority positions do not play their roles and command posts are not immediately established at the disaster scene,
- when there is little community preparedness for the disaster,
- if the community has had limited or no prior experience of dealing with crises,
- when the community crisis remains inadequately defined,
- lack of overall community coordination, over-all community control, and information, and
- an authority lapse which often occurs early in the emergency period (p. 72-73).

Having highlighted research that speaks to who engages in spontaneous or emergent behavior in disaster, the forms this behaviour takes, and reasons for this behaviour, I next describe my methods for exploring an understanding of an area of spontaneous behavior that has received less attention in research – spontaneous disaster related venturing.

Methods

The purpose of this study is to reveal elements of the experience of entrepreneurial venturing in the area of disaster related products and services with a particular focus on spontaneous venturing within this context. With a goal of also contributing to theoretical understanding of this context, this study also intends to propose reasons for these experiences.

Because so little has been written about this topic, I adopt an exploratory approach and seek to gather information on multiple aspects of the entrepreneurial process with the intent of narrowing my analysis based on the information gathered in data collection. In broad categories, I examine the process, enabling and constraining factors, and motivations of disaster related venturing. These categories approximately align with the entrepreneurial model proposed by Hindle's (2010) and Shane's (2003) frameworks for entrepreneurship. For phenomenon-driven research with limited existing theory, a broadly scoped research question is appropriate as it provides flexibility in examining the topic (Eisenhardt & Graebner, 2007). For this study, I use an analytic induction approach with data from multiple examples of ventures and interviews of individuals working in the field of disaster management.

Context

This study examines experiences of entrepreneurial ventures based in Canada and the United States, as well as one venture based in Australia and another in Ireland. While there are differences between these jurisdictions in disaster management⁴ legislated authorities and how emergency management is carried out and funded (some differences are noted in the findings), there are many commonalities. In all jurisdictions, disaster response generally starts at a local level with regional, provincial/state, and federal/national involvement as warranted by the capacity or authority of the lower level to address a situation. All of these jurisdictions also adopt a four or five phase cyclical model of disaster management that includes elements of

⁴ Government bodies in these countries typically refer to this field as 'emergency management' rather than 'disaster management'. However, I use disaster management to be consistent with my choice of "disaster" as an encompassing term for this paper.

prevention/mitigation⁵, preparedness, response, and recovery. Another common concept is that of an “all-hazards” approach which recognizes and integrates common disaster management elements across all hazard types, and then supplements these common elements with hazard specific components where needed (Ministers Responsible For Emergency Management, 2017, p. 11). In general, businesses do not have responsibilities for contributing to disaster management apart from recommendations or requirements that they prepare to handle events that may disrupt their own operations.

Informants and Data Selection

Ventures. Ventures included in this study were examined in one of two ways: 1) an in-depth analysis for the purpose of gathering information on a variety of elements of the entrepreneurial experience, or 2) a superficial review to confirm information provided by disaster management informants or to seek additional evidence to support or contradict potential propositions. Both of these may be referred to as cases or examples throughout this paper; however, they are not true case studies in that the venture data was not compiled into narrative case reports.

Ventures were selected using theoretical sampling (Eisenhardt & Graebner, 2007) which uses a replication logic rather than a sampling logic to select cases (Yin, 2003). With this approach, each case is analogous to an experiment. Cases may be chosen as literal replications in which similar results are expected or theoretical replications for contrasting but predictable

⁵ Mitigation in disaster management is actions to “adapt to, eliminate or reduce the risks of disasters in order to protect lives, property, the environment, and reduce economic disruption” (Ministers Responsible For Emergency Management, 2017). Most emergency management mitigation would be viewed as adaptation within a climate change paradigm.

results (Yin, 2003, p. 47). Yin (2003) further notes that “multiple-case rationales also can derive from the prior hypothesizing of different types of conditions and the desire to have subgroups of cases covering each type” (p. 52). Within the theoretical sampling approach, some cases were selected through snowball sampling (Yin, 2015) but conformed to the selection criteria.

Selection criteria. Hindle’s (2010) entrepreneurial model allows for different contextual rules. The context I selected for this study is a for-profit environment, thus all ventures included in the study had to be for-profit ventures or initiated by a for-profit business⁶. All ventures also had to be entrepreneurial in the sense of creating new means-end relationships. The majority of ventures were selected as examples of spontaneous venturing; however, I included some examples of non-spontaneous venturing for comparison. For spontaneous venturing, I selected at least two ventures to represent each of the proposed types of spontaneous venturing (discussed below). I also selected ventures to ensure that both all-hazard and hazard-specific ventures were included, as well as a variety of hazard types (despite the non-agentic approach discussed earlier in the paper). I specifically did not select ventures based on success outcomes in consideration of issues of undersampling on failure (Denrell, 2003). Together, these sampling criteria resulted in a fairly heterogeneous sample of ventures. Poole, Van de Ven, and Dooley (2000) examine arguments for homogenous versus heterogeneous samples, concluding that “researchers will never know the limits where valid comparisons end and where invalid comparisons begin unless

⁶ For ventures started by existing companies, the existence of a profit motivation for starting a spontaneous venture may be unknown before conducting an interview. Because of this, ventures initiated by a for-profit business are included even if they did not seek financial returns from the disaster related venture.

they empirically examine the broadest possible range of cases to which our definition of innovation applies” (p. 123).

Entrepreneurial. Entrepreneurial ventures included in this study had to be entrepreneurial as noted by value creation. Moroz and Hindle (2012) highlight value creation as a distinctive characteristic of many entrepreneurial models noting the importance of “the existence of profit based (objective) opportunities that may be exploited through the application of new means end relationships” (p. 806). Emphasis on new value limits entrepreneurship to new means-end relationships (Eckhardt & Shane, 2003). Schumpeter (1934) proposes five types of new combinations. Most ventures selected represented “the introduction of a new good – that is one with which consumers are not yet familiar – or of a new quality of a good”. One venture, which became the first distributor outside of the country of origin, is an example of “the opening of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before” (p. 66).

Spontaneous venturing types. I selected ventures to represent one of four proposed types of spontaneous venturing. I identified three of these types through observation, general web searches, and conversations with vendors at disaster management conferences prior to the start of this study. The three types are 1a) an existing business that took actions to start a non-disaster related venture pre-disaster and re-oriented its existing product for disaster during the disaster, 1b) a new venture that took actions to start up during a disaster and offered its product during that disaster, and 2b) a new venture that took actions to start up after a disaster and offered the product post-disaster. I induced that there would be at least a fourth type – 2a) ventures that took actions to start a new venture during a disaster and offered the product post-disaster. Figure 1 depicts these subtypes. I then grouped the first two and last two together to

represent ventures that offered products during disaster and those that offered products after disaster based on the assumption that ventures that offer products during disaster are distinct as they venture within an environment that includes a time constraint that is not present for ventures that offer products after disaster. In the course of this study, I identified a variation on 2a in which the entrepreneurs created a prototype of the product during disaster and then took actions to start a new venture after disaster. I include this as an additional type (2c) as these entrepreneurs view their venture as starting after disaster.

Figure 1. Proposed types of spontaneous venturing.

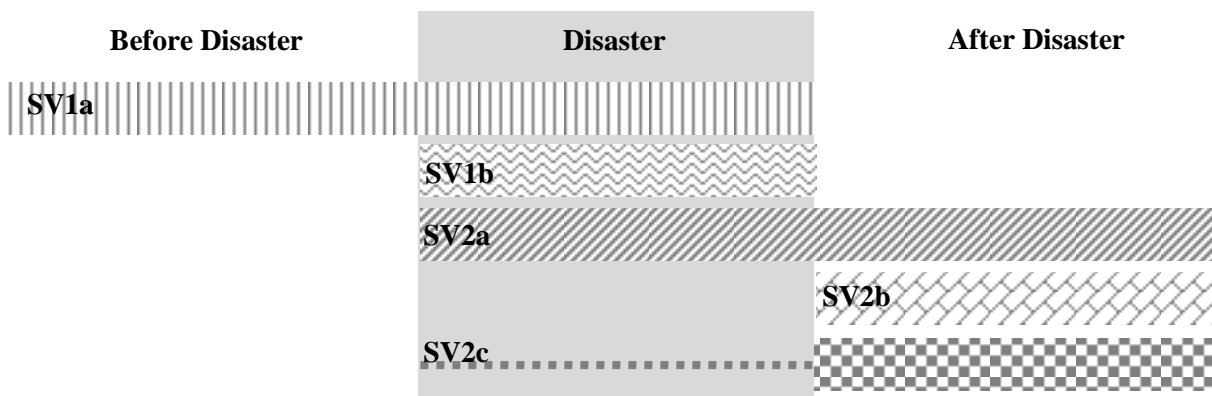


Table 1 notes the number of entrepreneurial ventures included for each of the spontaneous venturing (SV) types.

Because the spontaneous venturing types are based on timing in relation to disaster, it is important to be able to identify when a disaster begins and ends. Since at least the 1930s, researchers have made efforts to describe disaster through phases or stages (Neal, 1997). Phases typically cover elements of pre-disaster, disaster, and post-disaster activities. However, it is difficult to operationally identify when a disaster is occurring. Bardo (1978) states that “because disasters are processes, it is difficult to clearly distinguish the onset and termination of each

phase; thus, the divisions become heuristic devices designating the most general activities characterizing the time period” (p. 92). Researchers suggest viewing the process as “overlapping normal curves” (Bardo, 1978, p. 103) and not assuming phases occur in a specific order (Neal, 1997). Neal (1997) further proposes that researchers focus on functional rather than temporal aspects of disasters. As an initial step, researchers could identify which functional activities are associated with each phase of a particular classification, such as the commonly used mitigation, preparedness, response, and recovery framework (p. 259).

To follow this guidance, I adopted Drabek’s (1986) eight disaster management categories: planning and warning (preparedness), pre-impact mobilization and post-impact emergency actions or alternatively just emergency (response), restoration and reconstruction (recovery), and hazard perceptions and adjustments (mitigation). For this study, the activities associated with the following four categories were used to identify when a disaster is occurring: Warning – identified by communication of information about an imminent potential or occurring event or situation. Information urges the taking of pre-impact mobilization actions intended to limit the loss of or damage to life, property, and the environment. Warnings are for a specific event or situation in a focal area, not a widespread, slow-moving occurrence such as climate change. Pre-impact mobilization – identified by activities such as evacuations (Drabek, 1986), putting up temporary protections for structures, stocking up supplies such as food and fuel, and making arrangements for substitute heating and cooking arrangements (Dynes, 1970). Emergency/post-impact emergency actions – identified by actions to remove or neutralize the threat or hazard source such as fire suppression or isolating hazardous materials, search and rescue, caring for casualties and survivors by providing medical shelter, food, and clothing, and

Table 1

Summary of Venture Characteristics and Data Collection

Code Number	Product Type	Discussion - unrecorded (5 - 20 min)	Interview - Founder	Interview - Principal	Interview - Customer	Written Response (words)	Interview Lengths Total	Interview Lengths Average	Mentioned in DM interview	Archival Sources	SV type	Inspiring Disaster Type (Agent)
Spontaneous venturing												
1	Flood Protection / Prevention	1	1	-	1	-	180	90	1	10	1a	Flood
2	Incident Management / Situational Awareness	-	-	1	-	-	45	45	3	22	1a	Hurricane
3	Volunteer Management / Situational Awareness	-	-	-	-	145	-	-	-	20	1a	Earthquake
4	Hazardous Materials Remediation	1	-	-	-	-	-	-	-	25	1b	Hazardous Materials Release
5	Temporary Housing	-	1	-	-	-	19	19	-	24	1b	Urban Interface Fire
6	Flood Protection / Prevention	1	-	-	-	-	-	-	-	25	1b	Flood
7	Incident Management / Situational Awareness	-	1	-	-	-	59	59	1	10	2a	Terrorism
8	Flood Protection / Prevention	-	-	-	-	-	-	-	-	14	2a	Flood
9	Emergency Lighting	-	-	-	-	-	-	-	-	31	2a	Earthquake
10	Emergency Alerting / Notification	-	-	-	-	-	-	-	-	6	2b	Tornado
11	Emergency Alerting / Notification	1	1	-	2	-	230	77	-	4	2b	Urban Interface Fire
12	Flood Protection / Prevention	-	-	-	-	-	-	-	1	2	2b	Flood
13	Emergency Alerting / Notification	-	-	-	-	-	-	-	-	43	2b	Tsunami

Code Number	Product Type	Discussion - unrecorded (5 - 20 min)	Interview - Founder	Interview - Principal	Interview - Customer	Written Response (words)	Interview Lengths Total	Interview Lengths Average	Mentioned in DM interview	Archival Sources	SV type	Inspiring Disaster Type (Agent)
14	Incident Management / Situational Awareness	-	-	-	-	-	-	-	1	26	2b	Urban Interface Fire
15	Emergency Alerting / Notification	-	-	-	-	-	-	-	1	1	2b	Terrorism
16	Flood Protection / Prevention	-	1	-	-	-	101	101	1	1	2b	Flood
17	Flood Protection / Prevention	-	-	-	-	-	-	-	3	4	2b	Flood
18	Emergency Alerting / Notification	1		1			66	66		40	2b*	Hurricane
19	Volunteer / Donations Management	-	1	-	-	-	103	103	1	69	2c	Tornado
Likely spontaneous venturing:												
20	Emergency Alerting / Notification	1		-	-	-	-	-	-	3	1a*	Hazardous Materials Release
21	Emergency Alerting / Notification	-	-	-	-	-	-	-	-	9	1b*	Urban Interface Fire
22	Recovery Management	-	-	-	-	-	-	-	1	7	1b*	Flood
23	Hazard Modelling	-	-	(see #28)	-	(see #28)	(see #28)	-	1		2a*	Hazardous Materials Release
24	Emergency Alerting / Notification	-	-	-	-	-	-	-	-	14	2b*	Terrorism
25	Financial Claims Processing	-	-	-	-	-	-	-	-	1	2b*	Flood
26	Flood Protection / Prevention	-	-	-	-	-	-	-	1	3	2b*	Flood
27	Flood Protection / Prevention	-	-	-	-	-	-	-	3	9	2b*	Flood

Code Number	Product Type	Discussion - unrecorded (5 - 20 min)	Interview - Founder	Interview - Principal	Interview - Customer	Written Response (words)	Interview Lengths Total	Interview Lengths Average	Mentioned in DM interview	Archival Sources	SV type	Inspiring Disaster Type (Agent)
Not spontaneous, but inspired by emergency and disaster experiences												
28	Incident Management / Situational Awareness	-	1	-	-	3318	54	54	3	-	-	-
29	Responder Communications	-	(see #28)	-	-	(see #28)	(see #28)	-	-	-	-	First Responder Deaths
30	Emergency Alerting / Notification	-	-	-	-	-	-	-	-	7	-	Hazardous Materials Release
31	Incident Management / Situational Awareness	-	-	-	-	-	-	-	1	4	-	Drought
32	Flood Protection / Prevention	-	-	-	-	-	-	-	-	4	-	Flood
Spontaneous, business description only (no name given)												
33	Professional Speaking	-	-	-	-	-	-	-	1	-	-	-
34	Earthquake Protection	-	-	-	-	-	-	-	1	-	-	-
35	High-Rise Jump Protection	-	-	-	-	-	-	-	1	-	-	-
36	Swift Water Rescue	-	-	-	-	-	-	-	-	-	-	-
Spontaneous; not-for-profit												
37	Situational Awareness	-	-	-	-	-	-	-	2	-	1a	Earthquake
38	Volunteer / Donations Management	-	-	-	-	-	-	-	1	-	1b*	Flood

Code Number	Product Type	Discussion - unrecorded (5 - 20 min)	Interview - Founder	Interview - Principal	Interview - Customer	Written Response (words)	Interview Lengths Total	Interview Lengths Average	Mentioned in DM interview	Archival Sources	SV type	Inspiring Disaster Type (Agent)
Non-spontaneous or no evidence of spontaneous; inspiration could not be determined												
39	Business Continuity Planning	-	-	-	-	-	-	-	1	1	-	-
40	Business Continuity Planning	-	-	-	-	-	-	-	1	1	-	-
41	Flood Protection / Prevention	-	-	-	-	-	-	-	1	-	-	-
42	Flood Protection / Prevention	-	-	-	-	-	-	-	1	4	-	-
43	Incident Management / Situational Awareness	-	-	-	-	-	-	-	2	-	-	-
44	Emergency Coordination	-	-	-	-	-	-	-	2	1	-	Flood
45	Home Contents Protection / Storage	-	-	-	-	-	-	-	-	-	-	-
46	Incident Management / Situational Awareness	-	-	-	-	-	-	-	-	-	-	-
47	Incident Management / Situational Awareness	-	-	-	-	-	-	-	-	-	-	-
Non-spontaneous or no evidence of spontaneous; inspiration could not be determined; business or industry description only (no name given)												
48	Disaster Insurance	-	-	-	-	-	-	-	-	-	-	-
49	Security	-	-	-	-	-	-	-	-	-	-	-
50	Wildland Fire Prevention / Protection	-	-	-	-	-	-	-	-	-	-	-
51	Home Contents Protection / Storage	-	-	-	-	-	-	-	-	-	-	-

* Available data suggests this categorization

clearing major debris from streets (Dynes, 1970; Popkin, 1977; US Department of Homeland Security, 2016). Restoration – identified by “the patching up of public utilities, housing, commercial and industrial structures which can be restored...the return of those evacuees intending to return, and substantial rubble removal” (Popkin, 1977, p. xxvii). I also include activities such as enhanced levels of communication to the public about the disaster situation that are ongoing throughout a disaster event as indicative of disaster (Dynes, 1970; US Department of Homeland Security, 2016).

Data sources - overview. Data sources consisted of interviews with 21 informants as well as archival data about disaster related ventures. In summary:

- Ten interviews (average length of 70 minutes) with key individuals associated with eight spontaneous ventures.
- Nine interviews (average length of 69 minutes) with individuals working in the disaster management field.
- Three interviews, which included two discussions (average length of 78 minutes) and one written response of approximately 3300 words, with two individuals selected for their involvement in venturing and experience related to the disaster management field. The informant that was interviewed and provided a written response was associated with three disaster related ventures (noted in the table as likely spontaneous or non-spontaneous but inspired by disaster). The two informants representing ventures and the disaster management field were interviewed using the questions for both ventures and disaster management informants.
- Archival data (over 200 pages of key passages and data summaries), informal discussions (5-20 min), and brief written responses representing 12 spontaneous

ventures, 6 ventures identified as likely spontaneous, 3 ventures that were non-spontaneous but inspired by disaster, and 4 ventures identified as non-spontaneous.

Data sources - ventures. Table 1 summarizes the product type classifications, type of disaster that inspired the disaster, and data sources for ventures included in this study and ventures mentioned by informants. Venture founding dates ranged from the 1980s to 2015.

Ventures 1 to 19 were determined to be spontaneous venturing. Ventures 20 to 27 were classified as likely spontaneous as there was not enough evidence to definitely verify a spontaneous start. Ventures 28 to 32 were labelled as non-spontaneous but inspired by an emergency or disaster experience. These ventures clearly linked their origins to a disaster event but did not immediately begin venturing activities after learning about the event; in one case, a founder delayed venturing until 20 years after the inspiring disaster. Ventures 33 to 36 represented examples of spontaneous venturing mentioned by informants but for which specific venture names were not given. For example, one informant spoke about a professional speaker that got her start after the 2013 Boston Marathon bombing while another noted how ventures selling high-rise jump parachutes sprang up post- 9/11. Ventures 37 to 38 are examples of spontaneous not-for-profit ventures mentioned by informants. Ventures 39 to 47 are ventures that were mentioned by informants and could be confirmed to be non-spontaneous or for which there was insufficient evidence to determine spontaneity and inspiration. Ventures 48 to 51 are the same as the previous grouping except that they again represent examples for which specific venture names were not given. It should be noted that Table 1 does not include ventures that were assessed to be non-spontaneous but were not mentioned by informants.

I found ventures that fit the described selection parameters through multiple means:

1. I reviewed a listing of businesses (paid advertising) in a U.S. emergency management trade magazine and then conducted web searches for ventures in a category of computer applications which represented an all-hazard product. This category contained at least one venture that I knew in advance fit the selection criteria. This approach resulted in a small number of ventures.
2. I conducted web searches for disaster related ventures and product categories known to me through my disaster management experiences such as attending conferences with trade shows.
3. I conduct web searches for ventures related to particular disaster events mentioned by interview informants and in informal conversations about the study. For recommendations related to particular disaster events, I searched for ventures using terms such as “entrepreneur”, “venture”, and “business” and the name of the disaster event.

Venture searches conducted in steps two and three included both all-hazard and hazard-specific products. Web search locations included current and archived versions of company sites, LinkedIn, business listing sites, and general web searches using a variety of keywords and time limiters, particularly for ventures that no longer existed.

If ventures met the selection criteria, I conducted further web searches for names and contact information of founders, early executive officers, and employees involved in developing the products that were associated with the venture. I focused on these individuals because of their knowledge of the ventures’ start-up or early operating experiences. If I was able to locate contact information, I attempted to contact these individuals by phone, email, or LinkedIn (paid subscription) to ask them to participate in an interview. For some individuals, other informants

from the study provided the initial introduction. I received a variety of responses to my requests for interviews: agreement to participate, agreement to participate with a later decline due to scheduling conflicts, re-direction to a more appropriate individual, or no response to multiple attempts to make contact. Some non-responses were likely due to out-of-date contact information. For each venture, I attempted to recruit one or more individuals to be interviewed. In addition to those directly involved in the venture creation and early operation, I interviewed early customers for two of the ventures.

In most cases, interviews were conducted by phone as many informants were not located within a reasonable travel distance. Interviews were audio recorded and notes were taken during the interviews. Interviews were fully transcribed or additional notes were taken. The semi-structured interviews were designed to cover a wide range of entrepreneurial topics as well as contextual factors. Topic areas included the informant's work history; motivations and goals in starting the venture; the start-up experience focusing on key actions and events; changes in products, business models, or customers; factors (internal/external resources and context) that helped or hindered the venture; and uniqueness (if any) of disaster related venturing. Additional topic areas for venture customers included adoption decisions and implementation.

I also collected archival documents to triangulate or provide additional data for ventures that participated in interviews (Yin, 2003). Archival documents served as the sole source of data about a venture when individuals could not be recruited to participate or if the archival materials were sufficiently rich as to produce a fulsome case description. I obtained archival data online from sources generated by the venture: websites, blogs, crowdfunding sites, and videos; sources where the venture provided the primary content: interviews (written or video); and sources that didn't have any obvious connection to the venture such as news and business profile sites. A

particularly useful source of data for ventures that no longer existed or that had started many years ago was internet archives. Over time, many ventures refined and reframed their stories of how and why they started. Archived webpages revealed explanations that were often more detailed and seemed more genuine regarding original intentions of the venture. I identified the web addresses used for searching the archives by a number of means such as searching websites of business listings or simply guessing plausible web addresses.

Key passages or summaries of key passages from archival documents were recorded in Word document tables for each venture selected for deeper analysis resulting in over 200 total pages of passages or summaries. For other ventures, key passages were stored in simple summary documents of one to two pages. Passages were selected to answer similar questions to those posed in the interviews, as well as exploring informal propositions or theoretical ideas. I added additional topic areas when the data did not fit the available categories. Where possible, I organized data for each topic area chronologically to support an understanding of how the venture developed. One section titled “Description of Experience” provided a master timeline of events such as idea inspiration, initial start-up activities, product development, patents, team expansion, key interactions with external parties, and major resource acquisition (Yin, 2003, p. 111).

Data sources - disaster management informants. Disaster management informant were drawn from Canadian federal, provincial, and municipal governments; U.S. state governments; the private sector; and academia. Representatives from the disaster management field were identified through personal connections through 14 years of involvement in this field. It should also be noted that three individuals selected for venture interviews that had disaster management experience were not asked the disaster management informant questions as the idea of including

disaster management informants as a data source was developed later in the study. However, these individuals offered insights about the field in the course of responding to the venture informant questions.

The interviews were captured in the same manner as with venture informants. The semi-structured interviews asked informants to list and describe spontaneous ventures that they were aware of. Informants that participated in early interviews were not advised that they would be asked to list specific examples. Because of this it was sometimes difficult for informants to recall specific ventures on the spot. For later interviews, I provided informants with more information in advance to allow them to prepare to provide examples during the interview.

After informants identified ventures, I then asked them to comment on what they perceived to be the goals and motivations of the founders, who were the customers of the ventures, changes to products or business models over time, what (if any) role of the type of disaster played in the ventures, factors (internal/external resources and context) that helped or hindered these ventures, and uniqueness (if any) of disaster-related venturing. I also asked them to describe what scenarios or actions might result in success for a 1b-type spontaneous venture. If informants had few examples of spontaneous ventures, had limited knowledge of the details of these ventures, or seemed hesitant to comment on their perceptions of these ventures, I instead encouraged them to speak about disaster related venturing in general.

I followed up interviews with a cursory review of archival documents to triangulate or provide additional data for ventures that were mentioned by informants. For some examples, I conducted a more in-depth analysis of the venture with the intent on using it to inform my findings. Informants were fairly accurate in identifying spontaneous ventures and describing how they came to be formed and honest in noting when they were unsure about the details of a

venture. When informants were unsure, accuracy of information was lower. Sufficient archival data to confirm identification as spontaneous or non-spontaneous venturing was possible for most but not all ventures identified. Informants mentioned 29 ventures (by name, or description when they could not recall the name), two not-for-profit ventures, and multiple product types (e.g. crop dusters for firefighting) and industries in which they'd observed potential spontaneous venturing.

Analysis

To analyze the data, I used an iterative approach to identify themes and explanations for the disaster related venturing experiences. Starting with the case studies, I compared interview responses and content from the archival data tables across cases by category. The goal was to identify what was common between the cases, what seemed important based on frequency of mention and emphasis from founders and other informants, and what was interesting in terms of uniqueness to this area of study. When I identified potential commonalities or patterns, I would generate potential explanations and then go back through the data to see if these explanations could be confirmed or disconfirmed. I examined uniqueness for spontaneous venturing in disaster, spontaneous venturing in general (regardless of type), and disaster related venturing as a whole.

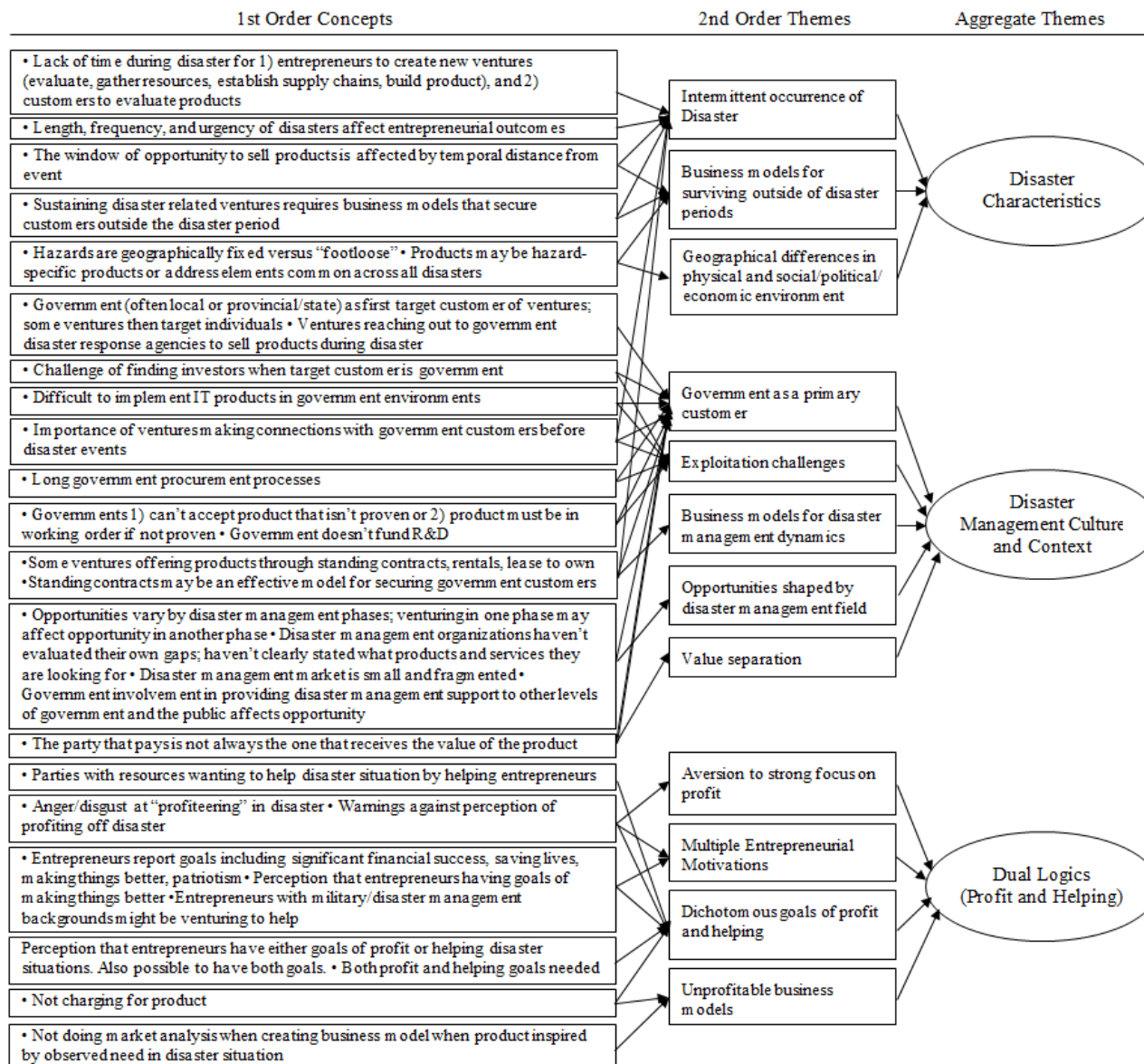
Information collection from disaster management informants started partway through the study, with data collection for ventures continuing throughout. Information from disaster management informants was used to identify themes and ideas that guided further examination of the case study data. Themes and ideas were identified by multiple readings of transcripts and notes from the interviews. For interviews that were longer or had more complex ideas, I created summary documents that identified key ideas and themes, how ideas were similar or different

from other interviews, and any ideas that seemed interesting. I then organized information from disaster management informants into tables with categories that represented the broad areas covered in the interviews. Additional categories were added to capture distinct topics within these broad areas that were mentioned by multiple informants. Examples of additional categories include “where is opportunity?” and “international differences in venturing environments”. Another category was added to capture informants’ reactions to venturing as the informants themselves are part of shaping the venturing environment.

The data suggested that there were some unique elements in the entrepreneurial process of spontaneous venturing in disaster as well as for spontaneous venturing in general. However, these unique elements appeared to be variations on a number of themes and ideas that were common to the disaster related venturing experience and unique from experiences in other industries. The most salient ideas were grouped into higher level concepts that represent key forces that moderate or shape the entrepreneurial experience in this context. Figure 2 presents these ideas that led to the higher level concepts or themes in a data structure following Gioia, Corley, and Hamilton (2013). With the intent of applying these themes to Hindle’s (2010) model of entrepreneurship, I returned to the data to identify additional data and relationships that reflected the proposed themes. The data that led to the themes centred on opportunity existence, evaluation, business models, exploitation, and value, while findings about commitment were developed after the themes were identified. The themes as well as unique variations for spontaneous venturing in disaster and spontaneous venturing in general are presented in the findings.

To ensure construct validity for this study, I used multiple sources of evidence and established a chain of evidence (Yin, 2003), as well as providing an assurance of anonymity.

Figure 2. Data structure for findings and the three themes.



Multiple sources of evidence were particularly considered for the venture informants that were asked to recall events that occurred 10 to 20 years in the past. The informants were fairly confident in speaking about the events that occurred but less confident in the timing of events. I thus based my findings primarily on events and informants' interpretations of these events rather than trying to build findings off detailed time sequences. I also provided informants with an informed consent document that assured them of anonymity to encourage open, honest responses. The chain of evidence includes organized records of interviews, archival documents including web addresses, tables and documents of key passages from archival documents, and citations of relevant information from the data in the findings section of this paper to allow the reader to understand the basis for the findings. Tables with additional passages and summaries are included with this paper as further evidence. Yin (2003) notes that techniques for insuring internal validity are not required for exploratory studies. The key forces presented in the findings are causal propositions in some sense, but do not make claims that event x leads to event y. External validity is established through the replication logic from multiple cases or examples, as well as information collected from a variety of informants in the field of disaster management. Recognizing that there may be contextual differences based on the jurisdiction in which the informant is venturing, I identify the country of the informant where appropriate. For instance, the intergovernmental funding relationship between federal and provincial governments in Canada is different than between federal and state governments in the U.S. Reliability was established by using a semi-structured interview protocol, and collecting archival data across cases for the same topic categories.

Findings

To present the findings, I start with introductory observations about where uniqueness in disaster related venturing may be found. This is followed by the description of three themes which are proposed to impact the experience of entrepreneurial process for those venturing in the disaster related context. I then present findings in 18 categories, formed by multiplying the three proposed themes by six activities or steps of Hindle's (2010) entrepreneurial process. After each of the three themes have been applied to an activity in the entrepreneurial process, I offer propositions to guide further research. The findings conclude with two proposed models of spontaneous disaster related venturing.

In presenting findings, I cite quotations from informants, referencing the venture informants by the numbers used in Table 1 (e.g. V3). Ventures with multiple informants are referenced as V1a, V1b, etc. Ventures with only archival data sources are referenced with an "ar" following the venture number code (e.g. V13ar). To preserve anonymity of informants, archival data sources for ventures with interviewed informants are attributed to the first venture informant. The venture references are also applied to some non-quotation text to provide clarity on which venture(s) are being described. Quotations from disaster management informants are referenced as DM1, DM2, etc. Quotations from venture/disaster management hybrid informants are referenced using the venture number codes.

Uniqueness in Disaster Relating Venturing

This study started with a focus on disaster related spontaneous entrepreneurial venturing and the intent of identifying key characteristics of the process, motivations, and internal and external factors for this specific type of entrepreneurial venturing, and where possible the specific types of spontaneous venturing. As the study progressed, the data increasingly suggested

that many of the characteristics and themes highlighted by the venture examples and interviews were applicable to both spontaneous and non-spontaneous disaster related ventures. This assessment was made based on comparisons between statements and characteristics of spontaneous and non-spontaneous venturing. This included similar comments made by founders from spontaneous and non-spontaneous ventures. For instance, regarding budgets:

Spontaneous venture founder: *“If we had just talked to more small government employees in a mentor/mentee relationship, we would have realized how stressed these budgets were and would have been more cautious in our belief that we could pull off this business model”* (V19).

Non-spontaneous venture founder: *“But in North America, we’re finding more and more of these agencies are looking for a lower cost up-front so they can get it through their budgets which are dismal. Budgets are really tight”* (V29).

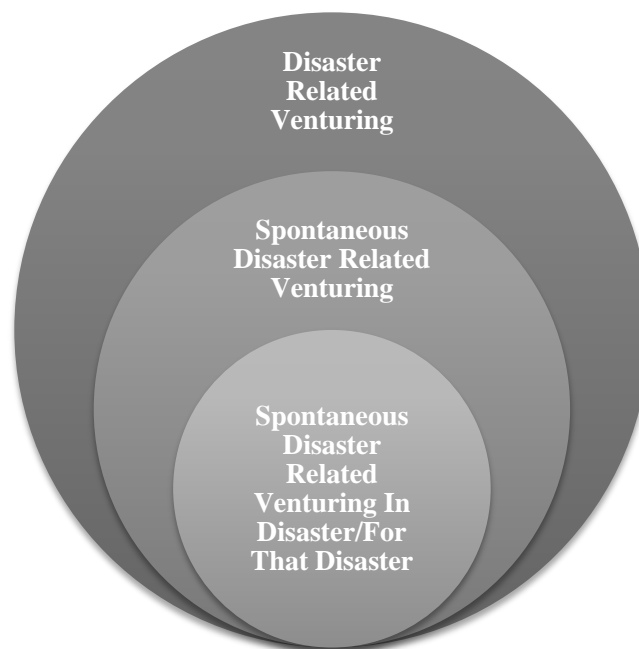
These comments highlight how the dynamics of selling to government are similar regardless of the process by which the ventures came to be. Reinforcing the assessment from the venture data, disaster management informants also identified similar external and environmental factors whether they were reflecting on spontaneous ventures or non-spontaneous ventures. This led to the idea that many of the findings should be viewed as applicable to disaster related venturing in general.

Despite the similarities across all disaster related venturing, there were some differences. At the level of types of spontaneous venturing, the primary difference was whether venturing occurred during and for the disaster that inspired it (SV1a/b), or for a future disaster (SV2a/b) [see p. 56 for descriptions of spontaneous venturing (SV) types]. Those venturing in disaster discover that disasters are brief and that in this contracted period it may be more difficult to

access information and customers. It should also be noted that many of the challenges of this disaster environment can be reasoned to be applicable to both spontaneous and non-spontaneous ventures. For instance, a customer that is responding to a disaster may not have time to review a product presented by a new venture *or* by an established venture.

At the level of spontaneous venturing in general, there also appeared to be some differences in how entrepreneurs evaluate opportunities and commit to venturing. These differences were hinted at in the data rather than stated overtly by any one informant. Figure 3 depicts a hierarchical conception of uniqueness in disaster related findings:

Figure 3. Uniqueness in disaster related venturing findings.



Returning to the commonalities, the strongest idea that came out of the data was that disaster related venturing in general presents unique opportunities and challenges. By reviewing the case examples and interviews, a number of themes or 'modifiers' of the entrepreneurial process emerged: disaster characteristics, disaster management culture and context, and dual

logics (profit and helping). The findings are presented to show how elements of each theme interact with the activities contained in Hindle's model of entrepreneurship.

Entrepreneurship Process Activities

From Hindle's model, I selected opportunity existence, evaluation, business model, commitment, exploitation, and value as the focal elements of the entrepreneurial process, leaving out his descriptions of domains and capacities. As described earlier, Hindle is agnostic as to the existence of entrepreneurial opportunity but notes that for the purpose of creating a model, existence is portrayed as an exogenously determined variable. Following this approach, I interpret opportunity existence as how the theme impacts the existence of potential opportunities, discovered or created. Drawing on Hindle's many descriptors of evaluation, I define it simply as the iterative process of discovering a 'business model'. As previously noted, a business model may be formal or informal and points toward a new means-end framework that the entrepreneur believes will produce the desired outcomes. Commitment is "...the pledged willingness of defined actors to undertake obligations and their consequences" and is a voluntary action (Hindle, 2010, p. 110). For value, I focus on recognizing if value has been achieved and who receives value.

Introducing the Three Themes

Disaster characteristics. Informants spoke frequently about issues of timing in disaster related venturing as well as the impact of location. Timing as a relevant concept stems from disaster events as intermittent occurrences, that occur with varying predictability or patterns, and have varying lengths. These characteristics are affected by the relationship of the underlying hazard to specific geographic locations as well as the unique social/political/economic environment in which the hazardous event occurs as it is the interaction with the social

environment that produces the disaster in its proper sense (Quarantelli, 2005a). The time and space variability of disaster produces certain pressures that shape the entrepreneurial experience.

Disaster management context and culture. As with the term “disaster”, there is a lack of consensus on the scope and meaning of disaster management (McEntire, 2004). One definition suggests it is “the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters” (FEMA, 2008). Across all phases of disaster, disaster management focuses on coordinating and integrating resources and groups. This is because resolving issues of disaster typically requires functions carried out by many different groups. For many of these groups, contributions towards disaster management are secondary to their primary day-to-day functions, as highlighted in Dyne’s (1970) typology of organized behaviour in disaster. Disaster management is carried out by both the public and private sector; however, governments typically have legislated roles, responsibilities, and authorities for disaster management in their jurisdictions. Quarantelli (2000) notes that “all governments of whatever political ideology have come to accept the idea that civil protection is a governmental responsibility, and usually that a specialized organization, usually of a civil nature, is needed for this purpose” (p. 15). Local governments are often required to have designated disaster management personnel while provincial/state, and federal governments typically have entire organizations dedicated to this function. While government is not the only potential customer, it is often more visible than others.

The view of government as a customer was mentioned by all disaster management informants, with many seeing large local governments and provincial/state governments as main customers of the ventures they highlighted. Some informants noted that federal governments might also be a customer. Informants also mentioned large industries with regulatory

requirements as well as individuals as customers. One dual role informant stated the “...initial [customer] is government. And then when you start realizing government is not going to get involved then it’s individual” (V16). Another noted that industries, such as the insurance industry, have individuals as the primary customer (DM3).

Most ventures examined in this study listed government as a potential customer for their products, with the exception being some emergency public alerting products aimed at the telecommunications industry (which has generally participated in public alerting at the direction of government). Government included disaster management organizations, other government departments, and the military. Many ventures also focused on businesses – either for industrial applications or for all-hazard applications such as being able to notify employees of an emergency or protecting the physical structure of a building. A small number of ventures also targeted critical infrastructure providers, schools and educational institutions, community groups, and not-for-profit organizations.

While all of these customers form part of the disaster management context, government has had a key role in establishing and working within the culture of this field through its policies and practices. Because of this, the theme of disaster management context and culture focuses primarily on findings related to interactions between ventures and government. Where differences between the context or culture of jurisdictions were specifically mentioned by informants or the nationality of an informant or venture seems to be relevant, this is noted.

Dual logics. Entrepreneurship research has identified subsets of entrepreneurs that work to achieve both private value and social value, as evidenced in social, environmental, and sustainable entrepreneurship (Hoogendoorn, Zwan, & Thurik, 2017). In this study, a majority of disaster related entrepreneurs also had multiple goals, with the two most prominent broadly

defined by entrepreneurs and emergency management informants as “profit” and “helping”. As one entrepreneur stated, “Well, I definitely wanted to be filthy rich and have the choice of what I did on a daily basis,” but also noted his need to do something innovative that contributed to society. Elaborating on that contribution, he explained, “We really wanted to save lives. And I had people working for me under contract and that was really what motivated all of us. We wouldn’t measure our success until we count the number of lives saved and it was clear that we had saved lives” (V11a). Another entrepreneur with a strong focus on helping disaster-affected communities explained that her team had considered becoming a not-for-profit but had chosen a for-profit model “just in case we had something we didn’t realize would be absolutely amazing and wildly successful” (V19).

While profit is easy to understand, a few explanations of helping emerged. One informant distinguished between a concern for “public safety” which he defined as “keeping people alive”, and “humanitarian”⁷ which he described as “making things better” (DM3). Some ventures also linked helping with “making things better”. For example one venture’s early description of the founding experience included this statement: “He recognized that the only way to process all of the information needed to plan for and respond to a major disaster is through automation. He knew that better technology could really help people, really make a difference” (V31ar). Making things better was a pervasive explanation for action from both disaster management informants and ventures and seemed to refer to either making an activity less labour intensive (less physically taxing on a body, fewer manual steps in an IT process, etc.) or to provide functionality

⁷ While speaking on another topic, another informant also noted a distinction between the philosophies and coordinating approaches of the disaster management/public safety communities and humanitarian/aid communities in disaster.

that wasn't previously available. For one venture, this meant "mak[ing] disaster recovery a lot less painful" (V19). The phrase "make things better" seemed to be used most often by those describing the motivations of entrepreneurs while entrepreneurs and their teams tended to instead describe the problematic situation that prompted them to create their product and how that product addressed the problem.

While some entrepreneurs linked making things better with helping, that link wasn't always obvious as in the following statements:

He explained how he was watching the coverage of the Manitoba flooding 1997, dubbed the Flood of the Century. He figured there must be an easier way than using sandbags to build a dyke. "The idea came to me instantly....but the idea was so simple I thought someone must have done it" (V17ar).

This new use of technology allowed municipalities to communicate with citizens at previously unheard of speeds and levels of accuracy (V21ar).

Although it might be clear to those in the field of disaster management that these products could benefit disaster management efforts, these statements could refer to recognizing a gap and potential profit opportunity, rather than an opportunity to help others. For instance, in a study unrelated to disasters, Baron and Ensley (2006) quote an entrepreneur that explained, "When I look at many situations, I think, 'There has to be a better way.'" (p. 1341). Thus, it is not possible to ascertain that the intent of this goal was always toward helping.

It is also possible that in some cases, making things better reflects a response to a perceived injustice which has resulted in human pain and suffering. The entrepreneurial response might then reflect what ought to be done. As one founder noted, "People *should know* [italics added] that they can rely on these sites in their time of need...If we can empower communities,

and especially local residents within them, with the right tools after a disaster, they can become the experts" (V19). Another explained,

I certainly didn't go into this to get rich, or do anything more than really solve what I thought were unfair problems and that were causing deaths. It drives me insane, it still does to this day, it's kind of a personal thing, when I know there's a solution to a problem and it's not being applied and there's information available that could make a difference (V7).

Still another stated, "People who have just survived humanitarian tragedies and natural disasters deserve to have their needs met more than anyone else" (V9ar).

Additionally, in most cases the idea of helping was directed toward people in a personal sort of way. However, the motive of one founder, a Navy veteran, seemed to reflect country-focused helping: "We're patriots...It's not all about making money. We just want in the fight. We have the equipment, the know-how, the people. For us, this is a mission" (V4ar).

As in the first quotations, it was not unusual for members of founding teams to express both profit and helping motives. A number of disaster management informants felt that they didn't have enough information to comment on ventures' motives and simply suggested that the venturing was a response to seeing a gap in the market. Some informants stated that the majority of ventures they'd encountered appeared to focus primarily on profit, others suggested the majority wanted to help, and some viewed it as an even split. Informants further suggested that helping actions might stem from having connections to the disaster management community or a military or public service background and wanting to contribute to the community.

The name of this theme – dual logics – is based on the idea of an institutional logic. Lounsbury (2007) explains that "the concept of logic generally refers to broader cultural beliefs

and rules that structure cognition and guide decision making in a field” (p. 289). This approach generally suggests that there is a dominant logic that shapes organizations within a field, with studies often examining interactions between logics with an environment (Lounsbury, 2007; Pache & Santos, 2013; Reay & Hinings, 2009). While there are likely multiple elements at work in motivating entrepreneurs to pursue venturing in this space, this theme focuses on the ways in the motivations of profit and helping resulting from logics are sometimes in competition, sometimes in cooperation, and in general shape the disaster related entrepreneurial experience.

Summary of Themes and Entrepreneurial Process

The following sections consider Hindle’s entrepreneurial process, applying the three themes to each stage of the process in turn. These stages or activities are presented in the order suggested by Hindle, though he notes that in actuality, entrepreneurs may “jerk around” between these activities to some extent (p. 112). Table 2 provides a summary of key points of discussion for each combination of entrepreneurial activity and theme. Figure 4 provides a visual summary of the proposed relationship between the three themes – disaster characteristics, disaster management culture/context, and dual logics in the forms of a helping logic and profit logic. Each theme is proposed to directly or indirectly moderate the multiple activities that make up the entrepreneurial process. These themes interact with each step of the entrepreneurial process in different ways, for instance, disaster management culture/context affects opportunity existence in certain ways and business models in other ways. This type of thinking is in line with other entrepreneurial research that suggests, for instance, that motivations differentially affect different stages of the entrepreneurial process (Shane, Locke, & Collins, 2003). Throughout the findings, I note where there appears to be significant cross-over influences between the themes. These cross-overs are examined more fully in the discussion section.

Table 2

Summary of Themes and Entrepreneurial Process

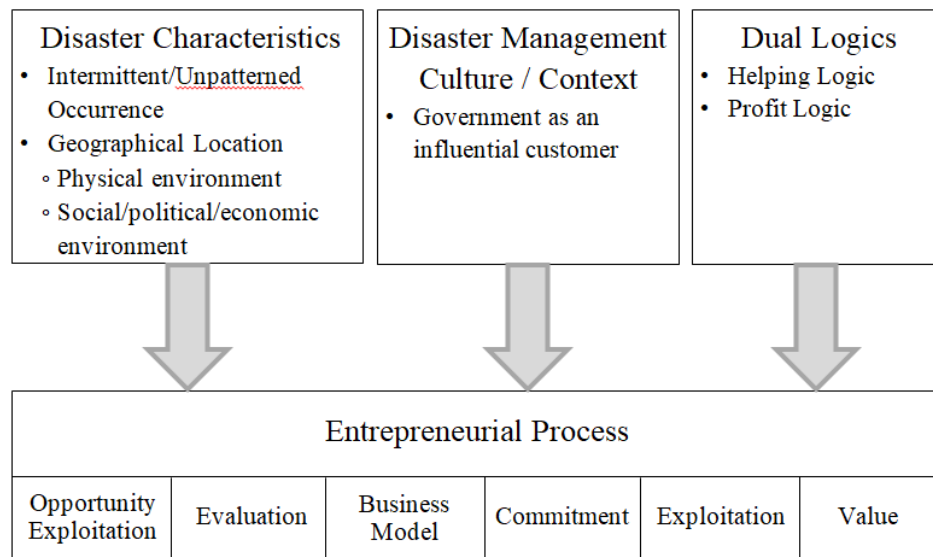
Theme	Opportunity Existence	Evaluation	Business Model	Commitment	Exploitation	Value
Disaster characteristics	Some opportunities are	Intermittent	Various business	Commitment	Forming venture and creating	Intermittent
	geographically fixed based on	information impacts	models that take into	may be	product	disaster events
	hazard type while others with	entrepreneur's	consideration	sustained by	- Geographical proximity	may cause delay
	all-hazard applicability may	understanding of	variable demand	exposure to	may be a limiting factor	in determining
	have fewer geographical limits	disaster risk to	related to the	subsequent	to venturing in disaster	impact value
		potential customers	occurrence of disaster	disasters	for that disaster	
		Intermittent	may be applied to		- Ventures may be created	When the desired
		information impacts	sustain a venture		in a partial form for	outcome is the
		evaluation of	between disasters		spontaneous venturing	absence of
		generalizability of	Venturing in disaster		during disaster	disaster it may be
		gap or opportunity	Venturing in disaster		Selling Product	challenging to
			for that disaster may			determine impact
			be more successfully		- Demand varies based on	value
			done by larger		temporal proximity to	
			companies that can		disaster event	
			carry costs through a			
			long event			

Theme	Opportunity Existence	Evaluation	Business Model	Commitment	Exploitation	Value
Disaster Management Culture / Context	<p>Disaster management phases</p> <p>- There are opportunities in all phases</p> <p>- Venturing in one phase may decrease opportunities in another</p> <p>Understanding disaster management needs</p> <p>- Disaster response and recovery experience is important to understanding gaps and opportunities</p> <p>- Government has not clearly communicated its needs</p> <p>Government involvement in providing disaster management support to other levels of government and the public affects opportunity</p>	<p>Successfully engaging government in the evaluation process is more likely outside of disaster</p>	<p>Various business models that take into consideration small disaster management budgets, last minute purchasing, and short-term spending behaviours may be applied to take advantage of disaster related spending</p>	<p>Commitment may be challenged by the absence of a clear market</p> <p>Commitment may be challenged by long government procurement processes</p>	<p>Getting Resources</p> <p>- Attracting investment may be difficult when the customer is government</p> <p>- Government grants programs for disaster related venturing may be limited</p> <p>Selling Product</p> <p>- Government disaster management customers may have expectations that ventures</p> <ul style="list-style-type: none"> ○ make contact in advance of disaster ○ offer a working solution ○ offer a proven solution 	<p>The party that pays is not always the one that benefits most from a product's value</p>

Theme	Opportunity Existence	Evaluation	Business Model	Commitment	Exploitation	Value
	<p>Market size and structure</p> <ul style="list-style-type: none"> - The disaster management market is small - The disaster management market in Canada and the U.S. is fragmented - Individuals are buying products, which may represent a shift in customers 				<p>Implementation</p> <ul style="list-style-type: none"> - Potential government customers may lack people and processes to facilitate effective and lasting implementation 	
Dual Logics	A helping logic may recognize	A helping logic may	A helping logic may	A helping logic	Getting Resources	Helping
- Profit versus Helping	<p>many opportunities to help address disaster related gaps, but these opportunities may be difficult to monetize</p>	<p>prioritize helping over evaluation towards a profitable business model</p>	<p>result in adopting a business model that does not maximize profit</p> <p>A helping logic may result in adopting a business model that supports</p>	<p>aimed first at self and close relations may contribute to commitment</p> <p>A helping logic may mean commitment to helping in the</p>	<p>- A helping logic of external parties may result in resource donations, investment, and free advertising</p> <p>Selling Product</p> <ul style="list-style-type: none"> - Customers may be sensitive to perceptions of 	<p>expectations of customers may conflict with an entrepreneur's profit logic</p> <p>Profit logic may be important in connecting a</p>

Theme	Opportunity Existence	Evaluation	Business Model	Commitment	Exploitation	Value
			humanitarian causes	general disaster situation rather than responding to a perceived gap A profit logic and long-term helping logic may be necessary to sustain commitment	profiting off of disaster, particularly during the disaster	product with a customer that will benefit from its value

Figure 4. Summary of themes and entrepreneurial process.



Opportunity Existence

Disaster characteristics. Opportunities for certain disaster related products are based on the hazards possible in a location. Informants noted that some hazards, such as earthquakes, are tied to particular geographical areas while others, such as tornadoes are ‘footloose’ and while still being bound to a geographical area will occur in any one area with less frequency. This is not limited to natural hazards either. A number of informants connected the ongoing need for emergency alerting tools to industrial hazards such as those related to nuclear power facilities, which are more permanently located. From an industrial hazard perspective, the transportation of materials by road in particular might represent a ‘footloose’ hazard. Tying this to opportunity, an informant suggested that communities with clear underlying hazards provide opportunities for more stable markets (DM5). Another informant, speaking about a not-for-profit organization that he heads explained that when he was asked to be a part of the organization, he “...had this feeling that this was really going to go somewhere. Because the need was there – it was

reoccurring. The [hazard] issues weren't going away" (V1b). One informant also pointed out that not only is the general hazard type important but also more specific considerations of relevance: "It's not just the type – it's the relevance to where you are...some [flood] products aren't relevant here" (DM7). For instance, a product that is applicable to storm surges might not fit all flood-prone areas because of differences in terrain.

In contrast to geographical opportunities are those related to all-hazard capabilities such as planning for disaster response and recovery, maintaining situational awareness, operating an emergency operations centre (EOC), and alerting the public and responding agencies to an emergency. These capabilities are applicable to the managing of disaster no matter the underlying hazard. A number of informants mentioned "those common elements across all disasters" as an alternative area to hazard-specific products. One explained that because these products are appropriate to any disaster, he can sell the need to purchase these products to his community council at any time (DM4). Thus all-hazard products are able to overcome geographic constraints of disaster to a greater degree than those focused on specific hazards, providing a more universal entrepreneurial opportunity.

Disaster management culture/context.

Within phases of disaster management. As stated previously, disaster management culture has accepted the key phases of disaster management – prevention/mitigation, preparedness, response, recovery – as a common way to describe its areas of work. Not only does the explicit recognition of these components provide entrepreneurs with potential areas of focus, disaster management informants also suggested that there are opportunities in all phases of disaster management (see table in Appendix B). Perspectives on which phases offered the most opportunity varied depending on the jurisdiction or industry with which the informant was

focused. For instance, one informant saw little opportunity in response but a lot in preparedness, while another considered response to have a lot of opportunity when the oil/gas industry was the customer (DM1, DM2). These opportunities were either assumed to exist based on seeing a growth in venturing in these areas or based on gaps experienced by the informants. Identified gaps were in ongoing areas of focus for disaster management such as multi-agency coordination, brought about by new technology and resulting expectations such as the use of social media in disaster, or based on changing societal behavior such as volunteerism. However, informants noted that the activities within the phases can work against each other to reduce gaps and thus opportunity. For example, it was noted that as mitigation increases, the need for response and recovery products decreases. Extending this, it also is logical that as preparedness increases, response opportunities may decrease as plans, procedures, tools, and skillsets will be in place to effectively address the situation before it becomes a large event. Further, an effective and efficient response might decrease damage thereby reducing the extent of recovery, and reduce the strength of cost-benefit arguments for mitigation when viewed in the short-term⁸. Not only are these win-lose situations possible, they are actively promoted by disaster management culture which emphasizes the need to permanently reduce risk through mitigation⁹, and the importance of being prepared for disaster rather than focusing solely on response and recovery.

Understanding of disaster management needs. Despite seeing potential opportunities, informants readily identified many obstacles to entrepreneurial opportunity. A frequently mentioned challenge was the inability of potential entrepreneurs to understand the needs and

⁸ For instance, someone might wonder why it might be necessary to invest in permanently reducing the likelihood of a situation that is so well-managed that it seems to be a non-issue.

⁹ For example, see the Sendai Framework for Disaster Reduction 2015-2030.

gaps in this field. A number of informants considered disaster response and recovery experience to be important to overcoming this gap. One venture informant recommended that someone interested in finding a venturing opportunity should “find a way to help out (volunteer) in the disaster, learn through doing/observing, [and] make connections/relationships” (V29). Another informant described how this experience would help entrepreneurs understand the needs, disaster tempo, and personalities (DM6). However, this experience is not always available to entrepreneurs. A venture informant advised that in these circumstances, the entrepreneur would need to get this knowledge through a customer or business partner (V29).

Taking this perspective, an obstacle mentioned by both disaster management and venture informants was the lack of clear direction on the kinds of products desired by those working in the disaster management field. Several informants compared the state of disaster management with the first responder community which they noted had sought to provide this direction by forming a multi-country consortium to develop common capability gaps for first responders in each participating country, do a market study to determine the buying power of the community globally, and conduct workshops to connect companies with the user community to develop solutions. A related obstacle identified by one disaster management informant was a lack of rigorous analysis, evaluation, and self-criticism by the disaster management community to identify true gaps and opportunities for innovation. The informant explained that with aircraft accidents, regulatory bodies

take a look, [and] they say, “oh, this plane crashed because that hydraulic line was put in backwards” and somebody says “why don’t we make it so that one end is square and one is round so you can’t install it in backwards” and they fix it. They identify problems and they innovate solutions. In the lack of any problem ever identified in emergency

management, where's the motivation to innovate a solution?

In contrast, “we [the disaster management community] never do anything wrong in our responses. Our responses were always perfect (DM5).

This is not to say that those working in disaster management never analyze events – after-action reviews are considered to be a best practice for the field – however; this informant questioned the commitment to provide a truly valuable assessment. Another informant suggested that even when a government disaster management group might want to point out a near miss, political support to do so is lacking:

So it's human nature, especially for politicians, to not want it to get out in the public that if things had gone a little bit more sideways, we're hooped, we're screwed! They'll never ever say it – “no, our team did a perfect job”. And the team is going, “nah man, we were on the edge!”....So that's the hard part is that there's that political cover that almost just waxes over the problem which may mean that the problem can never be solved (V7).

Finally, another informant noted his frustration that even though he was providing a product that addressed a recommendation identified in a government-endorsed after action report, he could not get an audience with that government to discuss the product (V16). It is possible that this inconsistency between analysis and customer action is a result of the issues mentioned by the first informant – perhaps the reports do not reflect true needs and thus misguide entrepreneurs. Altogether, these perspectives highlight that the existence of opportunity may be unclear to entrepreneurs and those who work in the field of disaster management.

Role of government. Several informants also highlighted government's involvement in addressing disaster needs as impacting entrepreneurial opportunity. A number of Canadian informants mentioned a situation where a government had unexpectedly provided a disaster

related product to a lower level of government, causing a venture to lose out on a business deal (DM1, V16). Similarly, a U.S. venture founder noted how a lack of government involvement in disaster management could provide an opportunity for its product:

We have designed a system that actually promotes self-sufficiency in a community and doesn't require the government to dictate this or that or provide for that... So that's really appealing currently in the particular political climate when there is so much tension around the role of government (V19).

One Canadian informant suggested that the public's tendency to turn to government rather than the private sector for disaster management solutions presented a barrier to entrepreneurship (DM1). On the flip side, a U.S. informant noted how a new state governor that wanted to help people meant that the government had purchased products for drought response (DM9). It is possible that government involvement provides more opportunity when it steps into an area in which individuals and private entities were simply suffering the consequences of a disaster rather than seeking to protect themselves. However, long term government involvement may decrease opportunity when its efficiencies in redeploying the same cache of resources to areas of need results in the requirement for fewer units of a product compared with private entities and individuals purchasing those products themselves.

Market size and structure. Several informants also comment on the market itself, noting that it was small, even when compared with the small first responder community. One informant explained:

We are investing tens of billions of dollars in R&D for front-line emergency response, most of that, half of it anyway going to law enforcement. There's a lot of investment there, but there's no comparable investment in emergency management solutions, and

why is that? Well, there's a lot more police officers and fire fighters than there are emergency managers. If you think about the size of the market and how many buyers are there - well, there's only 13 governments in Canada. If you look at it on a county basis in the U.S., there's 4000 counties, so that's a bigger market there. But even so, police will tell you that the reason they have a \$4000 or \$5000 radio is because there aren't enough of them to have enough market power to have \$500 radio....So there's a market size, market characteristic thing. Companies are more likely to build something for millions of clients than they are for tens of clients, or hundreds of clients, or a few thousand clients (V11c).

Another informant described a situation in which unusual winter conditions prompted the need for machines that thaw frozen infrastructure. The jurisdiction was unable to acquire additional machines from other jurisdictions, which were facing the same conditions, and discovered that it could not purchase more machines as they were no longer being made. The informant surmised that the company stopped making these machines due to limited demand as there were only so many jurisdictions that would need this type of equipment. On top of that, the equipment was very expensive, possibly because of the limited demand, and it was well-built thus reducing the frequency of replacement purchases. Considering this scenario, the informant also pondered whether ventures were at a disadvantage if their product was “bolted onto government” and asked, “Are those governments in the fiscal position to buy that stuff? Is there a need? Is there enough of a recurring need?” (DM7).

Focusing on the market structure, one venture founder suggested that the disaster management market was fragmented, particularly in countries like Canada and the U.S. as compared with some other countries. Describing what he meant by fragmented, the founder

explained that in countries like Canada and the U.S., federal governments are involved in disaster management but provinces and states as well as local jurisdictions have their own authority. In contrast, countries such as the United Arab Emirates have one lead disaster management group for the whole country that pushes a product throughout its jurisdictions. This makes accessing large numbers of customers more straight forward (V29). Another informant, commenting on the Canadian context, noted that “every little place across the country is buying their own little thing...what about if people were actually working together on something that was a little more coordinated?” (DM6). This observation suggests that that there might be opportunity for certain product types and price points if “every little place” could be brought together, not in a legal sense, but as a coordinated purchasing entity.

As mentioned in the theme introduction, the focus of disaster management culture/context is on the interaction between ventures and government; however, a number of informants and examples highlighted how ventures are gaining individuals as customers for products where governments were previously viewed as the primary disaster management customer. A news article from a recent hurricane in the U.S. highlighted how homeowners were purchasing their own flood protection products, at a cost of about \$9000 to \$12,000 per home rather than face flooding and damages and have to make insurance claims (Guzman & Montag, 2017). An informant noted a similar situation in Canada where cottage owners were renting similar products from a private contractor. He characterized it as an alternative to looking to government to protect them (V16). It is unclear whether these examples represent a growing market with homeowners rather than government. Further, if it does, it is unclear what is causing this shift. The homeowners in the hurricane example stated that they’d gone through flooding in previous years and didn’t want the hassle again, which might suggest that individuals are

reacting to new information from changes in the ecosystem services provided by the natural environment, as proposed in the first paper. Perhaps there are also changing government attitudes or involvement. For example, the newest Emergency Management Framework for Canada (Ministers Responsible For Emergency Management, 2017) emphasizes the role of all society in managing disasters and reducing disaster risk, which may capture a shift in government thinking in recent years.

Dual logics. The helping logic suggests that there may be a vast number of entrepreneurial opportunities because there are likely many areas in disasters and the disaster management field that can be helped or made better in some way. However, as multiple informants explained, every gap doesn't necessarily lend itself to a profit opportunity. For instance, one disaster management informant argued that "public preparedness is for the most part a public good and it's hard for people to monetize" asking, for instance, how one would monetize FireSmart, a program in Canada that provides information and resources to help individuals, local groups, and governments address the threat of wildland urban interface fires (DM5). Another, citing a not-for-profit venture designed to fill in gaps in intergovernmental collaboration, suggested that this might be a viable model to address certain types of issues in the disaster management context (DM6). On the other hand, an informant noted how a focus on FireSmart in his province had prompted consultants to offer evacuation planning services (DM2). Thus it is possible that the helping logic may not be at odds with the profit logic to the extent imagined by some informants.

Propositions. The themes suggest that opportunity may exist across all phases of disaster management, but may vary based on geographic and jurisdictional elements. However, opportunity is not static – actions taken in one activity of disaster management may affect

opportunities in another. Technology and demographic changes may also impact opportunity. Further, viewing the barriers to opportunity as a call to action suggests that more opportunities may be brought about by establishing a consensus on what disaster management customers need and will pay for, changing levels of government involvement in disaster management, identifying geographically independent products, and creatively monetizing solutions to operational gaps. Opportunities specific to disaster response and recovery may also be recognized through involvement in these disaster management activities. While the findings present a number of ideas about opportunity, I offer the following proposition as a synthesis of a selection of these ideas, with the goal of prompting future study that will provide entrepreneurs with more specific guidance as where opportunity may be found:

Proposition 1: Entrepreneurial opportunity for disaster related products and services in each phase of disaster management (prevention/mitigation, preparedness, response, recovery) will vary based on geography and geopolitical jurisdiction.

Evaluation

Disaster characteristics.

Understanding of disaster risk. One informant highlighted the relationship between risk (often defined as probability multiplied by impact in disaster management) of a disaster, and in particular, risk perception as a factor in both the entrepreneur's decision to pursue venturing and a customer's decision to purchase a disaster related product (DM5). Building on this idea, I suggest that because disasters are intermittent, the occurrence of the disaster that inspires spontaneous venturing does not provide long-term probability information to inform a risk-based opportunity. Further, the significant impact of the event may lead to errors in probability judgment, possibly due to biases of availability. For instance, Tversky and Kahneman (1974)

explain that when a class of instances can be mentally retrieved easily, the perception of frequency of occurrence increases. Instances that are recent or more salient, possibly because of greater impact on the focal person, may affect retrievability. Applying this concept, they note that “the ease with which disasters are imagined need not reflect their actual likelihood” (p. 1128). The informant in this discussion noted how sometimes the reaction to an event is incongruent with the impact:

For some reason, we'll take a single death type accident and react to it much more than sometimes we will to bigger event, right? One house burns down and kills a firefighter tragically, then we're fighting for new rules for drywall and stuff. A hundred homes burn down in a community from a natural fire, and that's [just] how it is, and we start rebuilding them as quick as we can (DM5).

Entrepreneurs faced with this intermittent and impacting information may be at risk of adopting inaccurate understandings of the likelihood of this type of disaster and thus the extent of the entrepreneurial opportunity. While an entrepreneur reacting to the type of situation described might assess the risk of the situation similarly to potential customers (i.e. this is a problem that must be solved) and thus be able to seize an opportunity, eventually concern will die down and the accuracy of opportunity related to probability and true impact of similar events will become more apparent.

Understanding of generalizability of gap or opportunity. A similar issue arises in relation to evaluation of the specific opportunity or gap. This study focused on spontaneous venturing from disaster, thus for many of the cases studied or highlighted by informants, the inspiring disaster is a key reference point for evaluation. This presents an opportunity by revealing a clear use case against which an entrepreneur can evaluate a business model. It also presents a potential

risk as it is only one example and without further examples, it might lock the entrepreneur into a business model that is applicable only to that one disaster.

For the spontaneous ventures that are formed in disaster to respond to a gap in that particular disaster (SV1a/b – see p.66), the risk of this lock-in is likely higher as informants suggested that ventures that were able to venture in this situation would probably have found a niche that was particular to that event. An informant commenting on this type of venture noted that,

Necessity is the mother of invention, as someone famous once said. And there's no time that society is more in need than during a crisis so I think there's some really great stuff that can be conceived of during a crisis but it really takes the right individual to make it happen. And it takes a good evaluation process afterward to fine-tune it so it sticks around for future events (DM4).

Correcting the locked in business model requires exposure to information from other disasters. However, because of the intermittent nature and geographical dispersion of disaster, this may not be readily available, particularly if historical information is insufficient or unsought.

An examination of ventures in this study suggests that many ventures maintained a focus on the applicability of their solution to the hazard type that inspired their venture for a period of time after founding. One venture was inspired by the personal experiences of a close friend that struggled to communicate with family members in the aftermath of a large scale disaster. The founders noted that through researching emergency preparedness and response, they found the same issues were common all over the world. Having determined that they correctly assessed an opportunity, the founders quickly built a solution in keeping with the inspiring disaster to “help families they support, for greater connectivity in the event of a large scale disaster” and stated

that they were “committed to addressing the gaps that impacted [their friend and friend’s family]” (V13ar). It wasn’t till shortly after launching their alpha version of their product that they realized the potential to expand their product for application to a wider variety organizations based on discussing the product with more people and organizations.

Another founder described her experience of developing a product based first on the inspiring disaster experience: “I think it’s pretty close to what we envisioned. It turns out that our [inspiring disaster experience] was not unique at all. That these difficulties that we faced were really really universal” (V19). The product evolved through feedback from bringing the product to communities in disaster:

We’d go to a tornado in Alabama and a tornado in Texas, and we’d realize, oh my goodness, everyone’s asking for this feature. And then we’d say, okay, do we think that that feature is universally necessary or do we think that community wants it in a unique way and no one else will want it? So by going from disaster to disaster and bringing our growing and improving disaster, we were able to see what was common to each disaster versus what requests we could safely set aside because they were probably very unique. So we just kept adding features that seemed to be common requests across multiple communities (V19).

In both of these examples, ventures were able to incorporate additional information by drawing on research, product feedback, and subsequent disaster experiences.

Disaster management culture/context. As noted earlier, it may be difficult for ventures to understand the needs of disaster management customers, particularly when ventures have less direct experience with disasters or disaster management. A number of the ventures in this study

engaged governments or other lead users of products for input on where gaps existed and the products features that could fill this gap. For instance, one founder sought to confirm the gap:

So I was in a state where I was looking for something and when I saw the problem, I'm going "Wow! That's a major problem." But I'm wondering how big it is and I kept asking questions. In fact, I asked the Canadian government, provincial governments, municipal governments, and I kept hearing that there wasn't a great solution to the problem and that there was a desire for there to be one (V11a).

Another founder informally worked with a potential user to refine a product idea:

And I started to go to the police departments, friends that I know, right? And sitting down over coffee, as I mentioned, and saying "What do you think of this stuff? Would this work for you and how?" And I would give them some ideas based on my experience and the problems, and they would agree that those are the problems (V29).

The founder described how his team devised a solution, received "about two pages of objections" from the user agency, revised its concept and then went back to informally validate the new approach. Thus a potential user helped refine the understanding of the opportunity.

A number of ventures also formally engaged potential users to participate in product testing. The users included a school division described as an innovator in emergency preparedness, individuals with extensive response experience in the area the product was designed for, and the general public (V13ar, V15ar, V9ar).

Success in soliciting this feedback was primarily evident for ventures that offered products post-disaster. Many disaster informants, when asked about engaging with new ventures during a disaster, noted the availability of time and human resources as limiting factors. One informant stated, "You could be great software engineer but you may have zero experience in a

disaster and the people that are working on the disaster probably don't have time to train somebody" (DM6). One exception to this was for a venture that refocused its nearly finished product as a potential solution to issues of the 2010 Deepwater Horizon Oil Spill (V4ar). In this case, a team of engineers and responders from BP and several government agencies screened 123,000 individual ideas solicited from the public and evaluated in detail or field tested 100 of these ideas (Cortez & Rowe, 2012). It is likely that this example of evaluation during a disaster response represents an unusual case, driven by the lengthy unresolved oil spill situation.

While the data showed that ventures did, in fact, receive evaluation assistance from those in the disaster management context, the information and interview questions did not lend themselves to determining if the culture is generally supportive of assisting ventures in this way.¹⁰ One founder noted how government could only partner with not-for-profits "because there's no kick-backs possible or favouritism or no-bid contracts" (V19), which suggests that government might be limited in how it can engage with ventures. It was also unclear if entrepreneurs sought or received feedback on any elements of their business models (the intended outcome of evaluation) other than their products. In the above case, the founder described how her venture *would* have benefitted from seeking financial information:

We had access to a lot of mentors in the start-up space who were venture investors or lawyers who had done start-ups before or successful business people. But I actually think if we had just talked to more small government employees in a mentor/mentee relationship, we would have realized how stressed these budgets were and would have been more cautious in our belief that we could pull off this business model (V19).

¹⁰ The open-ended approach to discussing factors that supported the ventures meant that some informants brought up this idea while others did not.

Personal experience suggests potential government customers may be hesitant to comment on proposed business models. In some cases, there may also be legal barriers to engaging some governments for evaluation assistance. However, formal programs to support innovation development, such as one represented by one of the disaster management informants, may provide mechanisms that overcome perceived and real barriers.

Dual logics. For a number of ventures, the helping logic appeared to take precedence in evaluation to the detriment of finding a profitable model. Referring to a venture which emphasized the social purpose of its product, a news article noted, “profit wasn’t something [the founders] had given much thought to” and described how, more than a year after creating the product, the founders sat down with friends to figure out a sustainable model (V9ar). For another helping-focused venture, the founders noted at the point of incorporation (about six months after beginning work on their product) that over the next year they were hoping to develop ways to make their venture sustainable in the future. Several months down the road, they then noted how their goal was not to make a profit but to at least have the product pay for itself. One founder later explained how “even though we won a bunch of contests because our [product] idea was great, no one realized, including ourselves, how weak our business model was” (V19). This venture eventually failed, prompting the search for a new business model.

The founder of another failed venture also commented on his lack of meaningful evaluation, suggesting that if he had used a formal evaluation tool, “I never could have come up with a [business] model that worked.” He later provided some insight on this dynamic:

I think the uniqueness [in this type of venturing] is that there’s too much heart involved, which is incredibly blinding... if you’re blind to some of the key factors of your industry,

it's hard.... [Ventures] won't see the cliff coming until they've shot right over and then their project is cancelled (V7).

As emphasized by this last comment, it seems that for some disaster related ventures, the need the product will fill and the benefit it will provide to others is so overwhelming and obvious to potential entrepreneurs that evaluation is either forgotten or assumed to be unnecessary based on the value to be provided.

Propositions. Across all themes, I highlighted potential risks to carrying out effective evaluation toward a business model. The three themes primarily interacted with evaluation to affect access to information to carry out the evaluation and the attention and rigour given to evaluation. Based on the findings, I propose the following:

Proposition 2: Entrepreneurial evaluation of disaster related opportunity is less accurate than evaluation based on a steady flow of information.

Proposition 3: Government engagement in entrepreneurial evaluation is more likely outside of disaster.

Proposition 4: A primary helping logic reduces the attention and rigour given to entrepreneurial evaluation.

Business Model

The business models described in this section focus primarily on the revenue model domain of business models, with the final finding under dual logics considering value proposition (Osterwalder, Pigneur, & Tucci, 2005). I grouped revenue model ideas into models that addressed long-term sustainability of the venture, considerations for the way in which a product or service is taken to the market, and models that do not maximize profit. Disaster characteristics appeared to have a more direct influence on the first type of business model, while

the considerations in taking a product to market seemed to have the greatest ties to the disaster management context, which makes sense as this is the context of a focal customer. The non-profit maximizing model and value proposition considerations are discussed in dual logics.

Disaster Characteristics. The long-term sustainability of a disaster related venture appears to be affected by the intermittent and variable nature of disaster. The section on exploitation further explores the idea that demand for products ebbs and flows with the occurrence of disaster. Applying the idea that customers are more likely to purchase products when a disaster is imminent or has recently occurred, particularly for response and recovery products, means that it may be difficult to establish a funding stream that can carry a venture through a non-disaster period. The ventures examined in this study employed a variety of business models to overcome this dynamic with varying levels of success. Each of these models appears to have the potential to succeed which suggests that this is only one of many factors that contributed to venture outcomes. To explain the variety of approaches demonstrated or suggested by informants, the models are organized in a 2x2 figure with the number of business lines (single product or multiple products) on one axis and the primary market of the company (disaster management or non-disaster management) on the other [Figure 5].

A. A number of ventures focused on selling a single disaster management product for use in the context of disaster management. A number of approaches were observed in the ventures studied or recommended by informants:

Expand geographical sales area of venture. Many of the ventures studied expanded beyond their local areas and often into other countries. This approach increases the probability of encountering a disaster and reduces the time between sales opportunities. This model seemed to

Figure 5. Long-term sustainable business models. This figure organizes proposed sustainable business models for disaster management ventures into four categories.

		Number of business lines	
		Single Product	Multiple Products
Primary Market of Company	Disaster Management (DM)	<ul style="list-style-type: none"> Expand geographical sales area of company All-hazard capability and multi-hazard application Disaster and non-disaster use Non-sales income from business competitions Non-venture income Not-for-profit 	<ul style="list-style-type: none"> Multiple disaster management products <ul style="list-style-type: none"> Same hazard type but multiple product options Different hazard types Changing hazard types Mitigation or preparedness product/service combined with response or recovery products / services (offered at time of disaster) Additional non-disaster related products All single product DM strategies
	Non-Disaster Management	<ul style="list-style-type: none"> Existing product used in disaster management application 	<ul style="list-style-type: none"> Existing product customized for use in disaster management application Intermittent prioritization of latent disaster management product during disaster Disaster management business line All single product non-DM strategies

be particularly important for Canadian companies, with one Canadian disaster management informant commenting:

I think when you look at the United States, it's bigger. (chuckles) So what would we be – I think 34 million now? And they're roughly ten times more. So it's a bigger market, it's not as hard, and traditionally there's been more money at the local level in the U.S. because of the tax size. So I think that if you're really going to do this as a Canadian firm, if we're talking Canada, the U.S. has gotta be part of your mix (DM6).

A Canadian founder focusing on the impact of disaster frequency in particular stated,

People say disasters know no borders. Well they certainly seem to recognize the Canadian border for some reason because what they experience in the U.S. is 100 fold to what we experience. I was with a person earlier this year...and they have 200 tornadoes in their small state in a year. And they [the U.S.] get hit with hurricanes on a regular basis and then they get hit with flooding (V11a).

Expanding into different countries also went beyond a Canada/U.S. expansion, with one venture, for instance, stating that its product was in 87 countries two years after product launch (V13ar).

However, some informants noted practical concerns with longer distances between company and customer. One venture offering physical (as opposed to virtual) services considered taking on a larger area but held back due to logistical challenges, such as having to fix a rented product several provinces away (V16). Similarly, a customer of a venture that was located across the country noted that distance for warranty work was the biggest hindrance in their working relationship (V1b).

All-hazard capability and multi-hazard application. As previously noted, all-hazard capabilities are relevant to any disaster, thus products which support these capabilities have the

potential to be used in more types of disasters than a hazard-specific product. Similarly, some products may not address an all-hazard capability but may be applicable to a variety of hazards in different ways. For example, one venture advertised its sandbagging tool which was inspired by a major flood event as also applicable to hazardous spill containment and fire control (V6ar).

Disaster and non-disaster use. Disaster products seemed to be used outside of disaster in two ways: 1) for everyday uses in non-disaster related industries, or 2) for disaster and everyday uses by the same customers. Disaster management has recognized the challenge of switching over to disaster tools and systems when an event occurs thus finding an everyday application serves to raise users' level of comfort with the tool during a disaster (Quarantelli, 2005b). Alternatively, customers without a disaster management mandate may view the tool as helpful for everyday purposes and small emergencies while recognizing the opportunity to use the same tool if hit by 'the big one'. The disaster / non-disaster approach may even erase the effects of disaster characteristics altogether by providing a steady stream of non-disaster customers. This dual approach was observed in a number of ventures studied and examples provided by informants. Ventures selling flood barrier products commonly noted the potential for industrial applications such as cofferdams, river diversions for repairs to bridges and docks, and dewatering work sites. One venture found an alternate application in the camping market while another venture inspired by major disaster later adjusted its system "to address any emergency – big or small" based on feedback it received from users (V9ar, V13ar). However, the second venture also noted the need to still keep its alerting and notification product dedicated to the disaster sphere to make sure people recognized that when the product was used, it meant there was an emergency and that attention should be given to the messages being communicated.

Non-sales income from business competition. Two ventures participated in business competitions that provided grants to winners. One founder noted how this helped sustain the venture:

Even when towns and cities were really interested in it, a dollar value of anything greater than zero was a huge turnoff and they'd never call us back or just stop writing. And in the meantime...we won a ton of money. We won almost a half million dollars from a bunch of competitions we entered (V19).

For this venture, grant income was not the intended business model but sustained the venture for a year or two after it realized that its intended business model had failed. The founders of the other venture recognized the financial benefit of participating in these competitions but noted that they participated in competitions because “it gave us an opportunity to practise the pitch and our presentation, get help on the financials and connect with people who could help us. It was also a way to get the word out about our company” (V9ar).

Non-venture income. A common approach was to rely on an additional source of income for the founder and/or principal team. Additional sources included retirement income, a steady job with another organization, or income as a founder or principal team member of other ventures. As an example, one venture had established a multi-year business plan which involved creating a regulatory environment conducive to its product. The company had raised funds through angel investors and venture capital but expected little to no revenue for many years. One of the principals was solely employed by the venture; however, the founder owned four other companies and one of the principals owned a company and was employed by another company (V18).

Not-for-profit. A not-for-profit model doesn't fit the for-profit scope of this study. However, one venture was in the process of moving from a profit to a not-for-profit model when interviewed: "We realized that the most steady funding stream for us and our mission and our work and our goals was probably philanthropic which we could never access as a for-profit corporation" (V19). Thus, some ventures opt to pursue an altogether different business model to achieve their goals and sustainability.

B. Some ventures focused on selling multiple emergency management products for use in the context of emergency management. Any of the approaches used for a single product are theoretically applicable to a multiple product scenario. For instance, a venture could offer multiple products that provide an all-hazard capability. There are also a number of additional approaches that were observed in the ventures or recommended by informants:

Same hazard type but multiple product options. Offering multiple product options for the same hazard took two main forms: offering variations (size, capacity, etc.) on the same base product, and offering complementary products. In the area of flood control, one venture offered multiple sizes of sandbags while others offered a sandbagging machine and sandbags. Another venture founder described a creative business arrangement with complementary products:

My business partner and I struck a reseller arrangement with [other company], a U.S.-based [company], to raise money and start market traction through earning commissions on resales of their product. This generated enough seed money to allow us to develop [a product] that would work with [the other product] and could be spun out as a product we would own, brand and market on our own (V28).

Offering multiple product options provides more options to potential customers and makes the venture's offerings more relevant for more disaster situations.

Different hazard types. Offering products with applicability to different hazards means that a venture may find opportunities in an even more diverse field of disasters. One informant for instance, advised that he had recently been approached by a company selling emergency response related equipment,

Everything from water and ice rescue solutions, to cutting tools, to porta-potties, to shelters that can be established, to fuel bladders, to sea containers that can be dropped quickly. All of this stuff is response related. You know even tractor trailers that can provide big generators so you can set up lighting and equipment and rechargeable batteries, etc. So this is all focused on the immediacy of response. And he's got equipment staged that he says could be in any area in the province within a twelve hour period of time. So that is really niche. That is really designed for the immediacy of response (DM2).

In this particular example, the company offered products for specific hazard types as well as all-hazard and generic (non-disaster) products that might be useful in disaster.

Changing hazard types. This approach is similar to the previous one, except that the venture changes its business offerings based on recent large disasters. Theoretically, there is no reason why this could not also be a single product strategy but it is included in the multiple products section as this fits the way it was discussed by informants. One disaster management informant shared an example of this:

This industry [of consultants] you're dealing with is very flexible and adaptable because depending on the latest crisis is, they can change or adapt their business model to suit what the latest big one is. So again companies that were dealing with flood related activities and equipment I think have retooled a little bit and they're now offering a lot of

– and you know they’ve hired people with expertise and they’re now going into that area where they deal with, more along the lines of evacuations and maybe FireSmart programs and getting money or providing advice to communities on how to get money to fund grant programs to pay for a business that will come in and do FireSmart assessments or clear-cut certain areas that were threats (DM2).

Mitigation or preparedness products combined with response or recovery products (offered at time of disaster). With this approach, ventures offer response and recovery products or services that can only be delivered at the time of disaster¹¹ and supplement revenue by also offering products for the preparedness and mitigation phases of the disaster management cycle, which are not tied to the occurrence of a specific disaster. One informant described this approach like this:

I think about disaster preparedness, emergency management exercise planning, grant preparation, again in the FEMA situations. All those services become something that’s easy to do and easy to scale and scalability is huge. So you can idle along in your basement as a disaster manager and writing grants. All of a sudden an event occurs, you can come forward as an ICS [incident command system]-trained incident commander (DM3).

Additional non-disaster related products. Like a number of other approaches, this approach looks to non-disaster related revenue to sustain the venture outside of disaster events.

¹¹ Most response and recovery *products* could be acquired in advance of a disaster event.

However, this does not happen for a variety of reasons (some of which will be discussed later in this paper). Response and recovery *services* may be contracted in advance but can only be delivered at the time of an event.

One venture highlighted by an informant offered a variety of flood related products as its main focus, but also offered a number of other products and services for the construction industry and for erosion control (V6ar).

C. A third combination is perhaps a bit odd in that it is a single product with a primary focus on the non-disaster management market. However, one of the ventures studied fit this combination using the following approach:

Existing product used in disaster management application. This approach is generally immune to the effects of disaster characteristics as the venture's primary market is not associated with disaster. However, finding an additional use for a product in the disaster related market provides new opportunities for revenue. One venture spontaneously stepped into a new market to apply its existing product to a disaster situation affecting its own community: "We were already in the business...so it was just an extension of the machine's capacity and capability. So we didn't have to change anything" (V1a). The founder noted how this new disaster application of the product sustained his company:

[We were] building and selling machines but at that time it was not very far from the beginning of the company so we were doing some [delivery of the new disaster management application as a] service and fabricating, building, everything. It was our way to get to the end of the month (V1a).

Even when a customer of this venture made modifications to the product to make it more robust for the disaster management application, the venture did not incorporate those modifications back into the product, choosing to continue selling its product as originally designed.

D. The fourth combination represents the most recommended strategy by disaster management informants – offering products to a primary market that is not related to disaster

management and then adding products for disaster management. Like the previous combination, this approach negates the intermittent and variable nature of disaster. The previously mentioned approach of using an existing product in a disaster management application continues to be an option along with additional approaches observed and recommended:

Existing product or service customized for use in disaster management application. With this approach, a company maintains its normal business lines but introduces an add-on or modification to one of these lines to fit the specific needs of use for disaster management. One informant summed up the benefits from a user perspective:

One of the challenges that we have is it's a very small niche market. So we're better served, in my view, by ubiquitous off-the shelf kinds of technologies and then we just build in some robustness and some redundancy, more than what you might have for day-to-day application.

He also noted how this could be beneficial to users if modifications were made to well-known products:

But you probably still want to use Microsoft stuff. You don't want to have to in the middle of a crisis give somebody a totally new tool with a steep learning curve and say "away you go, manage the crisis with this please" (V11c).

Intermittent prioritization of latent disaster management product during disaster. This approach, suggested by a disaster management informant, proposes that a company could prepare a product or service with a plan to switch its business focus to disaster management if a disaster were to occur. When disaster related opportunities were over, it could return its focus to its previous primary business (DM5). None of the ventures studied followed this specific path, though one developed a new web-based application to assist the public during a disaster and now

activates the application each time there is a large disaster event where the public would benefit from the capability provided by that product (V2).

Disaster management business line. With this approach, an existing business creates a new disaster management business line. The line may take advantage of the core capabilities of a business or the skills and knowledge of a particular person at the business, or it may simply be complementary to products already offered by the company. One informant described a company that provided engineering, environmental service, and project management and then developed a new disaster recovery business line during a major disaster in a nearby jurisdiction. The informant suggested that this may have occurred because one of the principals had experience in disaster management, and the company may have had a history of working with the jurisdiction (DM1).

Other comments on sustainability. Finally, a number of informants commented specifically on the sustainability of ventures that start up to respond to a particular disaster. While many of the comments were tied to the dynamics of the disaster management context, one comment in particular related to an interaction between sustainability, company size, and the length of a disaster:

Then it comes down to how long is the disaster going to be? Someone's got to pay [for the product] eventually unless you have deep pockets. And that's why the bigger companies can kind of play because they're probably thinking about something maybe down the road even though they probably wouldn't say that (DM6).

This statement suggests that in disaster, customers might be unable to pay for products immediately, thus placing a financial burden on new ventures that may not have the resources to carry such costs. In this study, most if not all spontaneous venturing in disaster was done by

ventures with close ties to existing businesses such as a parent company. Presumably these existing businesses would have resources which they could apply to helping the new ventures through the disaster period. This observed relationship in the venture examples might lend support to the idea proposed by the informant. Considering the theme of this section, it is also possible that approaches such as non-venture income could sustain a new venture without such ties through a disaster period. Additional examples of statements about sustainable business models are available in Appendix C.

Disaster management culture/context. From informants and venture cases came three key factors that impacted business models in terms of the ways in which a product or service is taken to the disaster management market: small disaster management budgets, last minute purchases, and short-term spending. Many informants noted that potential disaster management customers, particularly government customers, typically do not have large budgets that can be used for purchasing products. One informant noted “my experience is that it’s a lean operation in most of the provinces – the emergency measures organizations. They do tremendous work but there’s not a huge budget there” (DM6). Small budgets were attributed to factors such as the size of the tax base in the case of local governments, a misguided perception of disaster risk, and the lack of value for disaster management held by those who controlled budgets. As one venture founder stated,

It’s not going to happen to me, it’s not going to happen to us. There are very few communities that are willing to spend money to protect themselves prior to an emergency...But then, and it’s not a major purchase, but we’re dealing with people with municipalities that have... 2000 people, so they don’t have the money. I understand that, I totally understand that. But that makes it hard (V16).

Another informant noted,

Unlike a lot of other municipal government services, emergency management isn't valued enough both in terms of the sense of what it costs to do well, but more importantly valued in importance...to make it really a viable market for the private consultant companies (DM5).

In addition, where governments, such as those in Canada and the U.S., have policies that allow for cost-sharing between levels of government on response and recovery costs, governments may make last minute purchases at the time of disaster so as to maximize cost recovery from the next level of government:

A lot of these counties have a lot of those resources within their county government, like pumps and certain resources they have at public works. But when the time comes when they need more, it's more just renting it. Years ago when all the Homeland Security...came out [with] all that money, a lot of people bought stuff back then. But now since money is slowly getting less and less, they do more of just utiliz[ing][that money] when disaster happens. Because depending on what happens, they'll get 75 percent of that money back if it reaches certain levels that either the state or federal government will fund the disaster (DM8).

In some instances, major disasters may also lead to additional funds to prepare for future events. For example, the above informant noted how the U.S. federal government provided Homeland Security grants to states and counties after 9/11 and has also done so when faced with new threats. Unfortunately for those working to establish robust disaster management programs and those hoping to sell to them, these upswings in spending are rarely permanent:

There's no baseline for disaster response money – it just doesn't exist. It comes when you respond to a particular disaster, you get the funding for a particular client... There's only a market for two years after, maybe it's two years. I don't even know if it's that long. After disaster hits a particular area, then they forget (V7).

The study data suggested certain business models may be used to respond to these disaster management dynamics. For the disaster response and recovery phases, approaches used by ventures included offering rental products, delivering a product as a service, and establishing standing offers/contracts. In some examples of renting or delivering a product as a service, it is likely that these offerings would be the only way in which some customers could access the capability of these products given the high cost of purchasing these products. Informants also mentioned a number of ventures that established standing offers or contracts with potential customers that could be activated at the time of disaster. In one instance, a venture established an agreement whereby a customer paid them an annual retainer fee for the venture to keep the product on hand for them, and then if they decided to purchase the product during a disaster, the retainer fees were deducted from the purchase cost. One informant suggested that establishing this arrangement probably increased the chances that, were an event to occur, the customer would be likely to purchase this product as opposed to a competing product (DM7).

Outside of disaster, models included lease to own, annual fees, and per-user-costs. In an example of lease to own, a venture noted that this approach 1) avoided large, lump sum expenditures as only the current year's lease payments would need to be included in the operating budget, 2) maximized limited budget funds, 3) provided cash flow benefits of periodic payments, and 4) freed capital for operating needs such as construction projects and road maintenance (V6ar). One repeat founder noted similar reasons why he switched to an annual fee model:

But [with] the previous companies, we didn't do recurring revenue. We sold...a package and enterprise license fee and the annuity was the annual maintenance and support on the software which is typically 15 or 20%, which is still not a bad model and fits well for some of the international markets. But in North America, we're finding more and more of these agencies are looking for lower costs up-front so they can get it through their budgets which are dismal. Budgets are really tight. But keep[ing] a lower cost but on an annual basis in North America makes more sense is what I found...[this approach] reduces the upfront cost to the client which helps, and sometimes it can prevent someone from having to go to tender (V29).

While this assessment seems to make sense, another venture founder noted a contrasting experience with an annual fee model:

It turns out that towns and cities, if they have some money, they're much more confident and comfortable purchasing material goods that are one-time purchases. You know, like a new set of radios, or a fire truck, or whatever. Rather than say "we value this service enough that your software as a service is worth this each year in our annual budget". That was an extremely hard pitch to make. And usually the answer, almost always the answer was no (V19).

These cases are similar in that both ventures offered IT products. From the data collected, it is not clear what other dynamics contributed to the contrasting experiences of these two ventures. These contrasting experiences may represent an opportunity for future research.

Finally, a number of ventures used a per-user pricing model which allows organizations to scale their costs according to their size, thus making the product more attainable for some customers. One informant from a small city contrasted a notification system it had purchased that

was \$2 per person per month (and possibly less for smaller communities) with a more robust notification product that it did not purchase which cost approximately \$17,000 per year (DM4). Other ventures, also offering software products, had a per user per year pricing approach with very low rates for not-for-profits, slightly higher rates for organizations such as schools, and 12 to 15 times higher rates for private organizations or corporations (V13ar, V10ar). Another venture's disaster response app, which was intended to be used by entire teams of responders, had a lifetime fee of \$29.99 per user (V14ar).

In the cases and examples in which these approaches were used, lease to own, rentals, and service delivery were offered for equipment; standing offers were arranged for equipment and services; and annual fees and per-user-costs were offered for software and cloud-based applications.

Dual logics. The cases provided examples of two kinds of business models influenced by a helping logic.

Business models that do not maximize profit. The first business model was one that did not attempt to maximize potential profit. This was typically evidenced during disaster situations in which ventures donated or discounted their products to support response and recovery, suggesting a helping logic. For one venture, this was a key part of its business model:

We have always refused to charge communities of any size a single dollar if they've already been hit by a disaster. That seems morally repulsive to us in large part because of my family's own experience being approached by tons of companies after the [disaster] with these long contracts and these fast pitches that we can't understand, and they're just kind of preying on the exhaustion and confusion of survivors to make money.

So we've always refused a business model that relied on disaster happening and then taking advantage of the survivors (V19).

However, ventures often had alternate or additional reasons for donating. For a number of ventures, donating products in early stages of development provided a means of testing the product in a real world situation and establishing credibility and awareness of the product in the community of users. At least three ventures continued to donate occasionally once the product was established. These ventures noted that they did so to help but also as a way of potentially generating future sales. One founder described how, when a community needed his product, he charged them for only a single day rental while providing it to them for the three: "They're paying one day's rental, I'm charging one day's rental. But what it did was it showed them how they can help themselves" (V16). A report on another venture stated,

[The founder] said her company is donating the equipment and personnel to help Minnesota because emergency officials said they desperately need help although the funds are not immediately available to buy the [product]. She hopes the [product] will be put into various budgets for purchase at a later date (V6ar).

It should be noted that in some cases these business models were not entirely sustainable and the realities of the profit logic could not go unnoticed. The founder of the venture that did not charge after disaster explained this business model "totally failed". For another founder, non-venture income was what allowed him to survive personally while applying a business model in which he was "trying to supply a product that will help people" rather than making a substantial profit (V16).

Business models that support humanitarian work. The second business model influenced by a helping logic was one designed to fund humanitarian work. This was seen in one venture

which accomplished a humanitarian outcome by offering customers, in this case the general public, the opportunity to purchase one unit of the product for themselves and one to be distributed in a disaster situation or for a humanitarian cause (V9ar).

A primary helping logic was not evident in the majority of business models and thus cannot be assumed to be the primary approach for spontaneous venturing or disaster related venturing in general.

Propositions. In all three themes, findings on business models considered revenue, both short- and long-term. The discussions in the first two themes – disaster characteristics and disaster management culture and context – primarily considered the need to find a model that addressed the unique context in which this venturing occurs. In contrast, the discussion in the third theme – dual logics – focused on revenue models that were shaped around the entrepreneur's own goals, in this case a helping goal. The third theme also presented business models that sought to achieve value other than financial returns for the entrepreneur. Focusing on the first two themes, I propose the following:

Proposition 5: Business models that reduce variations in demand will increase the long-term survival of disaster related ventures.

Proposition 6: Business models that take into consideration small disaster management budgets, last minute purchasing, and short-term spending behaviours will be able to take advantage of disaster related spending.

Commitment

Disaster characteristics. When asked whether there is anything unique about disaster, one venture informant stated,

The only unique thing about it is you sort of get a push off a disaster but just be patient, there's another one around the corner. We got an initial push obviously off of Katrina and then just a series of them since. Obviously, Sandy was another big push. The tsunami in Japan was another big push. Just recently, and some of them are large, some of them are small, but with each one you point out, here's where this could have a difference. If this would have been in place, this would have been different (V18).

With each event, the informant found that potential customers and supporters once again recognized the gaps that existed and the need that could be filled with the product. While the informant was speaking about the effect of disaster dynamics on customers, it seems possible that disaster events occurring after the disaster that inspired a venture might also have reinforcing effects for entrepreneurial commitment. Lending support to this idea, one venture commented on the impact of a major disaster that happened shortly after the start of its product development in response to an earlier disaster:

Tokyo felt like a call to action...Once again a natural disaster had caused millions of people to be homeless and without electricity, a humbling reminder of how inevitable these crises are... The images of northern Japan, and the experience of feeling the earthquake shake Tokyo, served as one of many catalysts for us (V9ar).

Another venture regularly analyzed major disasters, noting how its product could have been of benefit in these circumstances and how these disasters continued to inspire the venture:

Clearly, communities face huge obstacles during and after a disaster. This is why I am so proud to be part of [this business], as the system would have made the world of a difference for Calgary residents (V13ar).

The Russian meteor blast damaged thousands of buildings and injured many with flying pieces of shattered glass and debris... By using [product], the time and attention saved could have been put to better use to assist those in need of medical attention or support (V13ar).

And each time we see a crisis impact a community, we are motivated to push ourselves harder (V13ar).

Crises such as Sandy are the inspiration for [this business]. We are committed to improving emergency preparedness and response, helping to connect and support as many people and communities as we can. We hope to help all individuals, families and organizations stay safe in any emergency, while addressing the gaps we've seen in too many disasters over the years, from Katrina through to Sandy (V13ar).

Other ventures also noted how seeing their products in action reinforced the value of their goals:

Tropical Storm Debby taught us a few powerful lessons, and reaffirmed the need to prepare communities with organizing tools, rather than launch them post-disaster... This experience has confirmed to us that preparedness is the most important recovery strategy, and that our tools must change to reflect that. We have built out our disaster organizing tools, and are now beginning to build complementary systems that can be used pre-disaster to prepare and organize communities for a variety of tasks (V19).

"My husband says I've created a monster... I think to myself: 'I could have sat at home and baked cookies. Why did I want to do this?'" But [the founder's] enthusiasm is rekindled when positive feedback arrives in testimonials about the [product], she said. Officials of the West Jefferson Levee District in Marrero, La., wrote to say that her invention increased sandbag-filling production by 500 percent (V6ar).

For the ventures in this study, exposure to a disaster was a key element in the decision to pursue an entrepreneurial path. Thus, it makes sense that exposure to other events could serve as reinforcement for commitment. But because disasters are geographically dispersed and may not always present a personal connection or be captured in widespread international coverage, ventures may need to make efforts to maintain an awareness of disaster situations, as in the example above.

Disaster management culture/context. In addition to the many challenges described throughout this paper, informants and venture examples highlighted obstacles that, if they were to be overcome, required long-term commitment of entrepreneurs in this market space.

Finding or establishing a clear market. For some ventures, the obstacle was the absence of a clear market for their product. When asked if there was a disconnect between where technology is at and disaster management is at, one founder answered with an emphatic “Yes!” (V29). In this study, a number of founders viewed their technology as ahead of the expectations and environments of their potential customers. However, it is only fair to note the possibility that the expectations of disaster management customers may sometimes be more advanced than the technology. For instance, disaster management informants were mixed in how they perceived venture offerings with some viewing products as sufficiently innovative while others were critical of what was being offered. An informant from a technology funding program also noted how the core part of the technology might be excellent but not fit to user need (DM6).

For some ventures, the lack of a clear market went beyond a mismatch between technology and expectations. It instead stemmed from product offerings that required changes in the fundamental ways actions were carried out in order to be implemented. Like the disaster management context, these changes did not rest solely with one entity but rather with multiple

groups that did not always have a requirement or history of working with each other. In some cases, regulatory changes were required to compel groups to participate. One customer informant suggested that when working to implement a product that requires this type of environmental shift,

You can go it alone with the best idea in the world but if you don't have any friends, partners, people that are going to help, you're not going to get very far.... You have to build a broad consensus, you've got to get partners, you've got to get people that are going to work with you on this thing and drive it forward (V11c).

Founding teams of at least two ventures did just that, taking actions such as working to create new standards, participating in multi-stakeholder working groups, and lobbying government bodies over many years (V11, V18).

The founders of several ventures facing environments requiring major changes did not seem to waiver in their commitment despite the long-term path. Further, more than just creating an environment for their products, they seemed to commit to solving the “big problem” often on a national level. One founding team that recognized its environment early on and incorporated it into its business strategy explained:

We knew going into this that it was going to have a long runway to take off. Cuz we weren't trying to go to a local city... We're trying to enhance the national [approach], and for that matter, international...we see this as a way to standardize globally (V18).

Another founding team incorporated this big problem commitment as they went along:

And so what we realized what we could force in our organizing platform is if your organization wants access to our centralized databases...you have to share all this data with everyone else... and we're going to force all of these disparate organizations with

these very disparate and often conflicting goals to work together in a way that centres the survivor instead of the interests of the organization. So this was something, we didn't realize this would become a core part of our mission – forcing this cooperation and collaboration....So we're trying to start a new model where there's a centralized database and we don't have secrets from each other anymore.... And that apparently is novel and that's something that we're trying to make standard (V19).

One venture worked to bring together information from multiple sources, but opted not to go down that path of developing a national approach:

We had like 16 or 17 systems we integrated that allowed them to make the decision that if they had not made the decision quickly enough, people would have died. That's part of my core, is solving the problem. That was, I guess, the only outcomes – to start solving those problems. I didn't have dreams of creating a national system that everyone would use...well, maybe I did in the beginning. But I quickly realized you can't be everything to everybody (V7).

Finally, one founder reflected on his frustration at not being able to shift the environment sufficiently to implement his product as intended and solve the big problem:

I think there are more Canadian companies that have come and gone than there are Canadian companies operating in the public safety space right now. They come in, there's a big problem, they want to solve it, and they assume, much like I did that because it's a big problem to the public, it's important to enough stakeholders that government's going to make it a priority and that's not how it works (V11a).

But despite this setback, another informant noted how that founder remained committed after ending his venture:

He wasn't doing this to make millions of dollars; he was doing this because maybe he could save ultimately millions of lives. So he was driven by this vision. Although he was thwarted on his method becoming the ubiquitous method...he still stayed in the game and eventually built another method which is used universally in the Canada and the U.S. (V11c).

Long government procurement processes. Another obstacle requiring long-term commitment for at least one founder was the long procurement process for those that wish to engage a government customer. He explained,

Another factor adding to the challenge of selling into the public safety/disaster management market is government's budget and procurement processes that are very long, cumbersome, and in some cases prevent a start-up without solid financial statements [from] even participat[ing] in a Request for Proposal... I mean if you have to tender it takes a year or more and by that time the technology's changed and your solution may be irrelevant. They're not moving fast enough (V29).

At the same time, for him the rewards outweighed the environmental challenges:

It is very tough – especially long sales cycles to government agencies with very little budget! But it is very satisfying if you are able to make a positive impact and perhaps directly protect the environment or save a life (V29).

While the focus of this section is on the influence of disaster management culture and context on commitment, the final statements from the last two examples highlight how a helping logic may be an important element in overcoming challenges to commitment from the disaster management context.

Dual logics.

Sympathetic identification with those affected. The literature review highlighted Barton's (1969) model in which he proposes that sympathetic identification with those negatively affected by disaster directly affects helping behavior. In this study, venture founders had various kinds of potential group identity connections to the event. In addition to actually experiencing or responding to the event, these connections included family members; business colleagues, employers, or customers; and being a member of an affected community, as noted in Table 3. However, some of the venture founders that had not experienced the inspiring disaster themselves made comments that suggested that they had personally connected the inspiring disaster to their own lives. In one venture, a founder was motivated to find a solution that would protect her children if a similar event to the inspiring disaster were to occur. In this case, the founder lived in a different country than the inspiring disaster but was located in an area at risk of a similar event (V13ar). In another, the founder noted that after seeing a disaster on television where first responders were challenged to notify residents to evacuate, he had recognized his own risk in that he was living close to a chlorine factory which was located above a train switching yard, and had no way of receiving emergency notifications were an incident to happen in his vicinity (V11a). These examples suggested that while some founders identified with those affected, the helping they wanted to do was oriented toward those closest to them, including themselves, as well as toward distant strangers. It is possible that for some founders, personalizing a disaster situation enhances a commitment to venturing.

Table 3

Summary of Venture Proximity (Geographic and Personal) to Disaster Event

Code Number	Product Type	Geographic Proximity to Event	Closest Connection Affected by Event
Spontaneous venturing			
1	Flood Protection / Prevention	Community	Community
2	Incident Management / Situational Awareness	International	Customers
3	Volunteer Management / Situational Awareness	International	Unknown
4	Hazardous Materials Remediation	Province/ State	Media, Industry Knowledge
5	Temporary Housing	Community	Self
6	Flood Protection / Prevention	Country	Observed
7	Incident Management / Situational Awareness	International	Media, Industry Contact
8	Flood Protection / Prevention	Community	Responded
9	Emergency Lighting	International	Media
10	Emergency Alerting / Notification	Community	Community
11	Emergency Alerting / Notification	Country	Media
12	Flood Protection / Prevention	Province/ State*	Responded
13	Emergency Alerting / Notification	International	Friend
14	Incident Management / Situational Awareness	Country	Responded
15	Emergency Alerting / Notification	Country	Employer/Colleagues
16	Flood Protection / Prevention	Province/ State	Responded
17	Flood Protection / Prevention	Country	Media
18	Emergency Alerting / Notification	Country	Family
19	Volunteer / Donations Management	Country	Family

Code Number	Product Type	Geographic Proximity to Event	Closest Connection Affected by Event
Likely spontaneous venturing:			
20	Emergency Alerting / Notification	Community	Community
21	Emergency Alerting / Notification	Community	Unknown
22	Recovery Management	Country	Unknown
23	Hazard Modelling	International	Unknown
24	Emergency Alerting / Notification	Country	Unknown
25	Financial Claims Processing	Province/ State	Self
26	Flood Protection / Prevention	Country	Media
27	Flood Protection / Prevention	Unknown	Unknown
Not spontaneous, but inspired by emergency and disaster experiences			
28	Incident Management / Situational Awareness	-	-
29	Responder Communications	-	-
30	Emergency Alerting / Notification	Country	-
31	Incident Management / Situational Awareness	International	-
32	Flood Protection / Prevention	Community	Self
Spontaneous, business description only (no name given)			
	Professional Speaking	Community	Observed
	Earthquake Protection	Community	-
	High-Rise Jump Protection	-	-
	Swift Water Rescue	-	-

Code Number	Product Type	Geographic Proximity to Event	Closest Connection Affected by Event
Spontaneous; not-for-profit			
	Situational Awareness	-	-
	Volunteer / Donations Management	Community	Community
Non-spontaneous or no evidence of spontaneous; inspiration could not be determined			
	Business Continuity Planning	-	-
	Business Continuity Planning	-	-
	Flood Protection / Prevention	-	-
	Flood Protection / Prevention	-	-
	Incident Management / Situational Awareness	-	-
	Emergency Coordination	Community	Responded
	Home Contents Protection / Storage	-	-
	Incident Management / Situational Awareness	-	-
	Incident Management / Situational Awareness	-	-
Non-spontaneous or no evidence of spontaneous; inspiration could not be determined; business or industry description only (no name given)			
	Disaster Insurance	-	-
	Security	-	-
	Wildland Fire Prevention / Protection	-	-
	Home Contents Protection / Storage	-	-

* Available data suggests this categorization

Finding a way to help. One venture example suggested that a helping logic may also result first in commitment to finding a way to help, and second to filling a specific gap. For this venture, members of the founding team expressed a commitment to helping the disaster situation rather than a specific problem: "... we wanted to help out in some way with the re-building process of fire destroyed homes... After several days of discussion and design amongst the office we attach our design for the [product]." "My way of helping was to try and design something or use the office as a way to do that" (V5). However, after producing and implementing one unit of its product, the venture ended its effort because it determined that it had not filled an actual gap. A founder noted that "if it happened again, I wouldn't do it... no one needed it, so in the end it was a waste of everyone's resources" (V5). A couple of other ventures also seemed to focus on helping the disaster situation in general, as suggested by their efforts to create or re-apply more than one product for a single disaster. These efforts suggested that the ventures were trying to identify all of the solutions that they could contribute to address multiple needs arising from those particular disasters rather than targeting their venturing toward one specific issue (V4, V9).

Profit and helping logic working together. For one founder, a helping logic kept him going, even when profit opportunities were limited:

Now we're in a government situation where there's austerity. The government can't really be buying. I understand that. But there's really got to be something to help people. And that's...I really believe in trying to help people. And this is one of the biggest reasons why I've stayed involved in this company with all the frustrations I've had (V16).

However, comments from other informants suggested that the relationship between helping and commitment might be more nuanced, with the key idea being that wanting to help fix a disaster problem was not enough to result in a commitment to venturing. The informant that

differentiated between public safety and humanitarian motivations explained, “If your single motivation is the prevention of death or the reduction of injuries and casualties, once the immediate threat is over why would you continue?” (DM3). The informant suggested that a public safety motivation focused on the current situation, but a humanitarian motivation looked to improve things for the future. Further, he noted that a profit motivation was also necessary and when all these motivations aligned they would produce a continuous long-term response. Other informants expressed similar ideas:

I think there’s a lot of people that create a resource or tool to support the need and then they just kind of go away, it doesn’t go anywhere from there, because they aren’t driven by business. They’re driven by “how do I fix the problem in front of me” and once that problem’s gone they go back to life as usual (DM4).

The timing works against you as well because the hot point of the disaster is where everybody wants to help but that quickly moves away to something called the recovery phase. I think a lot of times these things get spun up but there’s no lasting funding or mission to keep it going after the top point of the disaster, so it starts to drain away (DM6).

One informant also speculated on a lack of long-term commitment from those who demonstrate an initial desire to help, but could offer no definitive explanation:

There’ve been so many other products where people come together for a Hackathon for a weekend cuz they have some coding skills and make some great apps for this one disaster and they’re like “yeah, we’re going to spread this app everywhere.” And then I look up their email three years later and the website has been returned to the cloud and it’s like

404 and link broken. And they've reported to have this huge solution and they were so excited and I don't know people get busy and they have full time jobs... (V19).

Together these suggest that a helping logic with a short-term perspective may not lend itself to entrepreneurial commitment.

Propositions. All of the ventures in this study demonstrated enough commitment to create a product. One venture did not continue beyond initial product development due to an early lack of interest from potential customers; however, there appeared to be a strong commitment to venturing overall. I proposed that commitment may be the result of a helping logic for some entrepreneurs particularly when they and those close to them will be helped. Commitment may also be strengthened through the occurrence of future disaster events that highlight the continued need for the venture's product, as well as a profit logic that carries an entrepreneur beyond providing a short-term solution. Commitment may be challenged by an absence of a clear market or the need to go through long government procurement processes. Some entrepreneurs that remain committed in spite of these challenges seem to draw on their desire to help solve big problems. Further, some of these entrepreneurs may be committed to bringing about institutional change beyond the life of a commercial venture.

Proposition 7: Commitment to disaster related venturing is sustained through awareness and consideration of subsequent disaster events.

Proposition 8: Commitment to disaster related venturing is sustained through a desire to protect one's self and close relations.

Proposition 9: Commitment to disaster related venturing is sustained through profit and long-term helping goals.

Exploitation

Entrepreneurial exploitation encompasses many activities. For this analysis, I focus on creating the venture and product, getting resources, selling the product, and implementing the product.

Disaster characteristics.

Proximity to disaster. In line with Barton's comments on proximity being a factor in spontaneous volunteering, one informant suggested that venturing in disaster would benefit from a closer geographical proximity for recognizing an opportunity as well as for exploiting it:

Number one is your proximity to disaster to understand....how many people in the disaster area will understand the conditions and the need to be able, during a disaster, form that venture and have it going? Because you might be from somewhere else and see it afterwards and go wow, there's an opportunity there to fill a need but you're not there to do it (DM7).

As summarized in Table 3, several of the spontaneous ventures that were able to provide products in disaster were in the same community or province/state as the inspiring disaster. Those within the same country were situated in a neighbouring province or state. Those with an international proximity were those that offered a web or cloud-based product to those in the disaster zone, thereby overcoming the geographical distance. In contrast, ventures inspired by international disasters that were completed after disaster included one cloud-based product, two software products installed on customers' servers¹², and a non-software tool. Together these

¹² The two installed software products were created before cloud-computing was widely available. However, these products might still have been created as software installs because, as

examples suggest that geographical proximity may, indeed, be an element of exploitation for venturing in disaster.

Speed of launching venture and creating product. When asked about the possibility of forming a new venture in disaster for disaster, a number of disaster management informants suggested it would be difficult to form all the elements of a business, such as establishing a supply chain or creating marketing materials, in the relatively short period of the disaster: “In general, starting a venture during a disaster is a tricky proposition in that there is typically no time to spend designing and discussing product needs, market, etc. with those involved in the disaster response/recovery operation” (V29).

Some informants thought that those that formed a venture under these circumstances would be more successful if they targeted a time late in the response phase of a long disaster or anytime in the recovery phase. One informant explained,

That might be the nature of how quick and how transitory disaster is. You can't come up with an idea, get your funding, and get your product out there, whether it's a service or a product, in the time it takes to respond and start recovering from a disaster. Now recovery, maybe you can lean into that (DM1).

Another informant suggested that there might be opportunity to introduce a product in a disaster of sufficiently long duration by developing plans while helping out during the disaster and then introducing the product at a point where it would not distract or detract from disaster operations. However, this informant also suggested that potential entrepreneurs would likely be more successful if they gathered information during the disaster and then developed the business plan

one informant noted, “unfortunately cloud doesn't fit very well into the disaster management space and security space”. For some clients, this is because of data security concerns.

and product after the event (V29).

Of the ventures that formed during disaster for disaster (SV1a/b – see p. 56), it appeared that not all the elements of a business were addressed in that short time period. For both ventures that started from existing businesses and ones that started new, the focus was usually on the development of the product rather than creating a business with all the required components. Further, in several of those cases, there appeared to be no concern for immediately seeking revenue. Some exceptions to the product development focus included a venture where the product was fully created prior to the disaster and then applied in a new context (V1), and another where the product was in the final stages of completion when the disaster began (V4). In the second example, the venture was formed as a new entity but the product was designed through a parent company, which likely minimized the need to establish elements such as a materials supply chain.

To develop products during disaster for that disaster, ventures relied on a variety of accessible resources. Of the four ventures that created software/IT products, three relied on in-house staff to developing the products. For the fourth venture, which did not start out of an existing business, founders used general IT skills and free cloud based office productivity tools. One disaster management informant noted that for information technology type products, it is possible to build things faster today because of resources such as cloud based tools. However, he noted that while product development might be quick, integration into an organization is a bigger challenge (DM6).

Of the three ventures that fabricated products, one had the product nearly completed at the time of the disaster (V4), one relied on a fabricator with which it was currently working on other projects (V5), and one likely produced the product in the workshop of the company owned

by her husband (V6). Timelines for producing products during disaster are summarized in Table 4.

Venture founders that started product development after disaster also appeared to progress fairly quickly but had longer development timelines likely out of simple practicality. For instance, when asked why a meeting with a key stakeholder and potential customer occurred two months after the initial disaster occurrence, the founder explained they had been in contact since the beginning, but “it takes a little while to get those people together...they had a lot of madness to take care of themselves” (V7). No venture founders expressed a sense of pressure to be ready for the next big disaster so it is unclear if disaster characteristics related to timing had any lasting effect on development.

Variable demand. Just as disasters are not always present, the picture of the disaster related market described by informants is also one of ebb and flow. This has already been mentioned as a consideration in two of the three sections on business model findings, but is more fully discussed here because the variability in demand is often tied to the occurrence of disaster. This variability in the market is not inherently necessary – consumers of disaster products could choose to purchase products at any time in anticipation of disaster, either to respond to it or to prevent it. This, however, does not seem to be the rule. Both venture and disaster management informants commented frequently on this dynamic, noting the increase in demand when an event is upon you:

Emergency management is cyclical in nature. Trying to sell me a product on flooding when we haven't had any snow, that's a hard sell. When we have nine foot snowbanks in front of people's houses you have got my attention. So timing is certainly important (DM4).

Table 4

Spontaneous Ventures' Timelines for Producing Products during Disaster

Code Number	Product Type	Key Timeline
1	Flood Protection / Prevention	<ul style="list-style-type: none"> Product established prior to disaster
4	Hazardous Materials Remediation	<ul style="list-style-type: none"> At time of disaster incident, product was in final stages of testing at company's facility Within 15 days after incident, product had been lab tested and approved for use in oil spill cleanup (new application); new company formed
3	Volunteer Management / Situational Awareness	<ul style="list-style-type: none"> Six hours to assemble situational awareness tool Volunteer management tool created within days
2	Incident Management / Situational Awareness	<ul style="list-style-type: none"> Started developing product four days after disaster occurred First iteration of product available in four hours New iterations released throughout next eight days; focus on delivering one tiny piece of utility at a time

Code Number	Product Type	Key Timeline
5	Temporary Housing	<ul style="list-style-type: none">• Product designed in a few days, immediately after disaster occurred• Fabrication arranged one week after design completed• First product available two months after disaster event but during early recovery stage
6	Flood Protection / Prevention	<ul style="list-style-type: none">• Founder designed while on vacation; two weeks from design to testing prototypes in the disaster
21	Emergency Alerting / Notification	<ul style="list-style-type: none">• Product likely completed within one month
19	Volunteer / Donations Management	<ul style="list-style-type: none">• Two days after disaster occurred, began assembling and using prototype that would inspire actual product

Also when relevance of the event to the public and politicians is higher because of a recent event:

If you go to councils, councils have very short attention spans. Once the public is content with something, council is content with it and on to the next thing. That's the nature of the beast (DM4).

So we have what we call disaster amnesia...I guarantee you [that the community], they have not forgotten the wildfire of last year and it will probably be about three or four years until they do. So you'll see there's an uptick in their emergency management resources. They've got more resources, they've got their political support, they've got a little bit more public support, too. So they're going to be fine and they'll put some processes in place, etc. But if nothing happens in five years, you're going to see that maybe some of those processes will become outdated because they haven't been updated because communities are busy and they have all sorts of other things they have to do (DM2).

Tying this into the disaster management culture/context theme, disaster research notes that the manner in which political leaders address the issues of the public can influence levels of public approval (Boin & Hart, 2003), and lead to re-election or defeat (Neal & McCabe, 1984).

One informant suggested that entrepreneurs should look at factors that affect perceptions of risk to learn how to make a recent event relevant to other potential customers that were not affected by the disaster (DM5). However, risk perceptions appear to be only part of the story when it comes to making protective decisions. Research suggests there is only a weak relationship between risk perceptions and preparedness actions. Wachinger, Renn, Begg, and Kuhlicke (2013) propose three possible reasons for this disconnect: 1) experience and motivation

in which “individuals might perceive that benefits [of not taking preparedness actions] outweigh the potential negative impacts”, 2) trust and responsibility, in which “individuals trust in structural and/or governance measures to keep them safe”, and 3) personal ability to take action, affected by factors such as time, money, knowledge, or social support (pp. 1054-1059).

Kunreuther and Michel-Kerjan (2009), looking at homeowners’ decision making for purchasing disaster insurance coverage also find that people focus on more than just risk, working instead to meet goals such reducing anxiety, satisfy mortgage requirements, and satisfy social norms rather than following a cost-benefit analysis (p. 119). After a number of years without a disaster event, homeowners cease to renew their policies (p. 125). Finkel (2008) also highlights how risk perceptions and related decisions are multi-faceted and suggests that researchers need a theory of ‘cost perception’ rather than ‘risk perception’.

The data collected from and about ventures in this study did not reveal how ventures were able to overcome these barriers. One founder explained,

I mean, preparedness is hard. No one’s cracked it in the [United] States. It’s so difficult to get any individual or group to really think meaningfully about how to ready themselves...if it were not difficult, we wouldn’t need to do the work. And we still don’t have the right answers (V19).

It is clear that this is an area with outstanding questions, and until they are answered, the variable demand from customers is likely to be a persistent dynamic in exploiting disaster related venturing opportunities.

Disaster management culture/context.

Getting resources. Not all ventures appeared to seek external financial resources to assemble their ventures. Of those that did, many used typical sources such as friends and family,

angel investors, and venture capital. The perspective of one informant was that “It’s like any entrepreneurial venture....you have multiple rounds of capital, the first one being friends and family, the next one being angel investors, and then you move into institutional” (V18). One disaster management informant pondered whether there was a unique challenge to attracting external investment for disaster related products due to concerns about intermittent revenue. A venture founder responding to this idea explained that an annual fee structure that provided recurring revenue was, in fact, a preferable model for investors. However, he viewed this structure as preferable because it overcame investors’ concerns about governments being the primary customer in this space rather than because of disaster characteristics:

I probably could have raised a lot more money with the pitch. The biggest objection I got from investors once they dug into looking at the business plan was that it’s selling to government and they hate that. Because it’s difficult, as you know (V29).

The founder attributed this difficulty to the many years it might take for a product to take hold in the market due to factors such as politics, fragmented market structure, and lengthy efforts to prove the product to customers. To overcome these aspects of government purchasing behavior and to appease investors, the founder had found an enterprise license with an annual fee approach to be most successful for his IT related products, noting,

It can take years to really get [the product] accepted and then get the revenue flowing from it. But most investors that are investing into, our case, software companies, are mostly interested in fast companies or a software company that has a reoccurring revenue component to it... that reoccurring revenue is an annuity and it builds and builds over time as you bring on customers and that’s the model they like. You’ll get a much higher valuation on your company if you have that kind of business model (V29).

While this type of model worked for an IT type of product, the data did not provide any insights on how ventures that offer products such as large equipment might address similar concerns from investors. Perhaps revenue models built around ideas already discussed, such as renting products or delivering the function of the product as a service may provide the repeat revenue that attracts investors. Another informant noted additional benefits of this last approach, commenting that software companies were shifting to selling professional services rather than software because margins were better and because of the complexity of such products (DM6).

Another line of discussion around acquiring resources was the role of government programs for disaster related start-ups. One Canadian venture informant discussed this topic, noting a number of generic innovation and funding programs in Canada that he had found to be of value as well as a U.S. accelerator that had a focus on response (mostly toward first responders) but offered no funds (V29). One informant from a Canadian technology funding program also noted the applicability of his program to disaster management projects (DM6). While a number of ventures received grants and participated in business accelerators, there is no evidence that any of these resources had a specific focus on disaster related venturing. This may be because the ventures in this study simply did not access available disaster related business supports but it seems more likely that there are few programs that specifically target this type of venturing.

Selling to government – disaster management expectations. Interviews with disaster management informants suggested that there is an expectation that ventures will interact with potential customers in manners that replicate how disaster management practitioners interact with each other and that recognizes the role that disaster management fulfills. Comments fell into two categories: pre-disaster contact, and bringing the right solution.

In a disaster response, multiple agencies come together, bringing their own capabilities, and work to coordinate their activities to address the issues at hand. This means that individuals must frequently rely on others with whom they do not interact in their daily and regular work in a potentially fast-moving and high-consequence disaster environment. Disaster management culture encourages building trust and awareness of another's capabilities outside of disaster with the idea that this will help individuals work together in a more effective and rapid manner when an event occurs. Thus, disaster management personnel seek to interact before disaster in ways as simple as a handshake and brief conversation to as complex as engaging together in advance planning, training, and simulation exercises. Along this line of thinking, multiple disaster informants expressed an expectation or recommended that ventures reach out to them outside of disaster for the purpose of building a connection:

My first piece of advice is don't do it during, do it outside. So establish the networks, establish the relationships outside of an event. Do what this gentleman is doing here – he's introducing himself, he's saying here's what I got, I'd like to get on the list, I'd like to have a coffee with you and talk about it. So establish that relationship outside of an event (DM2).

You need to make your connections prior to the emergency so everyone is willing and understands how to work with each other. And what you do, and can do, and what service/support you bring to the problem. And even in the emergency management community it's all about connecting prior to the event so you know how to work together during the event. And I think it's the same for businesses the provide services/products during the disaster (DM1).

Informants also explained the practicality of building connections outside of disaster by noting the difficulty of trying to get an audience with disaster management personnel that would be in a position to make purchasing decisions:

But if you're in the middle of that disaster zone...you have a million people coming forward – it's a lot like chasing ambulances...So unless you've already broken the ice with the organization. I think it could be hard to crack into that (DM6).

If it's during an event...the first problem you're going to have is getting a hold of who - who do you talk to? So if you haven't already established those relationships, you're going to be calling the provincial operations centre, as an example, or you're going to be calling the community emergency operations centre. Well they've probably got a hundred phone calls right now and they're in the midst of dealing with the response and the crisis so you calling them up to say "I've got this piece of kit you can probably use" – I just don't think that's effective (DM2).

My problem is I don't know anyone in the Austin, Texas area or Texas period in the emergency management area. So I've worked some contacts like through Department of Homeland Security, though some of the DHS's partners. They've got a formal donation – corporate donation link that you can go to online as well just to offer your service or technology or whatever. So I've done that but I've had nothing in the past couple of weeks and I don't really expect to get anything because it's, again, everyone's just too damn busy and reactionary, trying to deal with things. You know – it's chaos, and they typically don't want to try new things at that time (V29).

In summary, informants viewed connecting with potential customers during disaster as difficult due to the time and staffing constraints of those responding to the disaster.

For bringing the right solution, comments related to bringing a solution that addresses the problem, and bringing a proven solution. Several disaster management informants at the provincial/state level displayed a clear preference for a proven solution:

And we looked at all of the features, and we didn't want a lot of features but what we wanted was a lot of capacity and a lot of reliability. So those are the two things that were most important to us (V11c).

I mean we're not really even allowed to purchase from a place like that. They just come up with something and it's not been tested by the U.S. Corps of Engineers and doesn't have a proven track record in a flood... We're not even allowed to purchase it because we don't want to purchase something and send it out into the field and it fails and then the state can get in trouble for that. They don't just have to come to the state with those – there's the private person who can purchase these items and use them for around their own house structure. Or you know, there are county levels that they reach out to as well (DM9).

In the case of provincial and state level governments, they perceived an expectation that they provide a reliable resource. This perceived expectation may exist because of the more professional nature of these levels of government when compared with small, local jurisdictions with limited resources. It might also be due to their responsibility as the next level of government support after local resources are exhausted.

Supporting the idea posed by a disaster management informant that a more local level of government might be open to something with a less proven track record, one municipal informant explained that he would be open to a working solution, even if it wasn't proven:

If you're going to do something in a crisis, it needs to be a working solution. Or it needs to be "I have this, I think it will work and here's why, but it's done and it's ready to try.

It's maybe not proven but I developed it for your situation. Can we try it?" (DM4).

In another example, a venture piloted its beta stage product with a municipal government during a major wildland fire disaster (V28). However, informants from both levels of government noted that partnering to do research and development was not an acceptable approach:

And we were going to buy it but again the vendor wanted \$3.5 million to complete the development; governments don't pay for R&D. We buy products and services.

The guy had done some research, had a bit of a scientific understanding but had no resources of his own to bring to bear. And to try to bring that to a community in the middle of a crisis: "Hey why don't you take a chance and let's see if we can develop it together?" That doesn't fly (V11c).

Interestingly, a number of ventures noted their preference not to partner too closely with a potential client in developing a product to ensure the ventures maintained their own direction. This thinking is in line with well-known research that notes the pitfalls of listening to current customers rather than considering future customers and pursuing strategies that would lead to company survival (Christensen & Bower, 1996). It should be noted that several ventures successfully engaged potential customers in pilot projects outside of disaster. It seems like the testing/trial stage may be the point at which ventures and informants find comfort in partnering to develop products.

The expectation of making a connection in advance and bringing a proven solution would likely be a barrier to most spontaneous venturing in disaster for disaster. However, informants did note some exceptions that might still lead to a venture's success in that environment – having

the exact right solution, being part of a trusted organization, and getting on government procurement lists (for those governments that use such a system):

I think that you may be lucky enough to get through and it could be timing – “oh, geez, that’s the exactly the piece of kit we’re looking for.” But the chances of that happening during an event are slim, especially if it’s a widespread, large-scale event because the operations centre is just going to be consumed with solving things (DM2).

And it can also of course be the organizational trust as well. Like if you’re out there and you have an unfortunate situation of a wildfire, and you determine that you need the military, then if I show up with a uniform on, you’re going to trust me (until I mess something up). So there’s also that sort of organizational representation. But if you’re just coming in, like cold, you’d have to have something that’s really compelling. Unless you were doing something from a social media perspective where you were able to build up capital from followers. I think you could build up trust that way as well, if you were seen to be able to enable an existing process (DM6).

Two informants specifically mentioned that their provincial and state governments had lists of pre-approved vendors which they could rapidly draw on during disaster (DM2, DM8). One informant noted that the benefit of this system is “crisis management is all about speed of response. I’m going to use whatever I can get my hands on quickest” (DM2).

Implementing products. For some venture informants, a significant barrier to customers purchasing and continuing to use a product was the implementation environment.

Implementation has been recognized as a key element in the diffusion of innovations (Greenhalgh, Robert, Macfarlane, Kyriakidou, & Peacock, 2005). Several informants referenced the people, process, technology mantra when describing implementation. Focusing on people,

informants identified the lack of the people with the right job description or the right skills to implement a product as an obstacle to implementation:

But the thing is there is nobody in the municipal structure. In most cities, this is true – there is virtually nobody in the municipal structure whose job description includes the things that we're good at. Which means if we go to a city and say, we're really really great at this...all these cities get so excited until they realize someone has to administer the site...Once municipalities realize that someone needs to kind of be dedicated with part of their time to this new, weird, amorphous, modern role in disaster recovery, you know, no one gets paid to do that. So a lot of conversations fizzle for that reason (V19).

An informant commenting from a municipal perspective noted a similar barrier:

Whereas something like [product] came along and I thought, here's some value. [Another jurisdiction] jumped on it, championed it, promoted it. [The emergency coordinator] used it in a big way but he had a person he could put on it to make it work. I was still trying to get emergency plans to stick and get people to agree to be in my EOC [emergency operations centre]. So I saw the potential but I didn't have the resources to commit to making it work. So it was easier not to pursue it till I was ready to...and it's a great product but it didn't hit the right spot on my priority list. It was too far down the list for me to commit resources to it. So maybe it's not even their resources, it's the environment they're walking into, it's my resources - what can I bring to bear? Is it something that I can use and use easily? I'm more willing to entertain that than something that's going to take a full-time person to run, to support it (DM4).

As these statements explain, customers may see value in a product but recognize that they are not in a place to be able to use the product as required or intended. Referencing the idea of

small budgets in disaster management, one informant related the implementation issue to a lack of investment in the person and process element of implementation:

And if you look at emergency management groups, their IT budget on average is zero, it's literally zero. Except when things go to hell. Then the budget becomes almost infinite. They can buy stuff. They buy tools and put them on their desk and have no idea what to do with them. By the time things calm down, they're going, "okay I bought that stuff and it was supposed to fix my problems" but the people and process haven't been addressed (V7).

The informant suggested that there was an implementation 'immaturity' in the disaster management context, at least in relation to IT products. He noted that unlike the military, which would normally commit funds to both purchasing a product and building an entire program that could train hundreds to thousands of people to use the tool, the disaster management field has not formalized this type of thinking and approach to implementing products. He further discussed his perspective on limiting factors in realizing a proper implementation environment:

[They're] fantastic at solving madness, they're fantastic at many aspects but when it comes to using technology to solve some of the problems, they're one of the worst certainly in the public service that I've seen because of that zero budget. It's really hard to do something with zero. I mean I feel for these folks and I've worked with some amazing people who've gotten an amazing amount done by begging and assisting other groups and it's not uncommon to see the fire side fund the emergency management group because they know they have to work with them and they benefit by them having some base capabilities (V7).

This is not to say that disaster management groups will not buy products that they cannot implement properly, but under such circumstances, it is more likely that they will not continue with the product long-term. The informant also suggested that even when groups do acquire a sufficient implementation budget, it often gets cut a few years later due to the demand dynamics of this context.

Dual logics.

Helping support from external partners. A number of cases suggested that disaster related ventures may receive assistance from external parties that are acting on their own desire to help. One venture that developed a product during a disaster for use in the immediate disaster recovery received donations of materials and fabrication from other companies to create the product. When asked what brought this about, the venture founder suggested it was,

probably because we were working with them at the time and also because everyone wanted to help in some way. So it was an outlet for people to provide resources. An alternate solution to donating money, I suppose...we asked them, and then we coordinated the whole thing (V5).

Some ventures received assistance through extensive press coverage that noted both the product's innovation and the good that the product was doing. The story of one venture was covered by media outlets such as Wired, The Wall Street Journal, BBC, and Popular Science (V13ar) while a talk by another venture was featured on the ted.com homepage for a month, providing "free, organic, word-of-mouth marketing" that continued to draw interest even years later (V19).

One founder also noted how a helping logic helped attract investors:

One of the things I did in my pitch is - and they call it an elevator pitch - I tried to pull on their heartstrings right away. So emotion. Because a lot of people with money are trying to put their money into doing some good in the world. And you need to play up-, play on that because that's what disaster management, as you know, is all about. It's about people and saving lives and helping people. So that's what I did is I really played on the fact that I've lost some friends that were frontline responders and I mentioned that right up front. And that I'm passionate about equipping those responders with tools and technologies and capability to help them save a life – save their life and save somebody else's life. That's really my whole reason for being in the business, right?

And so that caught attention because it's quite different than these other ventures – someone selling, I don't know, marketing or web development, online shopping solutions, and gaming solutions, all of those things...And that's what you have to get across right away and you'll attract the right investors, I think, and they'll typically be the type of investor that comes in longer-term. Like they're not just looking for a quick buck, especially if they see their money is going towards helping. That makes them very happy (V29).

Another venture informant summed it up with this reflection:

I think the kind of the benefit of being in an industry like this is you do have the ability to attract people, and we've had a couple of the folks that work with us use this term and say, "it's always good when you can do good while doing well". And I think that in the public safety arena that's a very applicable statement (V18).

Perception of venturing motives. The interviews overwhelmingly suggested that there is sensitivity to perceived motives of disaster related ventures. Based on the comments, it was clear that some disaster management informants were among those that were particularly attuned to motive but it was unclear from the comments whether the concern with venturing motive was common across society. In particular, the interviews highlighted an aversion to ventures that display a strong profit motive, particularly during a disaster event:

But you can have a really great product but someone that comes in and has that snake-oil feel to them, I'm probably going to shut them down in a hurry (DM4).

Any company that operates in a disaster environment has to understand the social risk of being seen to be gouging, seen to be taking advantage of the situation. And I think they walk a very thin line between service and being seen to be taking advantage of other peoples' bad luck. Have I seen that specifically? Not that I can think of but I think it's a serious risk for businesses that are playing around in this area (DM1).

I think it would have to be something where during the disaster they were able to fill a bona fide need in a way that was seen to be innovative and not exploiting a situation. So I think that their ability to look like they're value-added and come to the table with innovation that's valued (DM7).

There's a certain concern about the perception of carpet-bagging or profiteering off of other's misfortune even if you actually have a good product and it would actually help people (DM5).

I thought the guy was selling snake oil. Selling promises to people when they're in dire need and that's around emergencies. There's things that are sold or you know, you've got to stop your house from getting all this bacteria or this mold or...all these other little

things, and I don't even want to start going on...it made me mad seeing them. The phone calls I got as emergency coordinator – people trying to selling things (V16).

Ventures were also aware of this dynamic and for some, held that perspective themselves:

So, yeah, I strongly dislike companies that try to capitalize off of disasters and that's why it's a touchy space and it can be done badly very easily. Because my family felt kind of abused from these companies just right off the bat when we experienced our own disaster. That's something we have been really really cautious about. It is a very special space. These are not regular people. They're tired, they've lost loved ones, they've lost their homes, they don't have any money, and that's not, if that's who you want to sell to, I'd think twice about your line of work (V19).

It is simply a bad time to be getting people's (users) attention on something other than immediate priorities – the disaster response/recovery effort. It is also risky to be labelled 'opportunistic' during these times and that could close some doors to future collaboration with disaster management customers (V29).

At the same time, disaster management informants took a practical stance, recognizing that ventures must profit in order to survive. This was evidenced by the supportive or at least indifferent consideration of disaster related ventures:

If you are an entrepreneur, you're going to innovate to fill a need and if you're a successful entrepreneur the thing that you do is going to fill the niche - it's going to demonstrate a clear benefit to having that product in such a way that you'll be able to leverage the situation and make money off of it (DM7).

It's interesting because you get the savvy business people who see an opportunity to capitalize on a crisis and I don't mean that in the negative sense of price gouging (DM4).

I don't blame them if they have to make money to survive. A company won't survive if it doesn't make money. So I don't have a concern about that (V16).

One informant noted that “it’s great to be a philanthropist, but at some point you need a source of income. You have to have a personal return on investment.” However, he proposed that a sort of ideal hierarchy of motivations: “You’re doing a humanitarian function, you’re doing a public safety function, and oh, by the way, you’re making money – I mean, that’s the ideal situation” (DM3).

Given the expectation of some customers such as government that the ventures they engage with are financially sound, the complete lack of evidence of a value for profit would likely be detrimental to attracting sales. However, in disaster it is not necessarily the true motive but the perception of motive that is likely important. This means that a subdued profit motive with the overt display of a helping motive may be the right combination for successful venturing in disaster.

Propositions. In presenting the findings, I touched on only a small portion of exploitation, choosing not to discuss topics such as the structure or inner workings of a venture as the interviews and case examples did not suggest anything particularly unique to this venturing context. Where experiences were more distinct was in product creation, getting resources, and selling and implementing the product. Within this focus, themes pointed to the impact of the geographic location, short time period of disaster, and helping logic of others on product development and getting resources. Also highlighted were the impacts of intermittent occurrence on demand, and disaster management cultural expectations of ventures and their products. Although there are challenges to be overcome because of this venturing context, there

are also benefits such as the desire of others to address disaster issues by assisting a commercial venture. Focusing on a portion of these ideas, I offer two propositions:

Proposition 10: The helping logic of individuals or entities with resources contributes to exploitation by disaster related ventures. Said another way, the desire of individuals or entities to help resolve the problems of disasters may lead them to contribute resources, such as financial investment, access to goods and services, or goods and services at a reduce cost, to the exploitation efforts of disaster related ventures.

Proposition 11: Selling disaster related products to disaster related government customers is enhanced by fulfilling the cultural expectations of those customers. Examples of cultural expectations include making contact in advance of disaster, offering a working solution, and offering a proven solution.

Value

Disaster characteristics. As suggested throughout this theme, the intermittent nature of disaster does not lend itself to a steady flow of information. If an entrepreneur assesses value based on providing a product that reduces the impact of disaster (drawing on the helping theme) rather than solely a profit outcome, then it may be difficult to determine if that value has been achieved until a customer experiences another disaster event. For instance, a response or recovery product purchased in anticipation of a future event may be unused for many years making it unclear if it provides a benefit over previous approaches. Some products may not only require another disaster to determine value, but another disaster of a particular magnitude or with specific characteristics. Drawing on a mitigation example from outside this study, a floodway that can divert water around Winnipeg, Manitoba was completed in 1968 but it wasn't until 1979 that it faced its first critical test (Passfield, 2001).

For the spontaneous ventures that started during a disaster for disaster, this possibility of delayed value is less likely if the product is implemented immediately. However, for the venture that successfully demonstrated its product during the 2010 Deepwater Horizon Oil Spill disaster but was not selected for implementation by the customer, value could be inferred but not fully realized in that event (V4ar). For some ventures in this study that started outside disaster, product pilots likely reduced delay in seeing value. One founder noted that planned events such as marathons or community events were a great opportunity to pilot the product and featured some potential characteristics of disaster such as urgency and the presence of lots of people (V29). Those ventures that adopted some of the proposed sustainable business models such as expanding the geographic application of a product and applying the product in smaller, everyday emergencies may have also had opportunity to realize value more quickly.

Finally, given that disaster is intermittent and some products are intended to make it such that 1) an interaction between a community and a hazard does not result in an event to which a response is required, or 2) a response goes so well that the community does not experience the event as a disaster, it may be difficult to determine value when the indicator is an absence of something that is, by definition, intermittent.

Disaster management culture/context. Hindle (2010) explains that “protagonists will attempt to create new value for defined stakeholders” (p. 107) but leaves it open as to who those stakeholders are. A number of informants pondered the idea of who these stakeholders are within the disaster management context. Some looked at the relationship between government and the public recognizing that the government might sometimes be a customer, not because it intends to receive the benefit of a product, but because those who do receive the value can’t afford it. As one informant stated, “it’s not economically feasible for a community of 300 to buy ten miles of

Tiger Dams but it was for the province to buy 500 miles that they can deploy to 50 different communities” (DM4). In a similar vein, another explained that,

A lot of [ventures], I don't think they're targeting towards individuals, because I don't know if individuals have that kind of – like if you're the vulnerable kind of individual that might need that, you probably don't have the resources to procure it. If you're the person that has the kind of money to deal with that, you probably aren't in a situation where vacuum-wrapping your stuff in your basement is what you're up to (DM7).

On the flip side, a municipal government informant noted how a small percentage of companies tried to engage him in promoting a product to individuals in the community. The pitch from these companies to the government was that when individuals purchased the product, they would be more resilient and thus government's job would be easier (DM4). In this situation, ventures promoted the value as applying to both individuals and government.

Another disaster management informant expressed multiple times how disaster management is undervalued by many, and later pondered the long chain of stakeholders that might be beneficiaries of value from a product:

But then in the long term who benefits? Even if that benefit is just a lack of cost from the outcomes of that product? Sure, we bring a Tiger Dam, the city council sees it as a better way of being able to protect homes so those homes are protected. So you could argue that those homeowners get the benefit, but who else benefits? Well, I suppose a certain amount of the financial, the mortgage market places benefit because those homes are not lost and therefore their mortgages can continue. And then the flip side too is those people still work for somebody or they still employ somebody or there's just a benefit to the community overall to not lose those homes, and so then that feeds back to the city council

again. “Okay, we’re still going to keep getting property taxes from them, they’ll still be going to work and buying things and selling things. We’ll still be getting GST or PST or business taxes.” Communities that don’t suffer disaster are better off...[disaster money is] not really new money, that’s replacement of what you’ve got (DM5).

The long list of potential stakeholders points to the benefit of societal stability that is brought about by these products that are intended to reduce the likelihood and impact of disaster events.

The informant also suggested that the separation between the customer and the party that receives the value may also be present when a private company is the target customer: “And on the private side...it’s the shareholder or whoever has a stake in the promise of benefit from that investment. And again, I just don’t think most corporations see the value” (DM5). A previous section noted that some companies that had previously sold products to government on behalf of its citizens were now reaching out to sell these products to individuals as well. These actions suggest that some companies are attempting to remove the separation between customer and the party that receives the value. It is speculation, but perhaps there is opportunity to further change the approach by engaging the chain of stakeholders that receive indirect value as potential customers.

Dual logics.

Expectation of impact value without profit value. Another idea raised by one venture informant was that in addition to disaster management customers being challenged to purchase products because of budgets, some also thought that impact value should be delivered to them at a lower cost. The informant noted,

For some reason the emergency management realm, and this is me as cynic or a seasoned veteran, they seem to think that everything should be free. That the vendors out

there, buying software for \$5000 and getting 24/7 support should be one and the same thing which is really hard for a tiny vendor to do. Which is why recently, in the past five to six years, I've not been doing any software but I've been observing the industry, and I believe we are down to zero Canadian companies that are doing emergency management software (V7).

While a previous section noted that many of the disaster management informants recognized that profit was necessary, the experiences of this venture informant suggests that there may also be attitudes in the disaster management culture that do not recognize or value a profit logic, resulting in financial value not returning to the entrepreneur. It is not clear from the comments made by this informant whether the customers ever expressed a view that ventures should be 'helping' them address their needs, though this might be implied by this desire to underpay to obtain the impact value.

Profit logic as a support to helping goals. Those ventures that create a product with the intent of helping solve problems or improve situations will want to get their products into the hands of those customers that would actually benefit from using such a product. As noted in the previous section, cost may be a barrier to a product getting into the hands of those who could most benefit from it. However, comments by one informant suggest that taking a strong helping approach without recognition of a profit logic may also reduce the likelihood of achieving the intended value of the product through a customer that has a complementary need:

I believe you have to sell something because people need to actually pay for it in order to really look at it. If you try to give it away for free, we learned this the hard way, they assign it with a zero value which means they don't put their own time into it... When you're giving somebody something for free, it's really hard to know that they're

committed as opposed to it's a shiny object you just handed them. You need to know they have a real problem at hand (V7).

Similarly, a venture that made its product free a number of years in had the following observation:

So yeah, there was an uptick [after making the product free] and we've been really busy and active. But because we're not asking anyone to pay, there's just much less commitment once people start the platform because it costs them nothing to leave it (V19).

The founder further explained that it wasn't the lack of cost, but the experience of disaster and the recognition of need that had led to the greatest success with customers committing to the product and experiencing its benefits:

Because then the need is clear, they're looking for tools, they're overwhelmed with data, and then they find us and they realize oh my goodness, this is everything we need. But it's really hard to communicate that, you know, that gap until it happens to you (V19).

Another venture seemed to seek a balanced approach to helping versus profit in getting its product into places where it would be valuable. The founder recognized that “some institutions have the resources to pay for our products, and some don't” and opted to establish a philanthropic team to work with specifically with not-for-profit organizations. However, the venture could not take on all requests for assistance and was select in which organizations it partnered with, preferring those organizations that had needs and interests that specifically aligned with the strengths of the company and its product. It is assumed that those organizations that did not make the cut either had to purchase the product or find another solution. Thus, by distributing products through strategic not-for-profit partnerships and paid purchases by those

organizations that would truly benefit from the products, the company was able to work toward a goal of "...driv[ing] disaster response steadily and increasingly toward effective promotion of the common good, particularly for the most vulnerable" (V3ar).

Propositions. In this last entrepreneurial activity I focused mostly on what I describe as impact value in that the product addresses the issue or provides the solution as intended. Austin, Stevenson, and Wei-Skillern (2006) alternately describe 'social value' which they relate to addressing a social problem, and contrast with value in the form of personal and shareholder wealth. The focus on impact value is based on the comments from several disaster management informants as well as my own perspective as a public sector contributor to the field. Through the findings from interviews and case examples and extending the concepts in the themes, I noted challenges to achieving the impact value for defined stakeholders as well as determining if the value was achieved. I also discussed the perspective of one venture informant that viewed attitudes of some in the disaster management field as a barrier to achieving value in terms of wealth, though the extent of this attitude is unknown. Considering the reflections that those who would benefit from disaster related products may not be able to pay and that needing to pay may be the mechanism to find those who would truly benefit from the product, I offer two contrasting propositions:

Proposition 12: A helping logic is required to achieve the impact value of a disaster related product.

Proposition 13: A profit logic is required to achieve the impact value of a disaster related product.

With the presentation of findings for the 18 combinations resulting from the three themes and six entrepreneurial activities complete, I finish the findings section by presenting some cross-combination ideas.

Process Models of Disaster Related Spontaneous Venturing

Overall, the findings point toward unique characteristics of disaster related venturing in general, with some specific considerations for spontaneous venturing *from* disaster and for venturing or routine exploitation by an established business *during* a disaster.

Some of these specific considerations point toward a potentially unique ordering of the activities in the entrepreneurial process for spontaneous venturing. Figures 6 and 7 present a depiction of this possible order. As previously noted, Hindle (2010) suggests that the activities in his model of entrepreneurship may occur in various orders. In both of the figures, commitment is placed immediately following opportunity existence. This placement is based on the idea that the inspiring disaster presents a powerful picture of need that prompts an immediate commitment to address the perceived gaps. For the first figure which applies to spontaneous venturing to provide a product for the inspiring disaster (SV1a/b – see p. 56), commitment is followed by exploitation. Exploitation during disaster is likely focused on simply creating the product and getting it into the hands of users with less concern for revenue. This hopefully results in some impact value in terms of contributing to disaster efforts. Following the disaster, a venture then has more time to evaluate the perceived opportunity and find a business model. As noted by some informants, this evaluation unfortunately may not lead to a sustainable model if it is conducted without sufficient rigour. The evaluation and business model, combined with the opportunity to further develop a product, find financial resources, etc. outside of the time constraints of a disaster event would

Figure 6. Process of spontaneous venturing to provide a product for the inspiring disaster.

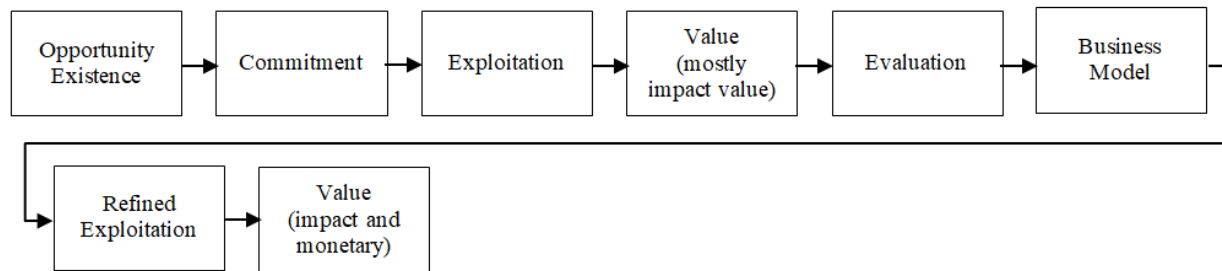
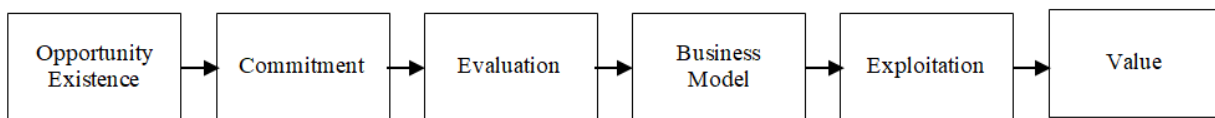


Figure 7. Process of spontaneous venturing to provide a product for a future disaster.



likely lead to refined exploitation and value in the form of monetary returns to the entrepreneur and investors and further impact value for intended stakeholders.

For spontaneous venturing started during or after disaster with an intention that the product to be used for a future disaster (SV2a/b), commitment would be followed by evaluation, business model, exploitation, and value. This is nearly the same order proposed by Hindle, the difference being that commitment is moved earlier in the process. In this model as well, early commitment may have ramifications for the later steps as evaluation toward a business model may still be insufficiently considered.

These models are not meant to suggest that all spontaneous venturing from disaster will follow such entrepreneurial processes. However, the proposed processes may be more present in these types of ventures than in general disaster related entrepreneurial venturing or in entrepreneurial venturing altogether. If the proposed alternate sequences of activities are defining

characteristics of disaster related spontaneous venturing, the earlier proposed definition of spontaneous venturing as featuring a near simultaneous progression from opportunity evaluation, which includes opportunity existence, evaluation, and business model, to commitment, and finally exploitation action may require revision in terms of the order of activities. Further research is required to confirm the proposed alternate orders.

Discussion

Theme Interactions

Findings were organized under the themes to which they seemed most closely related. However, some findings were based on dynamics from more than one theme. For example, within the disaster characteristics theme, I proposed a number of sustainable business models as adapted to the buying habits of those in the disaster management context, which are in turn built around the occurrence of disaster. As I noted, these customers (by which I mean those who are focused on disaster management as well as those that control their budget) could choose to purchase products separate from any occurrence of disaster, but they often do not. Thus the characteristics of disaster influence the business models that may be effective in the disaster management context.

It is likely that disaster characteristics and disaster management culture are closely intertwined, with the culture formed at least partially as an adaptation to disaster characteristics. For example, the disaster management field has accepted as a major conceptualization of what it does, a model that is based on temporal phases of activities. Further, it focuses on preparing in advance to carry out response activities efficiently and effectively, recognizing that it often does not have the luxury of figuring things out in the compressed time period of disaster.

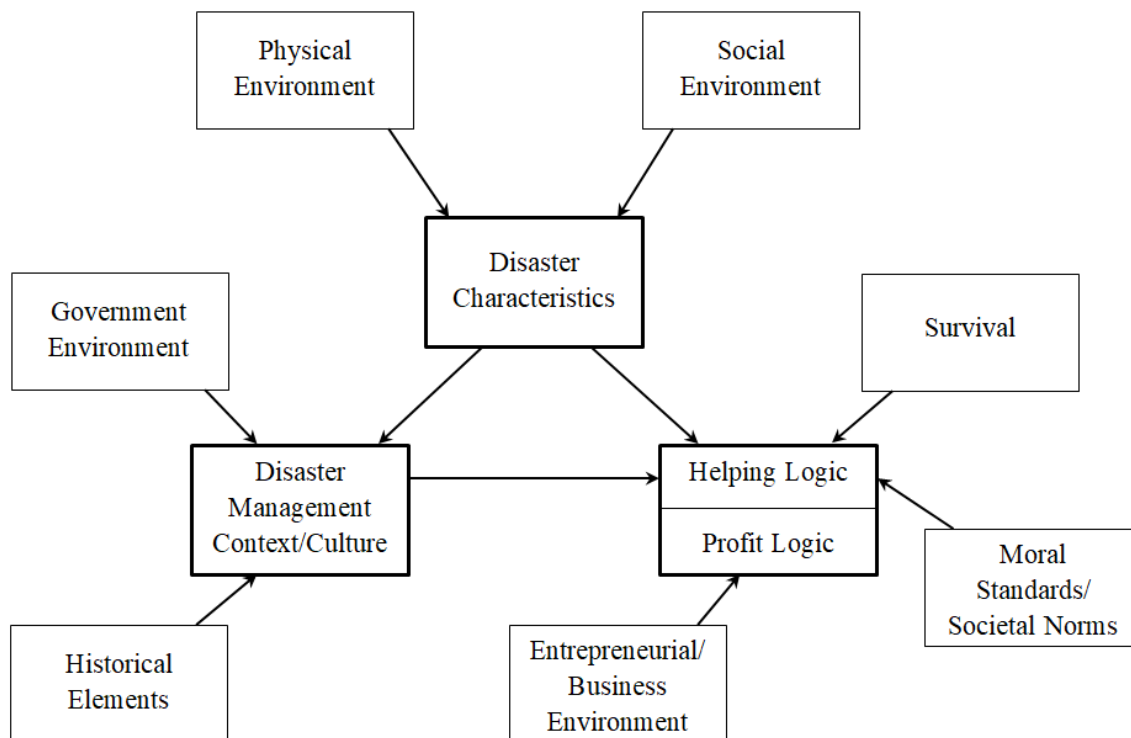
It is also likely that some parts of the dual logics theme is shaped by the other two themes. Earlier I noted Dynes' (1970) suggestion that disaster prompts the prioritization of values that are critical to survival, activates altruistic norms and behaviours, and results in emergent behaviours. Thus a helping logic would be a pro-social response to the societal breakdown in disaster. It seems reasonable to explain the aversion to profiting as a reaction to the violation of the altruistic norms. However, should this be the case in every 'disaster'? What about the minor events in which damage is likely without intervention but survival is not at stake? And does every type of person have this reaction? Some informants made it clear that they had this anti-profiting reaction while others merely explained that this reaction was possible without identifying the parties that held this view. They also didn't distinguish if profiting off disaster events was always or only sometimes distasteful, but assuming this was a consistently held view, then perhaps there are other explanations. I suggest that for those working in the disaster management culture and context which centres on people that work in a public sector environment, the answer lies in the values of this environment. Research shows that public sector workers have higher levels of public sector motivation, which is conceptualized as including self-sacrifice, altruism, and prosocial values (Perry, Hondeghem, & Wise, 2010). So perhaps the helping logic for government customers stems from the disaster management context which is closely tied to the government context. In contrast, the general public may be reacting to the characteristics of disaster – the intermittent occurrence of an impacting disaster event.

Figure 8 describes possible relationship between the themes and some of the other ideas discussed in the literature review and findings. The reference to historical elements refers to influences such as wars, international relations issues, and major disasters that have shaped the

disaster management field (Department of Homeland Security, 2017; FEMA, n.d.; Lindsay, 2014; Rubin, 2012).

In summary, disaster management culture and context may reflect an adaptation to disaster characteristics, and the helping logic may reflect an adaptation to disaster characteristics or an adaptation to the government environment that dominates the disaster management culture and context.

Figure 8. Relationship between three themes and other concepts.



Relationship of Findings to Other Research

One of the ideas discussed in the literature review was Dynes' (1970) typology of organized behaviour in disaster as well as later modifications to this typology. In this study, ventures represented three of the four types. One venture acted like an extending organization,

fully maintaining its normal structure but delivering its existing product in a new disaster application, or in a nonregular task. Some of the informants suggested that they had seen ventures where the founders had a military or first response background. These would represent emergent groups with latent knowledge, in that the founders were trained in contexts with similarities to disaster management. The vast majority of ventures are best classified as emergent, taking on new structures and new functions or tasks. This is obvious in the case of start-ups with no connection to any parent company; however, even ventures spun out of other companies took on new structures in the forms of new teams or new companies.

Another topic discussed in the literature review was the motivation for and conditions that prompted emergent behaviour. In this study, motivations identified by ventures and/or suggested by disaster management informants included helping in the form of keeping people alive and making things better in the long term, addressing injustices which have led to human pain and suffering, national patriotism, and profit. As noted, it is also possible that making things better may be applied in a non-helping way with a primary view toward entrepreneurial opportunity. A study of venturing in the period immediately following the 2010 Haiti Earthquake examined ventures that had a focus on alleviating suffering (Williams & Shepherd, 2016). The closest similarities in views were the prosocial views that were a component of the mindset of one type of venture, and the intent of righting injustices as a component of the mindset of another type of venture. However, the injustice mindset in that study was related to a view of reparation for historical wrongs. In contrast, the injustice suggested by the current study might be interpreted as an expectation of access to basic resources in the case of a venture that was founded in response to an international disaster in a developing nation. In the cases of other ventures, injustice could be related to an expectation that a country such as Canada or the U.S.

should be able to demonstrate a certain level of response that was not observed in the inspiring disasters. In the Haiti study, there is no evidence of a profit motivation which makes it unclear whether the ventures in that study had a profit component or potential for profit.

Many of the conditions previously identified in research that may lead to a perceived need for emergent response were present in the disasters to which the entrepreneurs responded. For example, a number of the events had emergency demands that exceeded communities' organizational capabilities, and demonstrated a lack of overall coordination and information. In addition, while it may sound obvious, I note that entrepreneurs responded to the specific disaster issues they perceived. This is to distinguish that entrepreneurs creating flood protection products did not, for instance, observe an authority lapse or an information issue and respond by creating a product that dealt with the disaster agent. Entrepreneurs that perceived an emergency notification issue created an emergency notification product, and so forth. Even when entrepreneurs would have been able to see many issues, they honed in on one or two and sought to address those issues.

Some past studies have identified entrepreneurial motivations such as contributing to the welfare of the community (Barba-Sánchez & Atienza-Sahuquillo, 2012) or helping society (Germak & Robinson, 2014). The Germak and Robinson study which looked at nascent social entrepreneurs also identified similar motivations to some of the ventures in the current study including a nonmonetary focus and closeness to the social problem. The primary overlap when comparing motivations expressed in the current study with lists of motivations expressed in general entrepreneurship literature is the desire for personal wealth (Kuratko, Hornsby, & Naffziger, 1997). Entrepreneurs in the current study did not express other commonly noted motivators such as those related to independence or autonomy. Perhaps if the research process

had included a survey that presented a list of common motivators, entrepreneurs might have identified additional reasons for pursuing an entrepreneurial path. In this study, the open ended nature of the questions combined with the disaster focus may have led informants to consider their reasons for pursuing a disaster related venture rather than entrepreneurship in general.

Turning to opportunity recognition and evaluation, Baron and Ensley (2006) suggest that new entrepreneurs may be “‘cognitively dazzled’ by the novelty and perceived potential of the ideas behind their new businesses [and] may fail to devote sufficient attention to several financial and business factors” (p. 1340). They also note research that suggests strong, positive feelings may reduce the ability to properly evaluate information (p. 1341). It seems likely that disaster creates a similar opportunity to dazzle. The complexity of disaster, the convergence of people, the scenes of suffering and then relief – all of these things likely create a powerful picture that may distract from other considerations. When combined with the opportunity to help, it is likely that positive feelings will be an outcome. Thus studies about first time entrepreneurs might have insights that could contribute to the understanding of opportunity recognition and evaluation by entrepreneurs engaging in spontaneous venturing in disaster. Similarly, findings about entrepreneurs engaging in spontaneous venturing in disaster could enhance understanding of the thoughts and affect of first time entrepreneurs.

Finally, I noted in the introduction that this study might contribute to understanding of social entrepreneurship. Some of the ventures in this study bear similarity to social entrepreneurship in their goal of creating social value; however, distinguishing characteristics suggested by Austin et al. (2006) such as ventures being a response to a social-market failure, difficulties in compensating staff competitively, or greater challenges in measuring performance in tangible ways were not evident in the data. I suggest that it would be incorrect to view the

ventures in this study as social ventures by default, though certain ones clearly identified themselves in that way. Despite the focal ventures of this study not necessarily being social ventures, this study may be able to comment on some of the research questions for social entrepreneurship posed by Short, Moss, and Lumpkin (2009). For example, they ask, “Do customers perceive the value created by commercial and social ventures that serve the same markets in the same way?” (p. 175). This study would suggest that when customers see a venture as providing a social good, they may have expectations that costs should be lower such that they receive a desired service without paying its true cost, or may demonstrate sensitivity to prices that they perceive as inappropriate, as noted in the discussion on ‘profiteering’. Short et al. also ask “What strategic and managerial consequences flow from social entrepreneurs’ urge to satisfy both economic and social objectives?” (p. 175). The findings of this study point to outcomes of venturing commitment, evaluation toward a business model conducted with reduced attention and rigour, and a desire to adopt business models that may not maximize profit.

Limitations and Future Research

This study identified more than 30 ventures that either represented spontaneous venturing or venturing inspiration from disaster. However, interviews were conducted with individuals related to only 13 of those ventures. This small interview pool meant that in some cases, an idea was identified by only one informant making it difficult to know if it could be generalized beyond that particular venture. However, a number of archival data sources also provided interview-like perspectives, particularly when the sources were regularly updated blogs by the ventures that tracked founders’ activities and thoughts over time or, in one case, a book in which the founder discussed his entrepreneurial experiences. Additionally, only a small number of non-spontaneous ventures were engaged for interviews. The original data collection plan did not

specifically target such ventures; however, given the proposed finding that much of the spontaneous venturing experiences are generalizable to disaster related venturing in general, a larger data set would have been beneficial.

Interviewed venture informants were from Canada, the U.S. and Australia while the majority of disaster management informants were from Canada. Further, the disaster management informants were drawn primarily from government. The generalizability or distinctiveness of findings would be enhanced by expanding this pool of informants to more evenly represent the countries of the ventures and also include more informants from academia and the private sector, as well as informants from not-for-profits. Finally, I was unable within the study period to refine the interview questions based on a developing model of findings and return to the informants to explore interim ideas in depth. Doing so would have resulted in greater certainty of the findings presented.

As this was an exploratory study, the intent was to suggest new ideas and relationships for further study. Future research could investigate any of the ideas presented in the 18 combinations of theme and entrepreneurial process as well as seek to understand the prevalence of spontaneous disaster related venturing for any of its proposed subtypes. Recalling Hindle's focus on evaluation as the defining component of entrepreneurship, future research could specifically examine the relationship between disaster and evaluation, seeking a greater understanding of how disaster related entrepreneurs understand opportunity.

Contributions and Conclusion

The primary contribution of this paper is the three themes – disaster characteristics, disaster management culture and context, and dual logics – which are proposed to uniquely impact the disaster related entrepreneurial experience. These themes speak to the context of this

experience as well as the psychology of those in this context. Johns (2006) describes context as “situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables” (p. 386) whether or not those in that context are aware of its impacts. By identifying key elements of this particular entrepreneurial context, this paper brings awareness to opportunities, constraints, and relationships in a way that may be valuable to those engaging in entrepreneurship as well as those that wish to further examine topics within this context.

The themes as well as their interaction with the six entrepreneurial activities offer a number of proposed outcomes, some of which are presented as formal propositions, which may form the basis for further research of entrepreneurship in this context. The themes naturally lead to practical value for current and potential disaster related entrepreneurs by providing a conceptual framework with which to consider how to venture in this space. Findings from the 18 combinations of theme and process suggest specific constraints or supports that a disaster related entrepreneur may want to consider. Entrepreneurs may also benefit from considering the business models that are proposed for this venturing context, the expectations and perceptions of potential customers, and the idea that a desire to help must be balanced with evaluation and realistic profit considerations.

This paper also proposes and finds evidence of several types of spontaneous venturing organized around the point of venturing initiation and the period of exploitation. Based on the interviews, disaster is identified as a unique period in which start-ups, corporate ventures, or even non-spontaneous exploitation by an established company (for instance, trying to acquire new customers in disaster) may face particular challenges not present outside of disaster. In addition, this paper offers a definition of spontaneous venturing that can be applied to

entrepreneurship in general or to an entrepreneurial process in which the disaster is the initiating event.

Beyond the practical implications for entrepreneurs, this paper offers considerations for governments that contribute to this venturing context. Recognizing that ventures may offer valuable solutions during a period in which funds may be more readily available, governments could devise ways to more effectively integrate these resources. For example, this study noted that some jurisdictions had established procurement lists as a formal way for ventures to make their products known. This practice could be adopted by other jurisdictions. An additional new approach for government could be to engage external partners to carry out the function of product evaluation on their behalf during disaster. Doing so would provide ventures with a mechanism to have their products considered for use during the disaster while allowing government staff to continue focusing on their own response efforts. Finally, governments could note the potential for bias against entrepreneurs that emphasize profit over helping. Assuming these entrepreneurs are not actually engaging in unfair pricing, government staff could determine to look past the displayed motivation and examine products solely based on merit.

In conclusion, the findings presented in this paper depict disaster related entrepreneurial venturing as challenging but also exciting and rewarding. The recognition of three dynamics that shape this subset of entrepreneurship contributes to a small but growing understanding of this experience as well as a fuller understanding of organized behaviour in disasters.

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Appendix A

Rapid Exploitation

Both the proposed definition of spontaneous venturing and the idea of venturing to meet an immediate disaster need suggest that venturing may occur rapidly in the disaster context.

However, creating a new start-up or a new product or service within an existing business typically requires a number of steps (Arend, Sarooghi, & Burkemper, 2015; Lichtenstein, Carter, Dooley, & Gartner, 2007). For instance, Stevens and Burley (1997) suggest that 3,000 raw ideas are needed to produce one commercial success and identify seven steps in the process of reaching this outcome. The characteristics of certain approaches to innovation and entrepreneurship suggest the potential for rapid action by accelerating or skipping steps, such market research, product development, or acquiring financial resources.

One potential rapid approach is the lean start-up which works to minimize the total time required to produce a viable product by seeking feedback frequently, and then updating and retesting hypotheses as quickly as possible (Müller & Thoring, 2012).

Improvisation may also contribute to the ability to rapidly start a new venture. In a study of knowledge-based start-ups, Baker, Miner, and Eesley (2003) identified firms that 1) were founded through improvisation in response to opportunities identified when talking to colleagues, suppliers, customers, or research partners, and 2) improvised tactics to shape future strategies. The authors describe how for many founders that improvised tactically, there was no ‘overarching strategy’ to these actions – rather improvised actions were reinterpreted to shape future strategies. (p. 261-263). These ventures were established in less than six weeks after receiving initial seed deals and often in less than a week. When describing improvisation, Baker et al. (2003) focus on the idea of converging composition and execution. In contrast, Weick (1998) highlights modifying or adapting previous elements or ideas to a greater or lesser extent.

He suggests that full-scale improvisation, which involves radically altering the initial elements, requires substantial time and resources. While time is something which is not in abundant supply during disaster, Kendra and Wachtendorf (2002) state that “an event that does not demand the exercise of improvisation does not, by definition, constitute a disaster” (p. 3). Improvisation observed in disaster includes “reproductive improvisation” which “emphasizes reproducing something valued that is lost”, “adaptive (deviations from the original model) and creative (altogether new) improvisations” (Wachtendorf & Kendra, 2012). To whatever extent improvisation occurs, it seems that a key element is having something to improvise on such as applicable knowledge or experience.

Another potential tool for rapid venturing is bricolage, or “making do with what is at” hand (Baker & Nelson, 2005, p. 329). Baker and Nelson (2005) highlight that bricolage is about actively finding a solution rather than considering whether the resources are sufficient to do so. The orientation toward action and the ability and commitment to use available resources rather than searching extensively for additional resources suggests that bricolage may be beneficial in time-sensitive situations. Baker and Nelson also find that bricolage may take place in three areas: inputs (material, skills, labour), regulatory/institutional, and customers. Bricolage may also overlap with other approaches to entrepreneurship. For example, Baker et al. (2003) identified what they called network bricolage, or “dependence on pre-existing contact networks as the means at hand” (p. 270) and noted that it occurred at greater rates in improvising firms than in non-improvisational founding firms, which made it more likely that the new venture was in a founder’s prior industry. They suggest that bricolage may be both a precursor to improvisation and a tool of improvisation. They also suggest that bricolage may be used as a tool of both

effectuation and causation, with the difference being whether the resources guide your actions or the resources support your pre-existing goals.

Effectuation involves taking “a set of means as given and focus[ing] on selecting between possible effects that can be created with that set of means” rather than seeking the means to achieve a desired effect (Sarasvathy, 2001, p. 245). Sarasvathy (2001) proposes that effectuation features a focus on affordable loss, strategic alliances, exploitation of contingencies, and control of an unpredictable future. (p. 259). Chandler, DeTienne, McKelvie, and Mumford (2011) find that experimentation, affordable loss, and flexibility, along with pre-commitments together represent effectuation. However, they note that pre-commitments are also used by causation approaches to entrepreneurship. They suggest that the two approaches use pre-commitments in different ways, with effectuation using this to “reduce uncertainty, minimize cost of experimentation, and maintain flexibility” and causation using this to “acquire essential resources and implement plans” (pp. 386-387).

Effectuation may contribute to a rapid start-up as this approach reduces time spent on planning and prediction. This also serves to reduce costs that would have been attached to these activities (Fisher, 2012). Effectuation is theoretically reasoned to be suited to unpredictable futures (Sarasvathy, 2001). This boundary condition might be more prevalent in disasters, or alternatively, may be a more prevalent perspective for those observing the event. Supporting this proposition, uncertainty, a related but different concept, has been found to negatively correlate with causation but positively correlate with experimentation (Chandler et al., 2011). However, Arend et al. (2015) suggest that the effectuation context rests somewhere between full information and complete ambiguity. Where it rests is underspecified making it difficult to practically apply this boundary condition.

Taking an alternate view, effectuation may also be slow in comparison with traditional or causation approaches. Sarasvathy (2001) notes that causation focuses on selecting optimal strategies: “In cases in which a particular effect has been preselected by the decision maker, causation processes can be applied to choose the best, the fastest, the most efficient, or the most economical method to achieve the chosen effect” (p. 251). This suggests that if a decision maker is able to follow a causation approach, they may be able to identify the fastest methods available to bring about their end goals.

While the above approaches may increase entrepreneuring speeds, Lichtenstein et al. (2007) propose that going fast alone is not enough to lead to organizational emergence. Instead, a combination of a high rate and low concentration of start-up activities with more of the activities happening later in the process do better than a low rate of concentrated activities with more activities earlier in the process. While the benefits of a high rate are fairly intuitive, they suggest that a low concentration may lead to more completed activities rather than many unfinished tasks. A greater concentration of activities late in the process may allow entrepreneurs time to gain knowledge and other resources that form a scaffolding that each activity builds on.

Appendix B

Areas of Opportunities Identified by Disaster Management Informants

Table B1

Areas of opportunities identified by disaster management informants

Phase Time	Mitigation	Preparedness	Response	Recovery	General / All Phases
Recently Observed	<ul style="list-style-type: none"> Floodplain analysis Engineering Building dikes 	<ul style="list-style-type: none"> Emergency planning Business continuity planning Emergency management training Exercise design/ management FireSmart planning, including evacuation models <p>Customers mentioned:</p> <ul style="list-style-type: none"> Local governments Provincial/state governments Oil/gas industry 	<ul style="list-style-type: none"> Specialized flood equipment and materials to contain water, pump water, etc. Incident management systems (software/ applications) Emergency coordination personnel Variety of emergency response equipment Private disaster evacuation services <p>Customers mentioned:</p> <ul style="list-style-type: none"> Governments Oil/gas industry Businesses 	<ul style="list-style-type: none"> Construction/ re-construction Specialization in post-flood cleanup of buildings including remediation of black mold/ problems specific to flooding Safety assessments of structures Insurance industry Environmental/ hazardous materials clean-up Damage assessments <p>Customers mentioned:</p> <ul style="list-style-type: none"> Individuals Governments 	<ul style="list-style-type: none"> Security and cyber security Public speaking about disaster response/ recovery experience

Time \ Phase	Mitigation	Preparedness	Response	Recovery	General / All Phases
			First response opportunities (noted separately due to scope of study): <ul style="list-style-type: none"> • Private first response (firefighting, emergency medical, etc.) for industrial incidents • First response wearables 	<ul style="list-style-type: none"> • Oil/gas industry 	
Possible Future Opportunities	<ul style="list-style-type: none"> • Possible opportunities as insurance companies own more disaster risk • Customers • Governments? • Individuals? 		<ul style="list-style-type: none"> • Social media monitoring and triage • Public alerting – wireless public alerting (on mobile devices); alerting solutions from local to national level • Automating any function that is/has been performed by volunteers, such as evacuee registration • Swift water rescue (post 2017 hurricanes in U.S.) Customers mentioned: <ul style="list-style-type: none"> • Governments • Not-for-profits 	<ul style="list-style-type: none"> • Tools/methods for businesses to communicate that they are open for business in/post-disaster • Overland flood insurance (in Canada) • Large scale recovery coordination Customers mentioned: <ul style="list-style-type: none"> • Businesses • Individuals • Governments 	<ul style="list-style-type: none"> • Products that address water-related issues • Augmented services where government doesn't have resources or skillsets to meet public expectation – in areas of preparedness, risk assessments, very technical work • Interoperability between groups/product and product standards

Appendix C

Additional Comments About Sustainable Business Models

Table C1

Additional comments about sustainable business models

Business Model	Comment
Primary Market: Disaster Management; Number of Business Lines: Single Product	
Expand geographical sales area of company	<ul style="list-style-type: none"> There have been companies that have tried, but they have not been able to necessarily sustain. If you look at the [Canadian] companies that have sustained, there's maybe been a U.S. operation...and again they're encompassing more of a North American market (DM6).
All-hazard capability and multi-hazard application	<p>All-Hazard</p> <ul style="list-style-type: none"> Or the product is one of those things that is sort of communications-based, as an example, where it's appropriate to every type of an emergency. That I can sell [to my council] at any time, right?" (DM4). <p>Multi-Hazard</p> <ul style="list-style-type: none"> Our [product] machines can be "lifesavers" in an emergency. Whether it is flooding, fire, soil erosion, or hazardous spill-containment, our machines will bag sand very quickly to help control the problem. When it comes to Emergency Management you can never be too prepared. We work with all budgets and when you consider the alternative, [product] makes perfect sense. Feel free to contact our team to discuss our emergency management budgeting to ensure that your property, township, or organization is well protected and prepared for emergency management (V6).
Disaster and non-disaster use	<ul style="list-style-type: none"> So they created that as a disaster response tool and then they recognized maybe there are ways we could branch out and market this to industry as a maintenance tool not just a disaster response or protection tool. So how do we make it more palatable when there isn't a crisis going on so we can still sell and make a profit? (DM4). The company has broken even on the back of sales to customers who plan to use the [product] for camping or other outdoor recreational activities (V9ar). The problem for the field is that we target on major, rare events, rather than frequent small, scale events. It's one of emphasis. It's sexier, if you will, to concentrate on the big one than to target all the little ones. As a result we put all our eggs in the big one basket and we get no traction and they don't occur. If we shift our focus to targeting small-scale localized events with a frequent occurrence, we have a service (DM3).

Business Model	Comment
Non-sales income from business competitions	<ul style="list-style-type: none"> We won almost a half million dollars from a bunch of competitions we entered. Because the idea is good and the [product] is good and we have all these fantastic use cases...and [the product] works really well (V19). We've leveraged business plan competitions and grant competitions and we've won an additional \$195,000 and we've put \$145,000 of that back into the business (V9ar).
Non-venture income	<ul style="list-style-type: none"> But that's my day job. And this disaster work is all volunteer in part due to necessity because we've been not lately successful at a business model (V19). [Founder] built the first [product] himself in his machine shed. "I was able to try it out because I had the conveyor and all the material to try it out," he said. [Founder] owned a gravel trucking business at the time (V32ar). I'm 70 years old. How much longer am I going to do this? If I was 30 years old, it's totally different. If I was struggling for money, totally different, you know? Business would be critically better (V16). [Company] business model - I think it's a pretty good one if you have a bunch of retired kind of military or emergency management type people who want to keep their hand in it, and a couple thousand bucks here and there. Because I'm just not sure, unless you're able to get enough communities buying your service, how you going to build up enough so that the people you're employing are finding it to be enough income for them to keep doing it unless it's purely a hobby (DM7).
Primary Market: Disaster Management; Number of Business Lines: Multiple Products	
Multiple disaster management products – Mitigation or preparedness product/service combined with response or recovery products / services (offered at time of disaster)	<ul style="list-style-type: none"> Disaster preparation is expensive for an uncertain event. You cannot predict when a disaster is going to occur and when your goods or services are going to be required. If you go to a bank and say, "I don't know when I'm going to be used but I got a really good thing", they're going to say "thanks for coming" because they want a continuity of demand. Disasters don't give that to you. But what it does do is create opportunities for intellectual exercises. I think about disaster preparedness, emergency management exercise planning, grant preparation, again in the FEMA situations. All those services become something that's easy to do and easy to scale and scalability is huge. So you can idle along in your basement as a disaster manager and writing grants. All of a sudden an event occurs, you can come forward as an ICS-trained incident commander (DM3). I'll just default to oil and gas. If you're contracted by an oil and gas company to be part of their response to go do clean-ups, you can get a call at 2 o'clock in the morning on Sunday because there's been an oil spill detected. You and all your equipment, under the terms of the agreement, need to be there immediately. So response related implies that you've got everything – you've got the trained personnel and you're on standby. You're either part of that company or you're contracted by the company. The recovery piece, again, there's no immediacy required for recovery. Getting manufactured homes out to a place is not going to happen when the flood waters are up. It's

Business Model	Comment
	<p>going to happen after the flood waters recede, it's going to happen after the engineers have gotten in there, it's going to happen after infrastructure. You know, there's an awful lot of stuff that needs to happen even for the interim recovery piece, right? So recovery in my mind intimates that it's going to be a - you've got more time. So most of those organizations that are part of or in that area, they don't have to be designed specifically for emergency management situations (DM2).</p> <ul style="list-style-type: none"> If as entrepreneur you're going to build a business just on response, it probably won't be that big of a business. [Informant instead notes how recovery is way longer than response but many people don't focus on it.] (DM6)
Primary Market: Non-Disaster Management; Number of Business Lines: Multiple Products	
Existing product or service customized for use in disaster management application	<ul style="list-style-type: none"> So if it's a flood, a lot of people are going to get in there and do waste removal, which they do normally anyways, and there are probably going to be companies in there looking to get contracts to build homes, etc. There's a small niche of that that are specialized in remediation of black mold and that sort of thing that are specific to floods, if you will (DM2). [business] started a sort of a business continuity consulting, as part of their consulting business, now expanding into crisis and emergency management consulting for business mostly. I think they do try to market to government as well but I'm not sure how much success they're having with that...[another business] who from my experience supports military training through simulation and simulated environments, but also is doing services for doctors and civilian medical support to the military has now branched into emergency management... these are big firms with pretty deep pockets. And they don't get into these business lines if they don't think they can make money at it (DM1). Yeah, well we've had some experience with flood barrier type products where I think they started in one thing. One helps control water inside mines. Others have started as environmental spill related things but have morphed into these water barriers. There are lots of companies now that are delivering both a product but also the service of installing them and taking them down too (DM1). I guess what I'm seeing, is like when you think of [software business], they have a package now for when disasters happen. Like there's certain software and tools that you can have access to (DM6).
<i>Intermittent prioritization of latent disaster management product during disaster</i>	<p>[Informant speaking of a hypothetical approach]: ...identifying a potential product or service and recognizing that the best time to launch it would be in the immediate opportunity following the relevant event and having the business model and gumption to get it all ready and actually have a contingent business model... actually formally adopt that into your business plan and say we are going to market to this but we know if that happens, we make a 45 degree turn and we just hammer down that path for the two years that that window of opportunity exists . And then when we see that post-disaster market fade, we aim ourselves back to our former one but we're going to be ready to do it (DM5).</p>

CHAPTER 4

CONCLUSION

In this concluding chapter, I combine some of the ideas presented in the two papers to offer additional insight or pose further questions. I start with the second paper, in which entrepreneurs were inspired to venture as a result of specific disaster events. This paper explores the experience of responding in an entrepreneurial manner to new information from the environmental changes brought about by disaster. However, this paper also notes how disaster related opportunity might result from new information produced by changes in technology, demographics, and the political/regulatory environment. For instance, opportunities related to social media and crowdsourcing information during disaster may stem from changes in technology, while opportunities from changes in demographic dynamics such as decreasing volunteerism may offer opportunities for disaster related products that provide an outcome using fewer people. One venture was also working to change the regulatory environment to create a market for its product. In this case, a regulatory change would be beneficial not only to the venture but likely prompt other ventures to participate in this market space.

Changes in the natural environment through disaster may also provide a context in which entrepreneurs come to simultaneously recognize new information about opportunities from the other sources of change. For instance, an individual who encounters an issue during a disaster may suddenly see an application for a new technology and thus a potential opportunity. Alternatively, changes in technology, demographics, or the political/regulatory environment may lead to opportunity without a new disaster occurring and revealing new information. In this type of scenario, an entrepreneur may simply respond to existing knowledge about disaster related gaps, and then with the introduction of a new technology, for example, recognize that the

technology offers a solution. In summary, disaster related ventures may be a response to new information from one or more sources of change.

In the second paper, all of the ventures that exploited opportunities related to changes in the natural hazard regulation ecosystem service did so through adaptation. This is in line with the actions of companies identified on the Inc. 5000 List of America's Fastest Growing Companies. This is not to say that ventures could not identify mitigation (terminology used as per the first paper) opportunities related to natural hazard regulation; however, it is likely difficult to create a product that, as an example, reduces the frequency of hurricanes. What might be more possible is to identify mitigation opportunities related to man-made disasters such as hazardous materials spills. In the second paper, one of the ventures offered a number of products to clean up oil on beaches and in the water. This venture was not responding to changes in natural hazard regulation ecosystem services, but to changes in availability of clean water and beaches with a goal of restoring those services to their previous state.

In discussing the main proposition of the first paper, one question that sometimes arises is whether opportunity from changes in the natural environment are exploited in a natural or green way. The answer to this is, not necessarily. However, a hypothetical example of responding in a natural environment way in the context of a disaster related venture would be an entrepreneur that becomes aware of new information revealed by a hurricane and forms a venture to plant vegetation to lessen storm surges to coastal areas. None of the Inc. 5000 List examples or ventures from the second paper exploited changes from the natural environment through a natural environment mechanism. All of the ventures examined in the two papers provided non-natural environment solutions to solving issues arising from changes in the natural environment.

The second paper proposed a number of business models that would provide long-term sustainability in the context of demand that varies around the occurrence of disaster. Some of these models were evidenced in the Inc. 5000 List examples. For instance, Target Logistics likely demonstrates customizing an existing product for use in a disaster management application. This company provides “temporary housing, catering, transportation, security, and logistics services for workers operating in remote, austere, or hostile environments, such as oilfields, disaster relief areas, mines, and military operations”. A review of the company’s website over the last 14 years shows that disaster relief was not its main focus and that it only began clearly listing disaster relief as a potential application about 10 years ago. As a side comment, while the company may have provided services for disaster relief many times in its almost 40 year history, it only started explicitly discussing these services following its work during Hurricane Katrina in 2005. This might mean that it is responding to new information from the natural environment. Datto, a company that offers hardware-based on-site and offsite backup, disaster recovery, and business continuity services, likely demonstrates an all-hazard model, and a disaster and non-disaster use model. Saratoga Roofing demonstrates a disaster management business line model by offering a disaster response service to quickly repair roofs after disaster as well as producing detailed reports, repair quotes, and documentation for further work. It is possible that some models, such as non-venture income, would not show up on the Inc. 5000 List as they might be less common among fast-growth companies such as the ones on this list.

I have identified some areas where the two papers might provide insight into or support for the inquiries of the other. Further study that combines ideas from the two papers with additional data could seek to answer questions such as, to what extent do companies on the Inc. 5000 list demonstrate the business models discussed in the second paper? Does the use of certain

models vary based on the phase of disaster management that the product is for? In the years following a disaster, do any of the companies add disaster related product lines or target disaster related customers with their existing products? In years without disasters, do companies with disaster related lines add non-disaster related product lines to their offerings or apply any other sustaining business models? What is the relationship between revenue and disaster occurrence for companies with disaster related products compared to those without such products? How close to a disaster event does a company have to be located to experience venturing inspiration or changes in revenue related to the occurrence of disaster? Also considering the initial discussion about sources of new information, questions could include, are spontaneous ventures typically a response to one source of change or multiple sources of change? Which sources of change lead to starting non-spontaneous disaster related ventures? Are disaster related ventures formed in response to multiple types of changes more successful than those that respond to only one type of change?

Together, these papers point to entrepreneurial opportunities related to changes in the natural environment that may be exploited by ventures that offer adaptive solutions to society. Further study may offer understanding on the frequency of such venturing actions and additional factors that contribute to their success.