Identifying Resilience in those Affected by the 2008 Sichuan Earthquake.

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Abstract: Risk is often mathematically described as Risk= Hazard x Vulnerability with the hazard component being largely the technically related aspects and the vulnerability being the more social aspects. The risk predictions from such a relationship were not being realized in disasters and it was noted that the adaptive ability of those affected by disasters significantly reduced the disaster's impact. Researchers have been keen to understand the role of this resilience as it had the promise of gains in terms of disaster response that were more accessible and cost effective then those commonly suggested for "hazard" and "vulnerability". However, the measurement of resilience is difficult, largely because of it's time dependent nature. Quality of Life (QoL) models have been used previously in disasters but not to specifically measure resilience. This papers seeks to address that gap and uses survey data gathered during July 2008 from those affected by the May 12 Sichuan Earthquake, in China to understand the validity of such an approach. In addition, such a survey would create a "baseline" that other researchers and practitioners could reference in later recovery and reconstruction activities.

Keywords: Disaster management, resilience, Sichuan earthquake, survey, DASS42.

Background

China knows about natural disasters (Janku, 2007) and while there is some debate about the exact death tolls and what constitutes a natural disaster a good estimate of the world's top 10 disasters is shown below in table 1. They include four floods, four earthquakes and two cyclones. China was involved in six.

Table 1: The world's most significant natural disasters[1]

Rank	Date and Location	Country	Approximate Deaths
1	1931 Yellow River flood	China	1,000,000–3,700,000
2	1887 Yellow River flood	China	900,000-2,000,000
3	1970 Bhola cyclone	Bangladesh	500,000-1,000,000
4	1556 Shaanxi earthquake	China	830,000
5	1839 India Cyclone	India	300,000+
6	1642 Kaifeng Flood	China	300,000
7	2004 Indian Ocean earthquake/tsunami	Indian Ocean	283,100
8	1976 Tangshan earthquake	China	242,000
9	1975 Banqiao Flood and Dam failure	China	231,000
10	1138 Aleppo earthquake	Syria	230,000

1: from *http://www.wisegeek.com/what-are-the-worlds-deadliest-natural--disasters.htm*

Moreover, within China earthquakes play a major role and have caused 98% of all deaths, 66% of all building damage and 84% of the total economic losses caused by all natural disasters in China from 1950-1999. These are tabulated below in table 2 (Ye, 2002). And at the bottom of this table is the data for the recent May 12 2008 Sichuan earthquake. Clearly earthquakes are a major natural hazard for China.

Table 2: Earthquake Catastrophes from 1950-1999 in China (with more than 1000 deaths)

	Time of Occurrence	Location	Mag.	Death toll	Number of damaged buildings	Economic loss million RMB
1	Aug 15, 1950	Chayu, Tibet	8.6	2,486	4,500	5
2	Mar 22, 1966	Xingtai, Hebei	7.2	8,064	5,080,000	2,103
3	Jan 5, 1970	Tonghai, Yunana	7.8	15,621	338,456	644
4	Feb 6, 1973	Luhuo, Sichuang	7.6	2,199	66,024	195
5	May 11, 1974	Zhaotong, Yunnan	7.2	1,541	66,000	193
6	Feb 4, 1975	Haicheng, Liaoning	7.4	1,328	74,739	1,733
7	Jul 28, 1976	Tangshan, Hebei	7.8	242,769	7,679,800	28,316
8	Sep 21, 1999	Nantou, Taiwan	7.3	2,295	11,6379	57,610
	Total for the 8 earthquakes			276,303	13,425,898	90,799
	Total for all catastrophes 1950-1999			281,706	20,223,989	107,627
	Percentage impact of earthquakes			98%	66%	84%
	12 May 2008	Wenchuan, Sichuan[1]	7.9	69,197	420,000+	120,000+

Based on http://en.wikipedia.org/wiki/2008_Sichuan_earthquake#Property_damage

However, what is additionally significant about this Sichuan Earthquake is that this was the first time that China has allowed outside media and agencies into their disaster area. And the uncertainty for many agencies is how to best assist China given it's extensive natural and vast human resources? Yaoxian Ye (a Professor and advisory Chief Engineer with the Architectural Design and Research Group based in Beijing) makes the following observation on post disaster reconstruction in China that "…we used to analyse the consequences caused by a natural disaster on the basis of natural science and technology in the past. Now we have to consider the social impact of a disaster and take additional actions on the basis of social sciences" (Ye, 2005). And consequently, the issue addressed in this paper is how this can be achieved?

Initial Methodology

What Ye is suggesting is difficult to achieve. Such an approach has problems of "measurement" given the number of variables and their associated measurement systems that impact on the socio-economic conditions in post disaster situations. Most practitioners attempt to measure all of them which usually results in an unwieldy survey instrument that produces unrelated data and un-intelligible results. But previous research has shown the potential for Quality of Life (QoL) Models that are able to cut across this complexity (Potangaroa, 2006).

QoL is defined by Wikipedia as "…an important concern in economics and political science. There are many components to well-being. A large part is standard of living, the amount of money and access to goods and services that a person has; these numbers are fairly easily measured. Others like freedom, happiness, art, environmental health, and innovation are far harder to measure. This has created an inevitable imbalance as programs and policies are created to fit the easily available economic numbers while ignoring the other measures that are very difficult to plan for or assess." (Wikipedia, 2006).

Selection of Survey Instrument

There are 38 such QoL models (Sharpe, 2005). But earlier research has confirmed the particular usefulness of one of these models called the DASS42. (Potangaroa, 2006). The particular advantages of the DASS42 are as follows:

- The DASS42 does not need a before and after survey to draw relative comparisons.

- It has been designed for use by non psycho-social professionals
- It deals with the ubiquitous situation
- The questions are phenomena-logically based and are largely trans cultural
- And importantly in disaster situations, do not generate expectations amongst the surveyed population.

The DASS42 was developed at the University of New South Wales, in Sydney Australia (Lovibond, 1995). And is a "set of three self-report scales designed to measure the negative emotional states of depression, anxiety and stress" and was "constructed not merely as another set of scales to measure conventionally defined emotional states, but to further the process of defining, understanding, and measuring the ubiquitous and clinically significant emotional states usually described as depression, anxiety and stress" (DASS, 2006). The characteristics of high scorers on each DASS scale are as follows:

- Depression scale: self-disparaging, dispirited, gloomy, blue, convinced that life has no meaning or value, pessimistic about the future, unable to experience enjoyment or satisfaction, unable to become interested or involved, slow, lacking in initiative.
- Anxiety scale: apprehensive, panicky, trembly, shaky, aware of dryness of the mouth, breathing difficulties, pounding of the heart, sweatiness of the palms, worried about performance and possible loss of control.
- Stress scale: over-aroused, tense, unable to relax, touchy, easily upset, irritable, easily startled, nervy, jumpy, fidgety, and intolerant of interruption or delay.

One significant advantage (mentioned above) was not requiring a before and after survey. This is because of what the DASS42 developers call a Severity table, shown in table 3 below. This table can "characterise" the DASS42 scores and was constructed by the original developers of the DASS42 (Lovibond, 1995).

Table 3: The DASS42 Severity Table.

	Normal	Mild	Moderate	Severe	Extremely Severe
Depression	0-9	10-13	14-20	21-27	28+
Anxiety	0-7	8-9	10-14	15-19	20+
Stress	0-14	15-18	19-25	26-33	34+

Moreover, the three DASS42 scales also link directly to the Disaster Life Continuum Model (EMA, 2003). This model suggests that depression indices will be higher in the immediate aftermath of a disaster due to a preoccupation and fixation of how things were before the disaster. With time, this reduces and is replaced increasingly by higher levels of anxiety (and despair) as the focus shifts to the future. Previous work has suggested that the time taken for this shift is a useful measure of resilience (Potangaroa, 2005).

So how is knowing this useful?

Application of the Approach

The "fundamental research question is what qualities does one group possess that will help them thrive in the face of adversity?" (Nelson, 2008) which Nelson suggests would be by a comparison of group designs. And hence the use of such QoL information would be in firstly identifying those groups that have such qualities and secondly in comparing different approaches. Interestingly, he gives the example of "..in the studies that followed the Buffalo Creek disaster, those individuals who immediately began restoring their homes and getting involved in community rebuilding effort were significantly less impaired and anxious than those who did not or were not able".

In addition, such information has been previously used to identify the vulnerable sections of disaster communities, to prioritise aid assistance, to guide professional psycho-social assistance and more recently for examining other data collected from disasters (Potangaroa et al, 2008).

Final Methodology

The DASS42, as mentioned earlier, is a standard set of 42 questions. This was translated in Mandarin taking care with questions 5, 8, 12, 14, 22, 26, 33 and 38. These have required extra effort in past translations into Udu, Hindi, Tamil, Bahasa and Acehense and are listed in table 4 below for interest and to give a sense of the type of questions posed in the DASS42.

Table 4: Questions in the DASS42 Requiring Careful Translation.

Quest.	
5	I just couldn't seem to get going
8	I found it difficult to relax
12	I felt that I was using a lot of nervous energy
14	I found myself getting impatient when I was delayed in any way.
22	I found it hard to wind down
26	I felt down-hearted and blue
33	I was in a state of nervous tension
38	I felt that life was meaningless

Those interviewed were asked to classify using a Likert scale of 0 (Did not apply to me at all) to 3 (Applied to me very much, or most of the time) over the past week. In addition to the 42 DASS questions, respondents were also asked their age and gender and this data was analysed and is discussed below. In all, 138 people were surveyed consisting of 66 female and 72 male respondents with 36 (less then 30 years old), 27 (30 to 39 years old), 15 (40 to 49 years old) and 29 (over 50 years old).

The camps in an around Mianzhu were selected for this survey as they were close to Chengdu, were accessible by bus, they were large and there appeared to be open access both to and inside the various camps. But perhaps most importantly, those affected seemed comfortable talking with members of the survey team. A team of 5 volunteers were employed (and are acknowledged at the end of this paper) to complete the DASS42 surveys. Certainly, surveys in other areas would have given a broader picture of the disaster and picked up pockets where the disaster was more distressing. This has been the experience from other similar situations.

Data Analysis and Discussion.

The data collected from these surveys was analysed using EXCEL spreadsheets and the main results from that are tabulated in table 5A and 5B below. Table 5A shows the numerical results while table 5B shows the Severity Table classifications (as listed in table 3 earlier). They show the following:

- Overall: Those surveyed have moved on from the disaster are now looking to their future as shown by the lower Depression and elevated Anxiety levels.
- Gender: Females were (and still are) more affected by the earthquake disaster than males. This imbalance has been recorded in other disaster situations (Potangaroa, 2006).

- Age: There appears to be a spike in this data for those in the 40-49 years old. But that aside, the interesting aspect is that the elevated levels for anxiety are across all the age groups which supports the "overall" conclusion above.

Thus, based on these results it seems that the disaster is being handled well and because the survey area appears typical implies that it could be representative of a majority of the people in Mianzhu and potentially beyond.

Table 5A China 6 weeks after the May 12 2008 Earthquake (DASS42 Results)

		Gender		Age (years)			
	Overall	Female	Male	>30	30-39	40-49	50+
D	8.2	11.5	5.2	8.6	10.6	12.9	11.9
A	9.4	13.6	5.7	12.7	11.0	14.3	11.5
S	11.1	15.2	7.3	13.5	13.6	15.2	15.4
Table 5B China 6 weeks after the May 12 2008 Earthquake (Severity Table)							
D	Normal	Mild	Normal	Normal	Mild	Mild	Mild
A	Moderate	Moderate	Normal	Moderate	Moderate	Severe	Moderate
S	Normal	Mild	Normal	Normal	Normal	Mild	Mild

D= depression, A=Anxiety S= Stress

How well can also be seen when the results for the Sichuan Earthquake are compared to other disasters that are listed in tables 6-10 below. Firstly, the Sichuan outcomes are better than those in Aceh Indonesia (after the 2004 SE Asian Tsunami) and Pakistan (for those affected by the October 8, 2005 Kashmir Earthquake). Both of these instances were surveyed at a similar time after the disaster and were in a similar disaster situation (people displaced from their homes and living in a temporary camp situation). Moreover, the Sichuan outcomes while being higher than those for Tamil Nadu and Sri Lanka, which were taken 234 and 238 weeks respectively after the disaster, were surprisingly lower than those for the Andaman Nicobar Islands ANI (235 weeks after their disaster).

Table 6 Aceh 9-10 weeks after the 26 Dec 2004 Tsunami/Earthquake

		Gender		Age (years)			
	Overall	Female	Male	>30	30-39	40-49	50+
D	9.6	11.6	7.5	10.7	10.2	9.6	8.4
A	15.2	18.3	12.0	17.8	15.8	14.7	14.3
S	13.0	15.7	10.1	15.0	13.5	12.9	11.3
Table 7 Pakistan 5-6 weeks after the Oct 8 2005 Earthquake							
D	19.3	20.4	18.5	22.1	16.8	19.7	18.9
A	18.7	19.6	18.1	21.6	17.2	18.2	17.6
S	23.3	25.4	21.6	24.4	21.7	24.9	22.2
Table 8 Tamil Nadu, India 234 weeks after the Dec 26 2004 Tsunami/Earthquake							
D	9.4	20.4	18.5				
A	9.2	19.6	18.1				
S	9.2	25.4	21.6				
Table 9 ANI, India 235 weeks after the Dec 26 2004 Tsunami/Earthquake							
D	13.1	12.4	14.8	11.5	12.6	10.2	18.9
A	10.0	10.3	9.4	12.4	7.9	7.7	12.3
S	16.3	16.0	16.9	14.6	17.5	12.0	19.9
Table 10 Sri Lanka 238 weeks after the Dec 26 2004 Tsunami/Earthquake							
D	8.0	8.4	7.5	5.4	7.0	8.1	11.4
A	7.5	7.7	7.3	6.4	6.4	5.7	13.0
S	7.4	7.5	7.3	6.4	4.2	6.8	12.6

Thus, the conclusion seems to be that the people in Mianzhu are highly resilient. Why is that and as posed by Nelson earlier "what qualities does one group possess that will help them thrive in the face of adversity?"

From a built environment perspective, the major difference between these situations was the completion of housing and infrastructure. In Tamil Nadu housing had been provided but in 7 out of the 9 villages surveyed did not have water and toilet connections. ANI were still living in transit housing and the better results in Sri Lanka was due to the proactive actions of beneficiaries installing their own toilet systems. This underlines the critical linkage between the resilience of the people/community and the management of the built environment that serves those people/communities.

Conclusion

The Chinese Government appear to have received some unfair criticism of their earthquake response in Sichuan. This survey suggests that the speed of the Government response enabled the resilient result that was recorded, a result that was better than several other disaster areas of a similar scale. Certainly, there will be areas where the QoL indicators will be higher and consequently need attention. Something that is common to all natural disasters.

But it is clear that engineering management needs to include social metrics further if it is to achieve the outcomes that China now seeks.

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