Flood Disaster Planning and Management in Jeddah, Saudi Arabia - A Survey

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Abstract

This paper presents the results of the survey conducted by interviewing representatives of the Saudi decision-makers and administrators responsible for disaster control in Jeddah before, during and after flooding in 2009 and 2010. First, demographics of the respondents are presented, followed by quantitative analysis of their views and experiences regarding the Kingdom's readiness before and after each flood. This is shown as a series of dependent and independent variables. Following this is a list of respondents' priorities for disaster preparation in the Kingdom.

Keywords
Disaster response policy, crisis management, effective service delivery

Background
Jeddah was flooded after a heavy rain on 25 November 2009. Situated on a plain beneath the 800m escarpment of the Jabal al-Hejaz in Saudi Arabia, as the desert city extends across numerous wadis off the escarpment, it is prone to flooding after exceptional storms; however at twice the city's yearly average, 90mm of rain fell in just four hours on that day. By noon, torrents struck many parts of the city, especially the poorer southern neighbourhoods where thousands of vehicles were caught in a traffic jam trying to escape. The death toll was 161, with damage to 8,000 homes and over 7,000 vehicles. The consequences of the floods drew criticism for wastewater management, flood mitigation and emergency response from the various responsible Saudi government organisations (Assaf 2010). The questionnaire has been prepared and survey conducted with top authorities involved in disaster and emergency management sector.

Methodology
The questionnaire was constructed in several sections to obtain information on the emergency response framework, to gather data on the organisational characteristics, and to investigate the views of the representatives of those organisations on the adequacy of the various entities' responses to the 2009 and 2010 Jeddah floods. The survey commenced with respondents' demographic details and position in the organisation. The second part of the questionnaire, which concerned only the information sought allowed for a range of factual responses, from open or non-directed, to closed, yes/no answers. It was constructed by numbered sections as follows:

1-Organisation profile (5 questions), 2-Risk assessments (6 questions), 3-Policy and planning (4 questions), 4-Training (4 questions), 5- Government structures (15 questions), 6-Non-government and Red Crescent input (12 questions), 7-Disaster relief resources (17 questions), 8-Funding (6 questions), 9-International assistance (10 questions), 10-Strengths and weaknesses of current plan (7 questions). The third part of the questionnaire used a series of independent and dependent variables regarding respondents' views of factors regarding emergency response. These were based on a 5-point Likert scale, 1(excellent) to 5 (poor). The dependent variables were: 11-Response time(3 questions), 12-Duration of response(3 questions), 13-Adequate emergency teams (3 questions), 14-Cost efficiency (3 questions)

The independent variables were: 15-Funding (3 questions), 16-Human resources (3 questions), 17-Training (3 questions), 18-Coordination between responsible organisations (4 questions), Other questions:19 Opportunities for improvement (19 questions).

Data collection
There were 40 possible disaster management respondents in various agencies and organisations in Jeddah and, after initial contact to establish this researcher's credentials, the purpose and ethics of the study, these questions

were sent to a central contact point in each organisation for responses by an organisational representative. Thus, the research comprised a population of public entities, rather than a sample of respondents from each of the relevant organisations. This was considered acceptable, as the questions concerned public policy rather than respondents' views (Bryman, 2012). Of the 40 written surveys delivered in August 2012, 27 (79%) completed surveys were returned for analysis by October, 2012.

Demographics

This section includes the ages, qualifications, and work experiences of the participants. The age profile is shown at Table.1.

Table 1: *Age profile of study participants*

Age level (years)	Frequency and percentage
< 30	2 (6%)
30-40	3 (10%)
41-50	20 (68%)
51>	2 (6%)
Not shown	3 (10%)
Total	30 (100%)

Given the youthful profile of the Kingdom, it was surprising that 20 of the 30 respondents (68%) were aged from 40 to 49 years and this was reflected in the participants' years of experience, 16-20 years (Table 2). Arguably, this is an indication that the offices were established during that period (1990s), as public servants have their jobs for life.

Table 2: *Work experience of study participants*

Years of work experience	Frequency and percentage
<10	2 (7%)
11-15	4 (13%)
16-20	19 (63%)
>21	2 (..7%)
Not shown	3 (10%)
Total	30 (100%)

The following Table, 3, shows all that reported were university graduates and that a majority (47%) had Master's degrees. Further, seven (23%) of the respondents had further qualifications, either postgraduate studies in disaster management, or higher degrees.

Table 3: *Qualifications of study participants*

Qualifications	Frequency and percentage
Secondary school	0 (0%)
Bachelor's degree	6 (20%)
Master's	14 (47%)
Other qualifications	7 (23%)
Not shown	3 (10%)
Total	30 (100%)

Analysis Descriptive

The Methodology section above outlined the nature of the questions. This section presents the responses of the questions using a 5-point Likert scale of 1= poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent. The results are compared and discussed in next section.

Quality of response (dependent variables)

These questions asked for the participant's response in relation to the lead disaster response agency for the Kingdom, the Civil Defence Organisation. Each question required a response for years 2009 and 2010. The results are presented at Table 4.

Table 4:*Quality of response of Civil Defence Organisation*

Year	Item	Weighted Average n=30	S.D.	Ranking
2009	Response time	2.778	1.500	1
	Efficiency	2.776	1.066	2
	Resources	1.949	1.000	4
	Cost structure	1.998	1.333	3
2010	Response time	2.001	1.100	3
	Efficiency	2.112	1.033	1
	Resources	1.991	1.333	4
	Cost structure	2.111	1.666	2
2009		2.375	1.224	
2010		2.530	1.283	

Table.4 shows four dependent variables depicting the study participants' views regarding the quality of the item relating to emergency responses from Civil Defence organisation to the Jeddah floods in 2009 and 2010. The participants were less satisfied with these responses for the 2009 the weighted average at 2.375 and standard deviation 1.224, than the comparable 2010 weighted average, 2.530, and s.d. of 1.283. Other results for 2009 flood disaster showed that the variable *response time* was of primary interest to the participants (w.a. 2.778, s.d. 1.500), followed by *efficiency* (w.a. 2.776, s.d. 1.066), *cost structure* (w.a. 1.998, s.d. 1.333), and *resources available*, (w.a. 1.949, s.d. 1.000). The 2010 results, on the other hand, ranked variables *efficiency* (w.a. 2.112, s.d. 1.0333), *cost structure* (w.a. 2.111, s.d. 1.666), *response time* (w.a. 2.001, s.d. 1.100) and then *resources available* (w.a. 1.991, s.d. 1.333) as the least important factor.

The next organisation examined was the Red Crescent. It is the lead agency in administering medical aid for the Kingdom, working with the ambulance services and the hospitals. Each of these items asked for the participant's views on the quality of Red Crescent's response for 2009 and 2010. The results are presented at Table 5.

Table 5: *Quality of response of Red Crescent*

Year	Item	W.A. n=30	S.D.	Ranking
2009	Response time	2.500	1.581	1
	Efficiency	1.889	1.666	4
	Resources	1.904	1.833	3
	Cost structure	2.000	1.003	2
2010	Response time	3.166	0.888	2
	Efficiency	3.500	0.667	1
	Resources	2.833	1.007	3
	Cost structure	2.333	1.223	4
2009		1.999	1.594	
2010		2.958	0.946	

Table 5 shows the analysis of participants' views of the Red Crescent and the quality of its response to the flood events of 2009 and 2010. The results show that participants were less satisfied with these responses for the 2009 flood, with the w.a. at 1.999 and s.d. 1.564, than the comparable 2010 w.a., 2.985, and s.d. 0.946. Other results for 2009 flood disaster show that the variable *response time* was ranked of interest (w.a. 2.500, s.d 1.581); followed by *cost structure* (w.a. 2.00o, s.d. 1.003), *resources available* (w.a. 1.903, s.d. 1.333); and of less interest, *efficiency* (w.a. 1.889, s.d. 1.666). For the 2010 flood event, the rankings were *efficiency* (w.a. 3.500, s.d 0.667), followed by *response time* (w.a. 3.166, s.d. 0.888) resources available (w.a. 2.833, s.d. 1.007); and finally cost structure (w.a. 2.333, s.d. 1.223).

Local and national emergency response groups provide immediate relief in the event of an emergency in their neighbourhoods. The participants were asked for their views on the ad hoc groups' responses in 2009 and again in 2010 (Table 6).

Table 6: *Quality of response of local emergency groups*

Year	Item	W.A. n=30	S.D.	Ranking
2009	Response time	1.833	1.353	3
	Efficiency	1.666	1.290	4
	Resources	1.966	1.402	2
	Cost structure	2.168	1.366	1
2010	Response time	3.833	0.957	1
	Efficiency	3.166	1.033	3
	Resources	3.300	1.002	2
	Cost structure	2.566	1.887	4
2009		1.707	1.553	
2010		3.216	1.219	

Table 6 depicts the respondents' views on the standards for local response groups to the Jeddah floods in 2009 and 2010. The participants were less satisfied with these responses for the 2009 event (w.a. 1.707, s.d. 1.553) compared to 2010 (w.a. 3.216, s.d. 1.219). Ranked results for the 2009 event show that the variable cost structure was of statistical interest (w.a. 2.168, s.d. 1.366); followed by resources available (w.a. 1.966, s.d. 1.402), response time (w.a. 1.833, s.d. 1.353), and efficiency (w.a. 1.666, s.d. 1.290). Other results for the 2010 flood disaster show that response time ranked first (w.a. 3.833, s.d. 0.957), then resources available (w.a. 3.300, s.d. 1.002) efficiency (w.a. 3.166, s.d. 1.033) and last, cost structure (w.a. 2.566, s.d. 1.887).

Quality of preparation (independent variables)

The independent variables, those factors available to address disaster response before the event, were funding, people, training and coordination. These were questions for the study participants to respond in regards of the two lead organisations, the Civil Defence Organisation and the Red Crescent, and also ad hoc emergency response groups. These questions were answered using a 5-point Likert scale of 1= poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent. The results are compared and discussed in next section.

The first table in this section, Table 7, shows analysis of participants' responses to items critical to the country's preparation to respond to a crisis, and this is for the lead agency, Civil Defence Organisation.

Table 7: *Preparation for disaster response by Civil Defence Organisation*

Year	Item	W.A. n=30	S.D.	Ranking
2009	Funding	2.000	1.445	4
	People	4.000	0.305	3
	Training	5.000	0.101	1
	Coordination	5.000	0.112	2
2010	Funding	2.000	1.433	4
	People	5.000	0.110	1
	Training	5.000	0.117	2
	Coordination	5.000	0.201	3
2009		4.000	0.490	
2010		4.250	0.436	

Again there are four variables for the participants' response for this section of the analysis on the lead agency, Civil Defence Organisation, and again the respondents were found to be mildly less satisfied with preparations for the 2009 flood event (w.a. 4.000, s.d. 0.490) than 2010 (w.a. 4.250, s.d. 0.436), with more people being available in 2010. Other results for the 2009 flood disaster preparation show that the variables *training* (5.000, s.d. 0.101) and *coordination* (w.a. 5.000, s.d. 0.112) as of significance, followed in ranking by *people availabili*ty (w.a. 4.000, s.d. 0.305), and last, *funding* (w.a. 2.000, s.d. 1.445). Analysis of participants' views on preparations for 2010, with the exception of *fundin*g, were fairly uniform: *people* (w.a. 5.000, s.d. 0.110), *training* (w.a. 5.000, s.d. 0.117), and *coordination* (w.a. 5.000, s.d. 0.201). *Funding* in the disaster planning phase, as noted, was last (w.a. 2.000, s.d. 1.433). The following Table 8, shows the analysis of these items for the Red Crescent.

Table 8: *Preparation for disaster response by Red Crescent*

Year	Item	W.A. n=30	S.D.	Ranking
2009	Funding	2.000	1.414	4
	People	4.000	0.998	3
	Training	5.000	0.301	2
	Coordination	5.000	0.112	1
2010	Funding	2.000	1.512	4
	People	5.000	0.222	2
	Training	5.000	0.189	1
	Coordination	5.000	0.300	3
2009		4.000	0.706	
2010		4.250	0.555	

As Table 8 shows, there are four variables analysed to report study participants' views regarding emergency response by Red Crescent to the Jeddah floods in 2009 and 2010. The participants were somewhat less satisfied with Red Crescent's preparations before the 2009 floods (w.a. 4.000, s.d. 0.706) than compared to preparations for 2010 (w.a. 4.250, s.d. 0.555). Rankings for preparation reported by the study participants were similar for *coordination* (w.a. 5.000, s.d. 0.112) and *training* (w.a. 5.000, s.d. 0.301), followed by *people availability* (w.a. 4.000, s.d. 0.998) and last, *funding* (w.a. 2.000, s.d. 1.414). For preparation in the next year, the study participants viewed t*raining*, *people* and *coordination* similarly (w.a. 5.000; s.ds. 0.189, 0.222 and 0.300 respectively). However, funding preparation gained their disapproval yet again (w.a. 2.000, s.d. 1.512).

The last set of questions concerned local emergency response groups and their preparation. As ad hoc organisations which were formed when a response was necessary, respondents' views obviously reflected different groups. Nevertheless, their responses were an indicator of the community's risk awareness and capacity to respond (Table 9) .

Table 9: *Preparation for disaster response by local groups*

Year	Item	W.A. n=30	S.D.	Ranking
2009	Funding	4.966	0.344	4
	People	5.000	0.003	1
	Training	5.000	0.011	2
	Coordination	5.000	0.022	3
2010	Funding	4.633	0.422	4
	People	5.000	0.004	1
	Training	5.000	0.110	3
	Coordination	5.000	0.014	2
2009		4.991	0.095	
2010		4.908	0.137	

The responses from the participants were relatively unchanged between 2009 (w.a. 4.991, s.d. 0.095) and 2010 (w.a. 4.908, s.d. 0.137), although there was slightly less satisfaction for the 2010 preparation for the groups. Otherwise, the 2009 rankings for groups' preparation were people, training and coordination (w.a. 5.00 and s.ds respectively 0.003, 0.011 and 0.022) with funding obviously last (w.a. 4.966, s.d. 0.344), as ad hoc groups were volunteers. Similarly, 2010 group preparation was people, coordination and training (w.a. 5.00 and s.ds respectively 0.004, 0.014 and 0.110), signifying less training preparation.

Priorities for emergency response planning

The respondents were asked their views on elements for improving the country's emergency response. Again a 5-point Likert scale was used of 1 = disagree strongly, 2 = disagree, 3 = neutral, 4 = agree, and 5 = agree strongly. The results are shown at Table 10 and discussed in next section.

Table 10: *Respondents' priorities on emergency response planning elements*

Item	W.A. n=30	S.D.	Ranking
Communications	4.833	0.498	6
Existing plan unchanged	00	00	--
Coordinate all organisations	4.933	0.401	4
Organisational training	5.000	0.001	1
Public awareness	4.900	0.321	5
Experienced resources	4.500	0.603	7
Community preparedness	4.966	0.399	3
Policy making	4.066	0.723	11
Infrastructure	4.166	0.643	10
Organisational preparedness	4.333	0.334	8
Finance	3.866	0.767	15
International advice	3.300	0.987	17
Public preparedness	4.333	0.311	9
Interorganisational responsibilities	5.000	0.012	2
Interorganisational information sharing	3.933	0.712	14
Interorganisational communications	3.766	0.822	16
Interorganisational practices	4.000	0.664	13
Physical resources	4.000	0.643	12
Average	3.889	0.465	

Rankings shown in Table 10 indicate that emergency response policy makers and administrators viewed training of response teams across all organisations (w.a. 5.000, s.d. 0.001) as vital for future preparedness of the country to respond to floods or other disasters. This was followed by defining the responsibilities of each group in the response system (w.a. 5.000, s.d. 0.012) to ensure they were allocating their resources to the greatest effect. Next was community preparedness (w.a. 4.966, s.d. 0.399), followed by coordination of all response organisations (w.a. 4.933, s.d. 0.401) communications (w.a. 4.833, s.d 0.498), and at priority 5, public awareness (w.a. 4.900, s.d. 0.321). Of least interest was to leave the system as it was, which attracted no answers, and to increase international advice and input w.a. 3.300, s.d. 0.987). Due to the number of choices, the average agreement to all the items was low (w.a. 3.889, s.d 0.465).

Conclusion

The participants were overwhelmingly in agreement on the top five areas for future attention: training of response teams, identification and coordination of the organisational responsibilities, community awareness and preparedness. Disaster mitigation was found to be very important for the representatives of public authorities. They felt that the population acknowledged the risk of natural and human-initiated disasters, and were generally responsive to disaster threats, but lacked community-based organisation. Participants are willing to accept improved disaster management policy changes. However, one-quarter of the respondents avoided to commit on their own training in an emergency capacity, although the remaining three-quarters were positive in their responses to performance enhancing training opportunities. The recommendations from this finding is that further research is necessary to follow the progress of policy initiatives, including a well-coordinated organisation that can be established to manage disaster responses among the population in the event of flood or further such disturbance.

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Biography

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