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Considering socio-cultural factors of disaster risk management

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Abstract

Purpose – The purpose of this paper is to explore the relationship between factors of socio-cultural contexts and disaster risk. Recent efforts by international organizations and research scholarship have emphasized that applying contextual understandings of human behavior can improve the effectiveness of disaster risk management (DRM).

Design/methodology/approach – The research employs multiple correlation analysis to find significant relationships between two sources of socio-cultural data and the World Risk Index scores.

Findings – There are interesting relationships between various measures of socio-cultural context and disaster risk, such as correlations with levels of individualism, self-expression, and secular-rational values.

Research limitations/implications – While using the broadest sample available with the data sources, generalizations about the relationships must be tempered as inherently anecdotal and needing greater depth of study. The national level of analysis is controversial.

Practical implications – Emergency managers can extend the knowledge about socio-cultural influences on disaster risk to tailor policy for effective practices.

Social implications – Societies may recognize their behaviors as being conducive or obstructive to DRM based on their socio-cultural characteristics; governments may operationalize the findings into policy responses for more nuanced mitigation efforts.

Originality/value – This research adds to the momentum for considering non-technical approaches to DRM and expands the potential for social science derived variables in DRM.

Keywords Disaster management, Cultural behaviour, Emergency management theory, Risk behaviour

Paper type Research paper

Introduction

The growth of disaster occurrences in contemporary societies is largely an artifact of human activity, rather than an increase in the frequency of the phenomena themselves (Oliver-Smith, 1996; Perrow, 1984/1999; Tierney, 2014). This prompts the need to integrate social sciences into disaster risk management (DRM) to improve understanding of the phenomena in societies, in contrast to the technological approach that attempts to engineer DRM solutions apart from subjective realities. The *Sendai Framework for Disaster Risk Reduction 2015-2030* emphasizes that future emergency management should integrate behavioral aspects, including the concepts of understanding risk, governance, investing, and preparedness for disasters (UNISDR, 2015). This research considers two different ways of measuring socio-cultural contexts and how they may inform better approaches to DRM governance: the World Values Survey (WVS) and Dimensions of National Culture (DNC). This is not to say that previous research has ignored cultural contexts – a notable recent entry is the *World*

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Disasters Report: Focus on Culture and Risk (Cannon and Schipper, 2014) that "looks at different aspects of how culture affects disaster risk reduction (DRR) and how disasters and risk influence culture" (p. 8) – but the mass of DRM research has come from natural science perspectives. This research aims to add depth to social science concerns for DRM in the hopes of building a more holistic (Quarantelli, 1979) and strategic (Choi, 2008) approach that is adaptable to a variety of contexts.

Recently, DRM research has in fact begun exploring the influence of socio-cultural variables on mitigation outcomes (Comfort, 2012a, b; IFRC, 2014; Tierney, 2014; Cannon and Schipper, 2014). The variety of factors that are coming into play for DRM research include a population's resilience (Donahue *et al.*, 2013; Norris *et al.*, 2008), its level of economic development (Kellenberg and Mobarak, 2008), and its patterns of behavior in response to risk (Dillon *et al.*, 2014; Kunreuther *et al.*, 2013; Paton and Johnston, 2001). Emerging theories have focussed on how to integrate the empirical lessons about population behaviors into effective DRM policy (Donahue *et al.*, 2013; Ha, 2015; Vermeulen, 2014; Viscusi and Zeckhauser, 2006). There is also a growing field of work about how government agencies can provide effective governance for disasters based on organizational capacity and standard models of risk behavior (Shavell, 2014; Smith *et al.*, 2006; Wang and Kuo, 2014; Wilson and McCreight, 2012). Despite this range and depth of research, the field has not offered a coherent analysis of how socio-cultural variables can be used to improve DRM from an interdisciplinary perspective. The interplay of disasters with a population's politics, economics, community, and administration is a complex calculus that cannot be served from a single perspective.

This paper attempts to bring together the ideas about socio-cultural influences on DRM. The expectation is an enhanced understanding of the importance of those influences on DRM effectiveness in order to better tailor DRM to the context it serves. This research discusses how those contexts can differ and what those differences mean for organizations tasked with DRM. It is worth emphasizing that this work is promoting an interdisciplinary approach to DRM in order to complement the necessarily cross-cultural nature of the topic (Hofstede, 2001, p. 19). That is to say that the comparative nature of the study demands that no single discipline can provide an appropriately comprehensive frame of analysis.

The basic argument is that, given there may be such a thing as a measurable notion of "national culture" (Hofstede, 2001; Inglehart, 1997) and that differences in a nation's disaster risk exist (Mucke *et al.*, 2014), the ideal approach to DRM should recognize the unique contexts of a society. Thus, there is a need to investigate the relationship between social culture and disaster risk to find any patterns of association. The concepts considered as part of a social culture include such things as a population's social attitudes, values, ideological foundations, acceptance of authority, risk orientation, and overall development, as well as how they are manifest in behaviors and action. This research raises some simple questions that have complex answers: Which societal qualities are related to better DRM effectiveness? What human behaviors can be exploited or confronted to improve DRM? Underlying these questions is the broader challenges of figuring out what, if anything, can DRM do to integrate the findings for improved practice?

To these interests, two significant and well-established socio-cultural measures are analyzed and posed as potential factors of the DRM model. Hofstede's (2001) (DNC) look at several dichotomous-spectrum characteristics of a population to inform their relative collective patterns of thinking, which "are reflected in the meaning people attach to

various aspects of life and which become crystallized in the institutions of a society" (http://geert-hofstede.com). WVS links people's beliefs to their societal development, using two dimensions of cross-cultural variation that are informed by a continuous monitoring of myriad aspects by widespread surveys and evolving analyses (www.worldvaluessurvey.org/). The two sources have some overlap, but together they provide a broad-based characterization that can then be used to operationalize each nation as a unit of analysis against other measures. In this case, the measures are juxtaposed with the World Risk Report 2015 Index scores (WRI) that indicate the exposure and vulnerability of a nation based on an array of demographic, economic, political, and disaster data (www.worldriskreport.org/).

This is exploratory research as there has yet to be established an empirically grounded theory of how any of these particular measures would be directly related to disaster risk. This is partly due to the sporadic and somewhat infrequent occurrence of disasters as a dependent variable (hence, the use of the WRI scores as a proxy), as well as the limitations of sample size and the variation in type of measurement. If a theory were advanced, then it would postulate that disaster risk is mitigated by societies that are more cautious, educated, and wealthy. Yet this claim cannot account for the time order of causality, nor is it particularly useful as a prescriptive idea. The objective herein is merely to describe some of the socio-cultural characteristics of nations at risk in order that the context can be accounted for in more effective DRM planning.

It is necessary to qualify the study being conducted at the national level of measurement. The convenience and robustness of the data makes for reliability in the analysis regardless of any assessments of global validity. This is not to excuse the fallacy of summarily characterizing the socio-cultural contexts of large, heterogeneous nations according to their political borders; it is certainly presumptuous to say that all people of a certain country are wholly assimilated to a dimension or value. Nevertheless, there are countries that exhibit strong homogeneity in such measures (e.g. Iceland, Japan, and Korea). Yet it is also missing the point to dismiss such attempts without conceding that there may be a starting place for such an approach to DRM policy, notwithstanding the possibility that regional (sub-national) socio-cultural contexts can be studied. Therefore this research does not make prescriptions according to national boundaries, opting instead for a more conservative goal of finding associations between generalized socio-cultural contexts and disaster risk for future application to DRM policy.

Literature review

The research literature on socio-political, cultural, and other "ancillary" factors of disaster management is gaining prominence. The globalization effort of the UNISDR and other agencies notwithstanding, there is still little scholarship that discusses the relative effectiveness of policies between countries. The reasons for this shortfall start with the acknowledgment that social and cultural elements are unique to each context (and even by regions within nations), closely followed by the extension of those unique elements into the unique processes that form DRM policies. As stated in the World Disaster Report (IFRC, 2014, p. 8): "The one thing that is certain is that we will have less sustained impact if we do not adequately take account of people's cultures, beliefs, and attitudes in relation to risk."

This prompts the question of whether or not we can have a global perspective without first compiling a systematic analysis of the various national or local (Torry, 1979) perspectives to DRM. Quarantelli (1979) initialized ideas for cross-cultural studies in disaster response behaviors, but the small number of comparative studies that have

followed tend to focus on recovery efforts across different contexts (Kearns, 2011) with few exceptions. Another cluster of research was presented in a two-part series in the *Journal of Comparative Policy Analysis*, wherein Comfort (2012a) recognized that, "reducing the risk of losses in lives, property, and disruption from extreme events is a global policy problem that can best be studied in comparative perspective" (p. 109) and noted that, "rapid technical, organizational, and cultural changes often intersect to create novel patterns of risk" (Comfort, 2012b, p. 199).

Wisner (1978) made "an appeal for a significantly comparative method in disaster research" that introduces the notion of alternative study frameworks for DRM. Torry (1979) may be one of the original "interdisciplinary" DRM researchers, invoking an anthropological consideration of DRM that was followed by a significant study by Oliver-Smith (1996), among others. Quarantelli (1979) marks an early call for the study of cross-cultural behavior in the context of disasters. These early works were mostly theoretical propositions that DRM was not solely a "hard science" issue.

Perrow's *Normal Accidents* (1984/1999) introduced the idea that socio-cultural behaviors have significant influence on disaster risk and its management. His case studies demonstrated that human action and reaction are integral to the incidence and effects of disaster. Tierney's (2014) study from the sociology perspective took the notion further, laying significant blame for disasters on social practices. Between these two texts, there exists a robust argument for understanding DRM as a socio-cultural problem before trying to apply technological solutions. Their work can be bolstered by a recent work by Ha (2015, p. 75) that dichotomized the "hardware" and "software" of DRM: "The software-oriented approach supports social aspects of emergency management. The position of emergency management is not neutral among individual values or organizational values."

Cutter *et al.* (2010) studied disaster resilience using local communities as the unit of analysis. They focussed on a region in the USA and found variation was related to urban/rural classification of communities, but they were unable to isolate the effects of socio-cultural indicators on disaster resilience. The call for further research from their work was to "suggest that the baseline indicators provide the first "broad brush" of the patterns of disaster resilience within and between places and the underlying factors contributing to it" (Cutter *et al.*, 2010, p. 18). Their work utilized a number of measures that are part of any socio-cultural study of a population, such as governance quality and welfare characteristics within resilience components.

Looking at comparative social studies for disasters, Yoon (2012) took aim at the methodologies of social vulnerability research. The research develops a framework for assessing inductive and deductive indices, then advances a factor-analysis to produce dimensions of social vulnerability that informs a study of property damages in coastal counties of the USA. Yoon (2012, p. 840) concludes that social vulnerability is a necessary part of DRM and that, "social vulnerability is often hidden and complex, nested in various human aspects, and place-sensitive."

Eiser *et al.* (2012) drilled down to individual perceptions of risk and action, finding that behavioral factors and non-rational decision making in the context of disasters are vital considerations. They reiterate that the ideal is often (wrongly) modeled from instances where populations have perfect information and that DRM practices do not adequately integrate variance in socio-cultural factors. Kunreuther (1996) and Kunreuther *et al.* (2013), using a behavioral economics perspective, also focussed on individual understandings of disaster risk and found that people have difficulty judging the efficiency of mitigation efforts in DRM, often to their own disadvantage.

The World Disasters Report (Cannon and Schipper, 2014) is subtitled, "Focus on culture and risk," suggesting that our understanding of DRM is moving from a mechanistic approach to something more heuristic and contextually based. This introduces a particular challenge for agencies and governments that must adapt DRM models to fit circumstances, not only including considerations of the quantifiable measures of development, but also considering culture and other intangible qualities of a society. Other organizations have taken up the humanitarian aspects of DRM and published reports that highlight the non-technical aspects to mitigate risk. DARA's reports and Risk Reduction Index (www.daraint.org) are a solid effort toward operationalizing the idea behind the WRI, insofar as taking the data to task for direct action in developing societies. The UNISDR publishes a bi-annual Global Assessment Report with a specific focus on the development of its global DRR initiative in each volume. The aforementioned Sendai Framework (UNISDR, 2015, p. 5) integrated some of the interests and messages of the prior four Global Assessment Reports in its call for "improved understanding of disaster risk in all its dimensions." The UNDP report (Pelling *et al.*, 2004) emphasized DRM as a part of modern development, rather than an afterthought to nations' economic agendas. This report also featured a "disaster risk index" that made connections between characteristics of societies and their risk profiles.

Data and methodology

This section describes the data in this study and how the measures are connected to concerns of DRM. For this study, the WRI is essentially a dependent variable and the two other data sources are examined for their relationship to the WRI. There is a valid objection to such an analysis being conducted with observations at the national level; nobody would agree that the socio-cultural environment of, say, the Northeastern USA is the same as that of the Southwestern region. Yet the preponderance of data collected at this level and the reserved claims from the forthcoming analysis allow for some latitude to say that the "labels" of a country based on the data sources is not meant to serve as anything more than a proxy for a type of behavioral context that seems to be located in that place. Thus, the conclusions drawn from the eventual analysis are not intended to make specific claims about a country, but rather to offer some connections between certain kinds of socio-cultural characteristics and effective DRM efforts.

World Risk Index (WRI)

The World Risk Report 2015 (Welle and Birkmann, 2015) is in a series of annual publications that calculates the WRI from 28 indicators. The WRI is a compilation of those indicators according to weighted values measured at the national level that yield "dimensionless index values" (Welle and Birkmann, 2015, p. 42). The WRI is posited as a measure of a country's exposure and vulnerability to natural events, but it "is not a forecasting model […] Rather, it demonstrates that risks in the context of natural hazards and the potential effects of climate changes are not solely the result of extreme natural events but that they are also determined by societal conditions" (Welle and Birkmann, 2015, p. 42). The WRI score is akin to knowing the climate of a nation; a country may have a tropical climate, but that does not mean we know whether it will rain on any particular day next year. While the WRI is valuable to DRM, it is missing some notable qualitative elements in its array of data. The WRI captures some of the lived behavioral characteristics of societies, but not so directly the cultural dimensions.

As admitted by the WRI authors, several factors that would ideally be included in its calculation, such as social networks and adaptation strategies, do not have sufficient global data available (Welle and Birkmann, 2015, pp. 42-43). The description of the main components of the WRI are as follows (Welle and Birkmann, 2015, pp. 42-43):

> *Exposure* means that an entity (population, built-up area, infrastructure component, environmental area) is exposed to one or more natural hazards.
>
> *Susceptibility* is understood here as the likelihood of experiencing harm in the event of a natural hazard process. Thus, susceptibility describes structural characteristics and framework conditions of a society.
>
> *Coping and coping capacities* comprise various abilities of societies and exposed elements to minimize negative impacts of natural hazards and climate change through direct action and the resources available. Coping capacities encompass measures and abilities that are immediately available to reduce harm and damages in the occurrence of an event.
>
> *Adaptation*, unlike coping, is understood as a long-term process that also includes structural changes and measures and strategies dealing with and attempting to address the negative impacts of natural hazards and climate change in the long run.

There is an interesting facet to a sub-analysis of the WRI components: exposure has the weakest correlations to the other components, but the strongest correlations to the WRI score itself. This is an artifact of the WRI methodology, but it does suggest that the non-human elements of disaster risk stand apart from the other three components (see Table I).

WVS

The Worlds Values Survey project has a history dating to the early 1980s with a conglomerate of international social scientists who have conducted hundreds of thousands of interviews. Its purpose is, "to help scientists and policy makers understand changes in the beliefs, values and motivations of people throughout the world" for "the full range of global variations, from very poor to very rich countries, in all of the world's major cultural zones" (www.worldvaluessurvey.org). The version used in this study is the sixth iteration for 2015 that plots countries on a coordinate system according to the spectra of traditional vs secular-rational values and survival vs self-expression values. The WVS observations were recorded as coordinate locations on the Inglehart-Welzel Cultural Map as found on the website. The definitions of the values are best quoted at length:

> *Traditional values* emphasize the importance of religion, parent-child ties, deference to authority and traditional family values. People who embrace these values also reject divorce, abortion, euthanasia and suicide. These societies have high levels of national pride and a nationalistic outlook.
>
> *Secular-rational values* have the opposite preferences to the traditional values. These societies place less emphasis on religion, traditional family values and authority. Divorce, abortion, euthanasia and suicide are seen as relatively acceptable.
>
> *Survival values* place emphasis on economic and physical security. It is linked with a relatively ethnocentric outlook and low levels of trust and tolerance.
>
> *Self-expression values* give high priority to environmental protection, growing tolerance of foreigners, gays and lesbians and gender equality, and rising demands for participation in decision-making in economic and political life.

Table I.
Multiple correlation of all study variables

	WRI components						WVS			DNC				
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*
A. World Risk Index 2015	1.000													
B. Exposition	0.919	1.000												
C. Vulnerability	0.618	0.330	1.000											
D. Susceptibility	0.672	0.415	0.926	1.000										
E. Lack of coping capacities	0.574	0.290	0.975	0.857	1.000									
F. Lack of adaptive capacities	0.567	0.291	0.955	0.860	0.886	1.000								
G. Survival/self-expression	−0.220	−0.097	−0.485	−0.338	−0.481	−0.527	1.000							
H. Traditional/Secular-rational	−0.431	−0.212	−0.693	−0.593	−0.742	−0.593	0.090	1.000						
I. Power distance	0.452	0.284	0.629	0.497	0.646	0.610	−0.564	−0.448	1.000					
J. Individualism	−0.490	−0.324	−0.706	−0.589	−0.719	−0.670	0.520	0.537	−0.673	1.000				
K. Masculinity	0.106	0.144	0.081	0.083	0.095	0.046	−0.016	−0.239	0.143	0.050	1.000			
L. Uncertainty avoidance	0.002	0.040	−0.007	−0.031	0.000	0.001	−0.311	−0.169	0.300	−0.325	−0.011	1.000		
M. Long-Term orientation	−0.209	−0.090	−0.327	−0.309	−0.406	−0.173	−0.287	0.706	−0.025	0.198	−0.002	0.015	1.000	
N. Indulgence	0.017	0.082	−0.169	−0.118	−0.105	−0.281	0.708	−0.341	−0.243	0.090	0.106	−0.106	−0.558	1.000

Inglehart's (1997) long-term study of culture and change argues that it is possible to provide a current snapshot of societies relative to each other in terms of development values. The "map" shows positions of countries according to their values and allows the rough grouping of countries by geographic and dominant value commonalities. While it does not purport to affix countries to labels for ready identification, the WVS is more than an anecdotal scheme for classifying nations. In general, more developed nations tend to score higher for both secular-rational and self-expression values.

Dimensions of national culture

Hofstede's (2001) ambitious work not only deems to categorize and summarize national cultures in a handful of measurable dimensions, but it does an admirable job of reconciling the inherently elitist conceit of such a task with substantial empiricism and objectivity. Stemming from his research into corporate cultures for multinational companies in the 1960s, Hofstede has continued the project over five decades to develop a comprehensive corpus that is accessible to a variety of purposes.

Hofstede's work provides a relative indication of a nation's culture also based on spectra of dimensions. The latest iteration of the study has six dimensions (http://geert-hofstede.com)[1]. Again, the definitions are best given by direct quote at length from the website:

> *Power Distance Index*: This dimension expresses the degree to which the less powerful members of a society accept and expect that power is distributed unequally […] People in societies exhibiting a large degree of power distance accept a hierarchical order in which everybody has a place and which needs no further justification. In societies with low power distance, people strive to equalize the distribution of power and demand justification for inequalities of power.
>
> *Individualism vs Collectivism*: The high side of this dimension, called individualism, can be defined as a preference for a loosely knit social framework in which individuals are expected to take care of only themselves and their immediate families. Its opposite, collectivism, represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty.
>
> *Masculinity vs Femininity*: The Masculinity side of this dimension represents a preference in society for achievement, heroism, assertiveness and material rewards for success. Society at large is more competitive. Its opposite, femininity, stands for a preference for cooperation, modesty, caring for the weak and quality of life. Society at large is more consensus oriented.
>
> *Uncertainty Avoidance Index*: The uncertainty avoidance dimension expresses the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity. The fundamental issue here is how a society deals with the fact that the future can never be known […] Countries exhibiting strong UAI maintain rigid codes of belief and behavior and are intolerant of unorthodox behavior and ideas. Weak UAI societies maintain a more relaxed attitude in which practice counts more than principles.
>
> *Long Term Orientation vs Short Term Normative Orientation*: Every society has to maintain some links with its own past while dealing with the challenges of the present and the future […] Societies who score low on this dimension prefer to maintain time-honored traditions and norms while viewing societal change with suspicion. Those with a culture which scores high, on the other hand, take a more pragmatic approach: they encourage thrift and efforts in modern education as a way to prepare for the future.

Indulgence vs Restraint: Indulgence stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun. Restraint stands for a society that suppresses gratification of needs and regulates it by means of strict social norms.

The validity of Hofstede's cultural dimensions is not without contention (e.g. Blodgett *et al.*, 2008; McSweeney, 2002); however, it does provide a framework for classifying populations in the abstract and finding cultures that are alike or dissimilar. DNC is positioned as a management tool; the theory of his work seeks to support the effect of society's culture on its values and how this is realized in its behavior (Hofstede, 2001). For DNC, the general trend is that more developed nations will exhibit lower power distance, masculinity, and uncertainty avoidance scores with higher Individualism (long-term orientation and indulgence dimensions do not show any trends with respect to development).

Putting it all together

It is tempting to try and build a model that extends the analysis of the independent socio-cultural factor variables of DRM to predict the dependent variable value of the WRI score. Such a model would necessarily include a control for the variation in the disaster phenomena themselves, as well as demographic qualities that are not already included in the other variables. This would dictate a wide array of independent variables while having a limited sample of countries for which the information is available. Variations of such a model were attempted, but there was no reliable and statistically significant relationship to be distilled; this can be attributed to a number of problems, the least of which is the small sample size. It is also conceivable that statistical relationships could be examined individually for each of the two sources (or select variables from each of the sources) against the WRI, but that leaves problems pertaining to the variety of scoring methods involved in the levels of measurement and scale. Parsing out all the elements of the indexes and factors to rebuild the research model is also not possible, as the raw data are in some cases not available and it would defeat the objective of using readily available analyses to understand the relationship of intangible factors on material outcomes. In other words, this research is neither designed nor amenable to predicting causal relationships. The indices are considered at the macro level to illuminate relationships for a holistic understanding of DRM effectiveness, rather than the more mechanistic goals of DRM solutions engineering.

As it is, the analysis conducted here is a multiple correlation of the various measures. The sample is restricted to the 62 nations that had complete data for all measures[2]. The measures are all varieties of index scores that are neither consistent in scale nor meaning. For example, a high score on one DNC value indicates a position on a spectrum from one dominant characteristic to another, while a high WRI score indicates that there are significant factors that would put that nation at risk on an absolute basis. The data were cleaned and arranged to conduct statistical analysis. A multiple correlation analysis (Table I) did reveal a number of strong relationships that are discussed below. The correlations show that there may be duplication, if not triangulation, of certain qualities between the measures which helps confirm the reliability and validity of some measures. There is an implied hypothesis supported by the wave of recent research in the socio-cultural considerations that these measures – individually and collectively – have some import to DRM. The WRI's relevance is

obvious, while there may be some question as to how "masculinity" is a consideration for mitigating earthquakes. Indeed, the forthcoming analysis will show where the strongest relationships exist and whether the less pertinent variables' values can be redeemed in the bigger picture.

Analysis and discussion

There are two ways to analyze the data in this study. The first is to consider each of the sources independently from each other and look for relationships to the WRI scores for each country. In this approach, certain measures may show some relationship while others do not. This is problematic insofar as the level of measurement generalizes both the characteristics of a nation's population and its disaster risk as being homogeneous throughout its borders, i.e. it may lead to conclusions that ignore the reality of sub-national diversity in behavior and vulnerability. The second way employs a holistic interpretation, potentially illuminating how different measures contribute to understanding the socio-cultural influences on DRM. Again, the objective is not to establish a time order and determine causality of disaster risk, but rather to find extant variables in populations that may be integrated into other models for greater DRM effectiveness.

Table I shows how the various measures relate to each other. One feature of the analysis stands out: the significant correlations between almost all of the measures, save three of the DNC. Of particular interest is how the relationships stack up against the normative theory of how they should be and if there are any significant surprises therein. With the definitions of the variable components given above, we would expect the following kinds of relationships:

> WRI versus WVS: those populations with higher Self-Expression and Secular-Rational values should have lower scores for WRI while populations that exhibit more Traditional and Survival oriented values will have higher WRI scores. This roughly corresponds to the trends between WVS and development status, as various measures of development are contained within the components of the WRI.
>
> WRI versus DNC: populations that tend to have lower scores for Power Distance, Individualism, Masculinity, Uncertainty Avoidance, and Indulgence dimensions with a higher Long-Term Orientation score should exhibit lower WRI scores. These suppositions loosely follow development levels, but are not as consistent as the WVS.

A study of the correlation matrix shows both confirmation and rejection of the normative expectations. If the WRI is held as an efficient proxy for measuring the need of DRM, then those populations that are characterized by Survival and Traditional values ("low" WVS scores) will have higher WRI scores, as shown by the negative correlation coefficients. This is in accordance with expectations, suggesting that survival and traditional oriented cultural contexts may need greater DRM efforts. Looking at the DNC components, greater power distance and lower Individualism values (strong positive and strong negative correlation coefficients, respectively) are associated with higher WRI scores. The relationship between Individualism and WRI is unexpected; nations with a loosely-knit social framework actually correspond to lower WRI scores. This finding could be investigated further with other techniques to better understand the dynamics of social capital for DRM (Kapucu, 2008; Paton and Johnston, 2001; Tierney, 2014; Viscusi and Zeckhauser, 2006). Although the correlation coefficient is not strong, the negative value for long-term orientation agrees with expectations insofar as populations with a more strategic outlook should have lower WRI scores. It is curious that the other DNC variables do not have significant correlations to WRI,

especially as one would expect uncertainty avoidance to show some relationship perceptions of disaster risk.

Putting the analysis together into a cautious summary, we can say that lower WRI scores are correlated to greater self-expression, secular-rational, and individualism values, as well as lower power distance values. A greater long-term orientation value shows a weak relationship with lower WRI scores. While no single nation "wins" by ticking off all the right values for the trigger variables and having a low WRI score, among those with veritable threats of disaster (as seen by above average Exposition values in the WRI component), Australia, New Zealand, and The Netherlands stand out. The socio-cultural characteristics of those nations, as measured by the variables with statistical significance, display correlations that tend toward lower WRI scores.

The value in applying WVS and DNC is that emergency managers can "play" to a population's interests more effectively to improve DRM outcomes. Trying to change a nation's culture may be an overwhelming task, but knowing the culture in order to tailor DRM policy for a particular context can serve as an effective approach. A generalized policy prescription would advocate more opportunities for citizen-government discourse about disaster management centered on reinforcing individual responsibility and communicating empirical understandings of disaster risk. A society with high uncertainty avoidance might respond better to mitigation efforts, while a population that displays survival values would benefit from guidance in aspects that emphasize personal accountability. These lessons apply across disciplines; policy makers, civil engineers, security forces, and other agencies can all benefit by knowing what kinds of DRM strategies will be most necessary and effective. The direct connection between a particular WVS or DNC score and any single DRM practice is far from evidentiary, but that such a connection might be tested and tenable is surely attractive for future studies.

Conclusion

DRM is an especially pernicious challenge for governance; it must contend with the disaster itself, the population at risk, and the government agencies tasked with protecting the public from the disaster. A standard approach is to confront the unpredictable nature of the disaster phenomena with rational understandings of the population at risk, technological applications, and the attendant governance capacities. The behaviors of a population, as affected by socio-cultural factors, can be difficult to ascertain. This leaves DRM agencies to deal with two unknown values when it comes to the calculus for effective mitigation: the disaster phenomena and the people. This research illuminates some of the ways that a population's behavioral context can vary according to its socio-cultural character in an attempt to get a better handle on one of these unknowns.

Socio-cultural factors have material influence on a population's relationship to disasters, be they natural or man-made. There is a rabbit-hole of blame involved in this situation, questioning the time order of behaviors and disasters (especially on the man-made side) that is extremely difficult to ascertain due to the limited sample size for any sort of causal relationship to be established through quantitative analysis. This has been a continued limitation to the social sciences' ability to gain a foothold in DRM research, notwithstanding the many case studies available for disaster management study. Nevertheless, some useful relationships are apparent between socio-cultural aspects of populations and their disaster risk in the foregoing analysis. Accepting the WRI as a viable and valid assessment of a nation's exposure, susceptibility, coping capacity, and adaptation qualities, the analysis shows relationships to underscore that the socio-cultural context should be considered in DRM profiles. While it would be

convenient if the analysis were able to say something to the effect that, "Country X has these scores for DNC and WVS, therefore the most efficient and effective DRM strategies and tactics will be […]," it is quite impossible to make such deductions. The use of nation and country in this discussion is a convenience that does not suggest that the findings can be bluntly applied in a diverse population; most countries are not uniform in their socio-cultural context.

Despite introducing data and referring to them as potential variables in the equation of effective DRM, the intent of this research was to provide empirically founded qualitative information about the variety of socio-cultural effects to DRM. More to the practitioner's perspective, the research asks what qualities and characteristics of a society need to be accounted for in applying best practices of DRM? This research is a brick in the construction of a bigger theory and practice of DRM as a socio-cultural, technological, and governmental endeavor.

Further research related to this topic could investigate the differences in DRM based on a nation's degree of de-/centralized governance (Tsai and Chi, 2012), as it is related to the population's preferences for such level of government involvement. There is also more to be understood at the broader level of governance *vis-à-vis* the Rule of Law (Western constitutional) vs Rule of Man (Eastern institutional) approaches to handling DRM. Another strain of research could build on a feature of one of the sources, such as Hofstede's dimension of individualism/collectivism and the literature on group-based risk aversion characteristics, in order to hypothesize about a population's understanding of disaster vulnerability (WRI score) in light of its level of communalism and the individualism of DRM policy and decision makers. And there is of course opportunity to test the general idea at lower levels of measurement, comparing sub-national regions as such data may become available. In other words, there is a wide array of interesting and potentially educating study to be conducted on socio-cultural facets of DRM in comparative population contexts. This research aimed to open that discourse by introducing just a few interdisciplinary approaches to indicate that the relationship between populations and effective DRM is rich, fascinating, and worthy of continued inquiry.

Notes

1. There is a relationship between the DNC and WVS through one of the latter's primary researchers, Michael Minkov. In a sense, the last two dimensions of are extensions based on the WVS; the correlations between them are apparent in Table I.
2. All 62 nations included in the sample have values for WRI. Four countries – Bangladesh, El Salvador, Italy, and Venezuela – did not have WVS6 2015 coordinates, but were plotted in the WVS5 of 2008. Ecuador, Guatemala, and South Africa did not have DNC values for "long-term orientation" and "indulgence"; the missing values were estimated from those of comparable countries.

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Further reading

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