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Natural hazard resilience and sustainable development: All-hazards and cross cultural perspectives

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Abstract

Worldwide, population growth in areas susceptible to experiencing natural hazard (e.g., earthquake, typhoon) consequences is increasing the risk faced by communities in many countries. Under these circumstances, one dimension of a sustainable society is the capacity of it and its citizens to co-exist with often beneficial, but occasionally hazardous, natural processes. An important aspect of sustainability in the face of disaster is the potential of people and communities to be resilient and able to adapt to hazard consequences should they occur. This paper presents a definition of resilience and discusses how person (outcome expectancy), community (community participation, collective efficacy, sense of place) and societal (empowerment, trust) factors interact to predict community resilience. The data supports the argument that the effectiveness of the risk management policies and practices used to facilitate community resilience is increased by integrating risk management activities with community development strategies. The cross-cultural validity of the model is discussed using data from testing the model in communities in New Zealand, Indonesia, Japan and the USA. Testing the model across countries and hazards (e.g., earthquake, tsunami, and volcanic hazards) supports its all-hazards and cross-cultural applicability. Data from Taiwan and Hawaii is used to discuss how cultural beliefs and ethnic characteristics influence resilience. The theoretical (e.g., identifying the degree to which the processes that underpin how people respond to hazard threats are culturally equivalent) and practical (e.g., supporting humanitarian aid work, providing a common basis for collaborative learning and research between countries, and providing risk management agencies in different cultures with access to a wider range of risk management options) implications of the cross-cultural equivalence of the model are discussed.

Keyword: Natural hazards, sustainability, resilience, culture.
1. Introduction

A long history of societal development in locations which expose communities and their members to adverse impacts from natural processes (e.g., earthquake, typhoon) has stimulated interest in identifying how to facilitate sustainability by developing a societal capacity to co-exist with the potentially hazardous elements in its environment. It is by developing a capacity for co-existing with the periodically hazardous environmental processes that a community can become resilient. Because hazards impact on people/households, affect communities, and disrupt community and societal functions strategies to facilitate sustainability must encompass these levels of analysis [1]. Given that hazards can strike with little or no warning, an important component of resilience is the degree to which people and communities are prepared (e.g., household emergency plans and resources, ability to work with others to confront local problems, capacity for self-reliance etc) in ways that increase their ability to cope with, adapt to and recover from hazard impacts (i.e., to develop sustained community resilience) using their own resources.

Research into factors influencing hazard preparedness has identified how intra-individual factors such as, for example, coping, self-efficacy and control beliefs influence levels of preparedness [2, 3; 4; 5]. Several investigations have also implicated social context factors as predictors of preparedness [2, 4, 6]. One way in which the social context influences people’s preparation decisions derives from the fact that the meaning people attribute to environmental events (e.g., hazard events) is constructed through the interactions they have with others [7]. Furthermore, the social context in which meaning is developed and sustained is influenced by the interactions that comprise everyday life rather than events specifically convened to discuss hazards and their management. The relationship between everyday life experiences and disaster prevention has received little systematic investigation. Another area that has not been extensively canvassed in the disaster prevention literature concerns the degree to which models proposed to account for hazard preparedness have any cross-cultural applicability. Investigating cross-cultural applicability is important in several respects.

Theoretically, analysis of the cross-cultural equivalence of models of hazard preparedness is of interest from the perspective of identifying the degree to which the processes that underpin how people respond to hazard threats represent universal social and psychological phenomena [8; 9]. It also has several practical implications. While relatively wealthy countries like Taiwan, Japan, and New Zealand can afford to devote resources to researching predictors of preparedness that can inform the development of their hazard mitigation strategies, many countries are less able to do so. Confirmation of the ability of the model to transcend cultural boundaries would make information about how to facilitate preparedness available to countries and communities that lack the resources to undertake this work themselves. The existence of an equivalent conceptual framework would also provide a common basis for collaborative learning and research across national borders and provide risk management agencies in different countries with access to a wider range of risk management options. If it can be demonstrated that preparedness decisions are independent of culture, a model would be available to assist disaster readiness and response planning irrespective of the location or population that is the focus of attention. The pursuit of these two objectives, identifying how mainstream community life influences hazard preparedness and assessing the cross-cultural applicability of the model, had implications for the approach adopted to selecting variables.
1.1 Selecting Variables

The first issue involved selecting variables that could assess peoples’ everyday experiences (e.g., participation in activities with other members of their community), thus allowing assessment of the degree to which mainstream aspects of community life influence levels of preparedness for hazard consequences. From a practical perspective, this approach is based on the premise that mainstreaming the development of risk management strategies with other community development activities increases the likelihood that a sustained capacity to adapt to infrequent hazard events will develop [1]. The second criterion for selecting variables arose from a need to test the model in different cultures. Thus, variable selection was informed by a need to accommodate populations that differed with regard to cultural characteristics such as individualism and collectivism. That is, variables used for cross-cultural comparison must encompass the personal beliefs likely to be more important in individualistic cultures and the social processes that are relatively more influential in collectivist cultures.

Personal beliefs were investigated by examining people’s beliefs regarding the likely effectiveness of preparing. The social context was examined from two perspectives. One involved the relationship between community members. This led to the selection of the variables ‘community participation’ and ‘collective efficacy.’ The second concerned the relationship between community members and civic sources of hazard information. This resulted in choosing the ‘empowerment’ and ‘trust’ variables. The rationale for these choices is discussed in the next section.

2. Developing the Model

People rarely have any chance to gain first-hand experience of either the consequences hazard pose for them or opportunity to assess the effectiveness of the mitigation measures they are asked to adopt for themselves. Rather, they rely on information from expert sources provided through public education programs that advise people that if they adopt a particular behavior the outcome will be increased safety. However, people interpret this information and its recommendations to estimate whether they expect that outcome to occur. The ‘outcome expectancy’ construct describes this interpretive process [6].

Negative outcome expectancy (NOE) reflects a belief that hazard consequences are too catastrophic for personal action to make any difference to peoples’ safety. If people hold this belief, they are less likely to prepare. In contrast, positive outcome expectancy (the belief that a measure will increase personal safety and mitigate a hazard consequence) can motivate people to prepare. If people have the necessary information and resources, positive outcome expectancy (POE) will predict preparing for natural hazard consequences. However, a belief that preparing can be effective is not necessarily the same as knowing how to prepare. If people need additional guidance, it is argued that they look first to other community members.

Faced with complex and uncertain events, when they do not possess all the information they need themselves, peoples’ perception of risk and how they might mitigate it, is influenced by information from others who share their interests and values [6, 10, 11, 12, 13]. Because participating in community activities can provide access to the views of people that often share one’s interests, values and expectations, information from this source can assist understanding one’s circumstances and deciding what to do, a measure of ‘community participation’ [14] was included in the model. However, the infrequent nature of hazard events means that people may first have to
determine what consequences they could face in order to identify the information, resources and strategies required to mitigate their risk. Collective efficacy, community members’ ability to assess their capabilities and resource needs and formulate plans to use resources to confront challenging tasks [15], represents a means of assessing community members’ ability to identify needs and formulate questions. It was assessed using a measure developed by Zaccaro, Blair, Peterson and Zazakis [16].

If community members’ deliberations identify information and resource needs that cannot be met within existing community contexts, they then turn to civic and expert sources to acquire the necessary information and resources [14]. However, an additional interpretive process is introduced into the model at this stage. This is included because people’s beliefs about the source of information (that is independent of the information they provide per se) influences their perception of the value of this information and whether they will use it.

The significance of including a community-agency relationship in the model derives from the important role trust plays when people make decisions under conditions of uncertainty [17]. As uncertainty increases, so does the importance people attribute to their trust beliefs about, and their past experiences with, the sources of information they turn to or have to rely on. People’s willingness to take responsibility for their own safety is increased, and decisions to prepare more likely, if they believe that their relationship with formal agencies is fair and empowering (e.g., agencies are perceived as trustworthy, as acting in the interest of community members) [6, 10, 11, 12, 13, 14]. If, however, the relationship between a community and an agency is not perceived as fair and empowering, the consequence is a loss of trust in the agency (i.e., the source of information), reducing the likelihood that people will act on the information and prepare. Empowerment was assessed using a measure developed by Speer and Peterson [18] and trust with a measure used in an earlier study of hazard preparedness [4].

The first objective of this paper was to examine whether people’s everyday social context influenced hazard preparedness. This was assessed, using structural equation modelling, by testing the ability of the model to predict tsunami preparedness [19] in Kodiak, Alaska (Figure 1). Support for the ability of the model (Figure 1) to account for differences in levels of preparedness can be gauged by Goodness of Fit statistics that indicate that the data are a good fit for the model [20]. The model accounted for 30% of the variance in levels of preparing. Accounting for 30% of the variance represents a strong effect size [21]. This analysis provides confirmation that people’s social context can contribute to accounting for levels of hazard preparedness. However, while allowing for the tentative application of the model in countries with cultural characteristics similar to the US (e.g., New Zealand, Australia), these countries are not representative of all cultures. Disaster transcends cultural boundaries. If a model is to have cross cultural utility, it must be able to demonstrate a capacity to predict preparedness in different cultures.

3. Assessing the Cross-Cultural Validity of the model

The question of whether the model can facilitate the cross-cultural understanding of resilience was examined by comparing data from Indonesian, Japanese and New Zealand populations. To examine this issue, it is essential to accommodate cultural (e.g., collectivist versus individualist) differences and their implications for the equivalence of constructs being examined [8, 9, 22]. For example, in individualist cultures, people act consistently across situations in ways that emphasise achieving personal goals. If
collective action occurs, it reflects personal choice regarding levels of cooperation, and this need not be sustained over time. In contrast, in collectivistic cultures, actions are driven by the goal of achieving collective goals and maintaining social relations over time [22, 23]. In light of these differences, the first question is whether equivalence could exist [8].

The model (Figure 1) demonstrated that the social context (e.g., community) does influence how members of an individualistic culture make risk management choices. At the same time, individualistic traits are being recognized for their potential to influence risk management choices in members of collectivistic cultures [24]. Consequently, there are grounds for examining the cross-cultural equivalence of the model. For this cross-cultural comparison, intention was used as the dependent variable.

Intention represents a more appropriate means for assessing the all-hazards utility of a model because it can accommodate hazard with diverse preparedness needs (e.g., the measures required to adapt to volcanic hazards differ in several ways from those relating to earthquakes). Intention can also facilitate cross cultural comparison of communities that differ with regard to characteristics such as hazard history, demographics, culture, and public education strategies. For example, differences between New Zealand and Japan in levels of community organization could confound a direct comparison of preparedness. Intention is also less susceptible than a measure of actual preparedness to bias from other sources. For example, people may not prepare if they lack the resources (e.g., time, money, physical resources, expertise) required to turn their intentions into reality [4].

A behavioural intention measure is less susceptible to bias from these influences than is actual behaviour. Intention thus provides a more robust basis for comparison. The intention measure comprised items that assessed people’s intention to acquire hazard knowledge, increase actual preparedness, and to work with other people/civic agencies to develop knowledge and capability [4]. Because of its greater sensitivity to cultural differences, intention was selected as the dependent variable for this comparison.

The countries selected for comparison were New Zealand (preparedness for earthquakes in Napier), Japan (preparedness for earthquakes in Kyoto) and Indonesia (preparedness for volcanic eruptions in communities surrounding Mt. Merapi) [25; 26]. The comparison is summarised in Figure 2. Figure 2 organizes the models according to the relative positions of the respective countries on Hofstede’s [27] measure of Individualism-Collectivism. The scores on this dimension are listed on the right hand side of Figure 2. Models were analysed using structural equation modeling. Analyses confirmed the hypothesised interrelationships between variables in New Zealand (N=255; \( \chi^2 = 5.919, df = 7, p=0.549, RMSEA = 0.0001, NFI = 0.983, GFI = 0.994 \)), Japan (N=251; \( \chi^2 = 7.478, df = 6, p=0.279, RMSEA = 0.031, NFI = 0.973, GFI = 0.991 \)) and Indonesia (Yogyakarta) (N= 322; \( \chi^2 = 331.9, df = 340, p = 0.61, RMSEA = 0.00, NFI = 0.83, GFI = 0.94 \)). The model accounted for 29%, 38% and 65% of the variance in intentions to prepare respectively.

Several differences and similarities were evident. Where differences were observed, they were consistent with those that would be anticipated based on the relative positions of each country on the individualism-collectivism dimension (Figure 2). Some measure of cross-cultural equivalence is evident in the similarity in the variables represented and their positions in the process that describes how people make choices about managing their risk. In the most culturally individualistic of the countries selected,
New Zealand, individual beliefs (e.g., POE) play a direct role in making risk management choices and also influence community processes. This reflects the pervasive influence of personal beliefs on personal and collective aspects of life in members of an individualistic culture. In Japan, although individual beliefs were implicated, they did not influence collective processes. This reflects the greater role played by the cultural attributes of mutual social obligation and cooperation that underpins community involvement in local issues in Japan. In the most collectivistic of the countries selected for this comparison, Indonesia, individual beliefs had no influence. Overall, the individual-level factor (outcome expectancy) becomes less influential as levels of collectivism increase. Similarly, as collectivism increases, so does the relative importance of community processes.

The comparison described in Figure 2 supports the view that, irrespective of culture, the more citizens are able to collectively formulate their risk management needs and strategies and the more they perceive their needs as having been met through their relationship with civic agencies, the more likely they are to trust them and the information they provide, and to use information to decide to adopt disaster prevention measures. These findings suggest the existence of some cross cultural universality in how people deal with risk and makes choices about whether or not to adopt disaster prevention measures.

A cross-cultural perspective provides opportunities for learning about disaster prevention. For example, while the same processes (e.g., community participation) are implicated in explaining the adoption of prevention measures, understanding how a process is enacted in different countries can provide new insights into disaster prevention. For example, the emergence of Jishubo (autonomous community-based organizations for disaster prevention) in Japan has increased community member’s satisfaction with and the quality of their learning about hazard management [24]. Exploring how this mechanism is developed and enacted can provide new ideas for other countries. Similarly, understanding how culturally implicit mechanisms such as gotong royong (communal labour) in Indonesia might influence the preparedness process provide additional insights into how cultural beliefs that facilitate collective responsibility and action under normal circumstances can influence disaster resilience [26]. Opportunities for culturally-derived learning can arise in other ways.

Local government plays a direct role in organizing community participation in disaster prevention in Japan, with much disaster prevention-related policy in Japan being implemented through the social schemes of Chonaikai and Jishubo [24]. In contrast, in New Zealand greater separation (from a disaster prevention perspective) of community and government agencies responsible for risk management increases the likelihood that agencies will fail to provide the information and resources community members deem necessary to meet their needs and expectations. What does this mean for risk management?

The New Zealand analysis highlighted a need for closer attention to be directed to community processes and the community-civic agency relationship than has previously been the norm in more culturally-individualistic countries. In this regard, evidence for the effective role of mechanisms such as Jishubo, particularly if people are active volunteers [24], provides tangible evidence of the benefits accruing from the presence of empowering links between communities and civic agencies within risk management strategies. While cultural differences mean that replication of this specific mechanism may not be totally terable in culturally individualistic countries like New Zealand, it
illustrates the importance of facilitating active community-civic agency interaction in risk management programs. Lessons can also flow in the opposite direction. Research in New Zealand on the origins of outcome expectancy beliefs and how they can be managed to facilitate preparation could be used by to provide emergency and risk management agencies in Japan with cost-effective access to strategies that can be used to influence outcome expectancy beliefs.

These analyses identified how culture-specific practices (e.g., gotong royong) that were independent of risk management per se could nonetheless be implicated in developing resilience. However, until more systematic research into this relationship is undertaken, this link must remain tentative. That pursuing this issue may be worthwhile is evident from other work that demonstrates how cultural predispositions can influence resilience in populations that have faced disaster.

4. The Relationship between Culture and Resilience

The relationship between community life and disaster resilience is evident in some recent work in Taiwan [28, 29]. Jang [28] discussed how a cultural predisposition in the Hakka people residing in Tung Shih in Taiwan, the Hakka Spirit, can influence peoples’ disaster resilience. In the aftermath of the 921 or Chi Chi earthquake (September 21st, 1999) in Taiwan, Jang described how elements of the Hakka Spirit played a role in predicting resilience and posttraumatic growth in residents of Tung Shih.

The Hakka Spirit represents a set of socio-cultural beliefs (e.g., frugality, diligence, self-reliance, social responsibility, and persistence) that increase the capacity of people to thrive in adversarial situations, and, when enacted, facilitates people’s ability to respond to adverse circumstances in a manner that promotes resilience. An important characteristic of the Hakka Spirit is its emphasis on the belief that people should not try to control nature, but strive to co-exist with nature in an harmonious way.

Parallels between the elements of the Hakka Spirit and the contents of the model introduced above can be drawn to illustrate how certain characteristics of community life influence disaster resilience [29]. In particular, the farming practices of the Hakka people can be implicated in how outcome expectancy, collective efficacy and community participation, developed from confronting challenges in everyday life. Typhoons strike Tung Shih annually, and often cause damage to property and produce. However, it appears that interaction between the characteristics of the Hakka Spirit, the farming practices it engenders, and the response to typhoon-related experiences over time may have increased the resilience of the Hakka people dealing with the devastating consequences of the 921 earthquake.

Most of the people in Tung Shih are farmers. Over time, they developed (positive) outcome expectancy beliefs through farming practices that evolved to limit the impact of typhoons on their livelihood. For example, typhoons often occur from July through September, and destroy the buds of fruit trees. As soon as the typhoon leaves the island, farmers would graft buds into fruit trees, with the outcome expectancy being that the grafted buds would bear fruit. Hakka farmers might have to repeat the same process several times depending on the number and severity of typhoon in that particular year. The development of this kind of outcome expectancy belief spilled over into their disaster preparedness and was linked to increasing the likelihood that people would act to secure their homes from hazard consequences [28]. Farming practices also support the development of community participation and collective efficacy.
Tung Shih is a mountainous township comprising many small peasant farms (orchards) where mechanised farming is difficult and seasonal work demands are high. To overcome these challenges, farmers help each other through a reciprocal process. For example, farmers A, B, C, D, and E would work on A’s orchard for 2 days or so, and then the whole group move to B’s orchard and so on. By doing so, they don’t need to worry about high labor costs or shortages. Such collaboration has been practiced for some time in Tung Shih. The community participation and collective efficacy competencies derived from this approach to the demands of daily life underpinned the development of neighbourhood and community response to reconstruction projects (all neighbors working to rebuild their homes to comply with new building codes to develop a safer community for all) and facilitated their ability to adapt to the new reality that people were confronted with after the 921 earthquake [28]. Collective efficacy was also sustained by the refusal to concede defeat and the sense of optimism and social responsibility to family and neighbors that is an implicit characteristic of the Hakka Spirit.

An important issue to consider here is the fact that the practices adopted by the Hakka people to respond to the hazards they encountered were consistent with their cultural beliefs. This need not always be the case. In an era when hazard mitigation practices are increasingly using engineering, technological and land-use strategies, it is important to consider whether the interaction between cultural beliefs and mitigation strategy might influence the effectiveness of the latter. The importance of including an understanding of this relationship in risk management planning can be illustrated in study into the relationship between Hawaiian cultural beliefs and levels of community support for volcanic hazard mitigation measures [30].

Gregg et al. [30] discussed how a need to consider cultural factors arose when the State of Hawai’i were exploring, in 2002, the possibility of using engineering solutions to divert lava flows from future volcanic eruptions in high risk areas in Hawai’i. Cultural considerations emerged in the context of how Hawaiian beliefs in Pele, the Goddess of volcanoes, could increase cultural sensitivity to engineering solutions because they would interfere with the essence of Pele (e.g., diverting lava flows represents interfering with the wishes of Pele). To explore this issue Gregg et al. examined how factors such identifying with Hawaiian ethnicity and belief in Pele could influence support for mitigation measures that involved interfering with or diverting lava flows [30]. Significant differences were found for both beliefs and ethnicity [30]. The findings are summarised in Table 1.

It is clear from the responses listed in Table 1 that identifying with Hawaiian ethnicity influenced levels of support for engineering mitigation measures involving diverting lava flows using specially constructed walls or bombing lava flows. Overall, respondents identifying with Hawaiian ethnicity were significantly less likely to support each action and significantly more likely to disagree with the adoption of each measure [30]. Clearly ethnic identification, and the cultural beliefs that accompany this identification (e.g., reverence for lava as a physical manifestation of Pele) do influence the acceptability of mitigation practices.

These data highlight the importance of accommodating cultural and ethnic practices and diversity in mitigation planning. A failure to do so could increase vulnerability (e.g., because people will not support or adopt measures) or increase the risk of community fragmentation (e.g., by creating opportunities for disagreement amongst members of the same community, reducing future levels of community
participation on hazard issues). Proposing measures that conflict with cultural or ethnic beliefs or practices could increase distrust of civic authorities responsible for risk management, increase the likelihood of risk management being inconsistent with social justice principles, and thus reducing community resilience [1].

5. Conclusion

This paper supports the view that sustainability in areas susceptible to periodic hazard activity can be developed by increasing community resilience. The approach adopted here focused on understanding how mainstream community competencies and characteristics could influence disaster resilience. The fact that a level of disaster resilience can reflect the influence of pre-existing community characteristics and competencies supports the view that risk management strategies can be developed and implemented by integrating them with mainstream community development activities [7, 12, 31, 32]. Risk management strategies that dovetail with community development activities are more likely to be perceived, by community members and civic authorities alike, as offering a solution that has immediate benefits, by facilitating the development of social capital that will show a return on investment in everyday life, and not just in the event of the occurrence of a disaster at some indeterminate time in the future.

Building on capacities developed through mainstream activities increases the likelihood that some level of resilience will be sustained over time. That is, resilience can be forged and sustained through community engagement in activities concerned with identifying and dealing with local issues even if they have little or nothing to do with hazard readiness per se (e.g., gotong royong in communities surrounding Mt. Merapi; farming in the case of the Hakka). Participation in identifying shared problems and collaborating with others to develop and implement solutions to resolve them engenders the development of several resilience competencies (e.g., community participation, collective efficacy) that, in turn, facilitate the development of resilience and increase the sustainability of societal functioning during a disaster.

Understanding how to develop a sustainable community capacity to cope with adapt to hazard consequences can also benefit from cross-cultural research. The work discussed in this paper illustrated how cultural characteristics (e.g., Hakka Spirit, Hawaiian ethnicity and beliefs) deserve to play prominent roles in risk management planning. The findings discussed above highlight the potential for cross-fertilization in research and intervention that can accrue from cross-cultural collaboration. The study on the relationship between Hawaiian beliefs and levels of acceptance of mitigation options has additional implications for risk management in multicultural countries.

In increasingly pluralistic societies, risk management strategies must be applied against a backdrop of growing diversity with regard to people’s needs, perceptions, goals and expectations. Reconciling this diversity with the costs and benefits of hazard mitigation in fair and just ways is a demanding task and one that requires risk management strategies to be based on social justice principles. Community engagement in decision making about acceptable levels of risk and the acceptability of strategies used to mitigate this risk positively influence risk acceptance, increase community members’ acceptance of responsibility for their own safety, and increase collective commitment to confront hazard consequences using community-led mitigation strategies.

By testing the model with different hazards (tsunami, earthquake, volcanic) and cultures (New Zealand, Japan, Indonesia), it is evident that it has some all-hazards and
cross-cultural utility. As such, this would allow countries that lack the resources to research resilience themselves with a foundation for their risk management planning, and provide opportunities for collaborative learning across cultural boundaries.

The pursuit of sustainable risk management will also need to accommodate changes in societal priorities (e.g., from natural hazards to terrorism), hazard-scapes (e.g., from global warming, environmental degradation), as well as changing community membership, goals, needs and expectations. The assessment and development of resilience must be seen as a dynamic and iterative process. In conclusion, when risk management strategies promote resilience, estimates of community capability to deal with, adapt to, and develop from exposure to natural disaster will increase substantially, as will confidence in the planning and policies that define societal responsibility and the actions they stimulate to ensure a sustained capacity for communities to co-exist with the hazardous elements in their environment.

References


Table 1. The relationship between Ethnicity (Hawaiian versus Other) and support for engineering mitigation measures. Adapted from Gregg et al. [30]

<table>
<thead>
<tr>
<th></th>
<th>Hawaiian Ethnicity</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
<td>Yes</td>
</tr>
<tr>
<td>Agree to help build walls</td>
<td>63</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Agree that soldiers should bomb lava</td>
<td>12</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>Willing to help unload bombs</td>
<td>27</td>
<td>66</td>
<td>35</td>
</tr>
</tbody>
</table>

Figure 1. The test of the resilience model for tsunami preparedness in Kodiak, Alaska (Adapted from Paton et al., 2008a)

Goodness of Fit: $g^2 = 15.19, df = 13, p=0.117; RMSEA = 0.037, 90% CI 0.007, NFI = 0.99, GFI = 0.99, AGFI = 0.95.
Figure 2: Model comparison in New Zealand, Japan and Indonesia

More Individualistic

Hofstede Score

79

More Collectivistic

46

14

Disaster Prevention and Mitigation System